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PRODUCTIVE PERFORMANCE, BLOOD BIOCHEMICAL TRAITS AND IMMUNE RESPONSE OF SASSO CHICKENS SUPPLEMENTED WITH SACCHAROMYCES CEREVISIAE OR MANNAN OLIGOSACCHARIDE AS NATURAL GROWTH ADDITIVES

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ABSTRACT: A total number of 300 unsexed 7 d old Sasso chicks were randomly divided among 5 dietary treatments with 6 replicate cages per treatment and 10 chickens per cage, assigning experimental unit to investigate the effect of either live yeast of Saccharomyces cerevisiae (SC) or Mannaoligosaccharide (MOS) as a natural growth promoters on blood parameters, carcass characteristics and immune response. Dietary treatments were: 1st group fed a commercial basal diet without supplementation and served as control, the 2nd and 3rd groups fed basal diet supplemented with 0.1 and 0.2% of SC, and the 4th and 5th groups fed basal diet supplemented with 0.25 and 0.5g of MOS/kg. Results showed that treated groups had significantly greater body weight (BW), body weight gain (BWG), economical efficiency as well as higher values of nutrients digestibility than the control group. All treatments decreased serum AST, ALT, urea, creatinine, serum total lipids, triglycerides, cholesterol, LDL and increased glucose, T3, T4, TAC, GSH, GPX, SOD, RBC's , WBC's, total protein, globulin, phagocytic activity, phagocytic index, IgG, INFγ, IL2 and IL10 compared to control. Supplementation of SC or MOS increased significantly percentage of dressing and decreased abdominal fat compared to control. Moreover, SC or MOS decreased bacterial count of the digestive system compared to control group. In conclusion, both Saccharomyces cerevisiae and mannan oligosaccharide could be used safely as natural growth promoters to improve growth performance and immune response of Sasso broiler chickens.

Key words: Saccharomyces cerevisiae -MOS - Growth performance - Blood profiles-Sasso.

INTRODUCTION:

In past decades, sub remedial dosages of antibiotics have been used to enhance poultry growth performance, health and control pathogens. The negative impacts of antibiotics, i.e., the increases of microbial resistance to antibiotics and residues in chicken meat products which might be harmful to consumers (Diarra et al., 2007; and Koc et al., 2010). Therefore, the use of antibiotics as growth promoters was completely banned in 2006 by the European Union (EU). Nowadays, world, feed additives, , i.e., probiotics, prebiotics, are being tested to lighten the problems connected with the withdrawal of antibiotics from food (Attia et al., 2014). Microorganisms as probiotics (non-pathogenic microscopic organisms and/or yeast) are one of the choices for growth promoters in animals. Role of supplemental dietary microbial items in the digestive system are not known precisely, but presented mechanisms are; 1) help in feed digestion, 2) increase nutrient availability, and 3) restrain harmful microscopic organisms in the gut (Owings et al., 1990). Normal flora in the digestive system plays a necessary role in the health and performance of chickens (Thong Song et al., 2008). Saccharomyces cerevisiae known "bread cook's yeast" is a standout amongst the most generally marketed species and one of the compelling adsorbents rich in protein (40-45%), vitamin B complex, biotin, niacin, pantothenic corrosive and thiamin and its natural quality is high (Reed and Nagodawithana, 1999).

The inclusion of SC in the poultry feed has been shown to improve chickens performance and diminish mortality (Attia et al., 2011). Likewise, Some authors reported an advantage of yeast that are fed to animals as responsible for the production of digestive enzymes and vitamin B complex and for stimulation of intestinal mucosa immunity and expanding insurance against poisons delivered by pathogenic microorganisms (Dabiri et al., 2009; and Attia et al., 2011). Many researchers affirmed that the impacts of yeast could be an alternative to antibiotic-based drugs in poultry feed (Hooge et al., 2003; and Stanley et al., 2004).

Cell wall components of yeast or whole yeast products have been utilized to influence the physiology, morphology and microbiology of the intestinal tract of broiler chicks (Yang et al., 2008; and Morales-Lopez et al., 2009). MOS is gotten from the external cell wall of Saccharomyces cerevisiae and its evaluation in poultry diets is of particular interest because it shifts gastrointestinal microflora balance toward beneficial organisms (Fairchild et al., 2001). MOS have shown promising effects, such as decreasing pathogenic microflora of the gut, stimulating a strong immune response, and elevating the strength of the intestinal mucosa in studies with poultry (Spring et al., 2000; and Iji et al., 2001). By balancing the intestinal microflora and stimulating the immune response, MOS have been shown to increase the growth of broilers (Hooge, 2004) and enhanced intestinal function (Yang et al., 2007 and 2008; and Bovera et al., 2010a, b). This study aimed to investigate the effect of live yeast of either SC or MOS as a natural growth promoter on performance, blood profile, bacterial account, meat analysis and the immune response of Sasso chickens.

MATERIALS AND METHODS:

This study was conducted at the Poultry Research Unit (El-Bostan Farm), Department of Animal and Poultry Production, Faculty of Agriculture, Damanhour University, Damanhour, Egypt, from November to December 2015. Three hundred unsexed 7 day-old Sasso strain chicks obtained from a commercial hatchery, At 7 day-old were randomly

distributed into five groups, (n=60 birds) each group contain 6 replicates (10 birds each) and reared on similar managerial conditions. The chicks were fed basal diet and were submitted to the following dietary treatments: the 1st group fed a commercial basal diet without supplementation (control), the 2nd and 3rd groups fed the same basal diets supplemented with 0.1 and 0.2 % of SC, and the 4th and 5th groups fed basal diet supplemented with 0.25 and 0.5g of MOS.

The experimental diets were formulated according to NRC (1994). Chicks were fed basal diet containing 22.9% and 3042, 21.4% and 3103, 19.1% crude protein and 3200 kcal/kg during the starter, grower and finisher periods, respectively. All Chicks were housed in battery brooders in semi-opened room equipped with two exhaust fans to keep normal ventilation. Chicks were fed the experimental diets ad libtium and given free access to water. A light schedule similar to commercial conditions was applied until 7th day being 23 h light followed by 20 h light from 8th day until 3 days before slaughter test (8-50 days of age). The average outdoor minimum and maximum temperature and relative humidity during the experimental period was 22ºC and 24ºC and 55.7 % and 58.7%, respectively. The brooding temperature (indoor) was 32, 30, 27 and 24-21ºC during 1-7, 8-14, 15-20 and 21-53 days of age (declined gradually).

Chicks in each replicate were weighed (g) weekly between 7 and 53 d of age, and the BWG (g/chick) was calculated. Feed intake was recorded for each replicate (g/chick) and thereby FCR (g feed/g gain) was calculated .European production efficiency index (EPEI) was measured throughout the experimental period (7-53d of age). Production index value was calculated throughout the experimental period (7-53d) of age (Attia et al., 2012) as follows. $PI = \frac{BW\,(kg) \times SR}{PP \times FCR} \times 100$ Where:

EPEI = European Production Efficiency Index; BW = Body weight (kg)

SR = Survival rate (100% - mortality)

PP = Production period (days)

FCR = Feed conversion ratio (kg feed / kg gain)

The apparent digestibility of nutrients and ash retention was done using five birds per treatment housed individually in metabolic cages/treatment using total collection method, cited by Abou-Raya and Galal (1971). Nitrogen, EE, CF and ash content of the dried excreta as well as those of feed were determined according to AOAC (2004). Economical evaluation for all experimental treatments was made (Zeweil, 1996). At 53 d of age, 12 chicks were taken randomly from each treatment and slaughtered to determine dressing percentage.

Twelve blood samples were taken randomly from each treatment (about 3 ml) were collected in before slaughter from the brachial vein for hemato-biochemical analysis. The blood samples were divided into two parts, the 1st in heparinized tubes as anticoagulation and 2nd without heparin to obtain serum. Plasma or serum were separated by centrifugation of the blood at 3000 rpm for 20 minutes and stored at –20°C for later analysis. Biochemical indicators such as (Glucose, Urea, Creatinine, ALT, AST(U/L), Alkaline phosphatase, Total Lipid, Triglycerides, Cholesterol, HDL, LDL, Total antioxidant capacity (TAC), glutathione peroxidase (GPX), glutathione (GSH), superoxide dismutase (SOD), T3, T4), Hematological traits such as (RBC's, Hemoglobin, PCV %, MCV, MCH, MCHC), WBC's total and differential counts, and Immune indices such as (Total protein, Albumin, Globulin, α–globulin, globulin –β, Globulin–γ, Lysozyme activity (LA), Bactericidal activity (BA), Lymphocyte transformation test (LTT), Phagocytic index (PI), Phagocytic activity (PA), immunoglobulin (IgY, IgM and IgA) and IL-2, IL-10 and

IFN-γ were measured as described previously by (ELnaggar et al., 2016). At the time of slaughter, 6 samples of cecal content for each treatment were taken for bacterial counting. The effect of dietary treatments on the microbial activity of the digestive system include: total bacteria count which was determined according to the method of (ICMSF, 1980), as well as the detection of Salmonella and Escherichia coli strains following the ISO-6579: 2002 food microbiology procedure employing the horizontal method of food and animal feeding stuffs (ISO Standards catalogue 07.100.30; WHO 2010).

Finally, samples of breast and thigh meat (50:50 basis) from slaughtered birds and the experimental diets were chemically analyzed according to (AOAC, 2004) and breast and thigh total antioxidant capacity (TAC) was determined by the ORAC assay (Cao and Prior, 1999).

Obtained data were analyzed using the GLM procedure (Statistical Analysis System (SAS, 2002), using one-way ANOVA using the following model: $Y_{ik}= \mu+ T_i + e_{ik}$

Where, Y is the dependent variable; μ is the general mean; T is the effect of experimental treatments; and e is the experimental random error. Before analysis, all percentages were subjected to logarithmic transformation (log10x+1) to normalize data distribution. The differences among means were determined using Duncan's new multiple range test (Duncan, 1955).

RESULTS

The production performance, economical efficiency and production index of broiler chickens fed diet supplemented with S.C and MOS during days 7-53 of age are shown in Table 1. Chicks fed basal diet supplemented with either S.C or MOS at different levels had significantly ($p\leq0.05$) greater BW and BWG than the control group. Moreover, Chicks fed the basal diet supplemented with 0.25 and 0.5g of MOS had significantly($p\leq0.05$) decreased FI and improved FCR during 7-53d of age followed by those fed basal diet supplemented with 0.2% of S.C then 0.1% of S.C compared to the control group. Chicks fed basal diet supplemented with 0.25, 0.5g of MOS and 0.2% of S.C had significantly better economic efficiency and production index followed by those fed basal diet supplemented with 0.1% of S.C, both are higher than the control group.

The apparent digestibility of the nutrients of broiler chickens fed diet supplemented with S.C or MOS during days 7-53 of age are shown in Table 2. Chicks fed basal diet supplemented with either S.C or MOS at different levels had significantly ($p\leq0.05$) better digestibility values of dry matter, crude protein and ether extract than the control group while, those fed basal diet supplemented with 0.5g of MOS had significantly higher digestibility of crude fiber than only the control group.

The biochemical blood constituents of broilers are shown in Table 3. All supplementation of either S.C or MOS decreased serum AST, ALT, urea and creatinine and increased urea /creatinine ratio compared to control group. In addition, all supplementations increased glucose and decreased serum total lipids, triglycerides, cholesterol, and LDL compared to control group. No significant differences were recorded among the different supplements except in creatinine, urea /creatinine ratio, HDL and cholesterol where, chicks fed basal diet supplemented with 0.25g of MOS had significantly lower creatinine and cholesterol and higher urea /creatinine ratio than other supplements. Moreover, Chicks fed basal diet supplemented with either S.C or MOS at different levels had significantly higher T3 and T4 than the control group. On the other hand, antioxidants enzymes including TAC, GSH, GPX and SOD were higher in chickens fed basal diet supplemented with either S.C or MOS at different levels compared to the control group.

Feeding diet with different supplementations increased RBC's hemoglobin, PCV, WBC's and lymphocyte and decreased MCV and MCH compared to control group. Chicks fed basal diet supplemented with 0.25g of MOS or 0.1% of S.C had significantly higher RBC's than other supplements. While, Chicks fed basal diet supplemented with 0.25g of MOS or 0.2% of S.C had significantly lower MCV and higher MCHC than other supplements and control group (Table 4).

Feeding diet with different supplementations increased total protein, globulin, α–globulin, globulin-γ, LA, BA, LTT, phagocytic activity, phagocytic index, IgA, IgM, IgG, INFγ, IL2 and IL10 compared to control. Furthermore, Chicks fed basal diet supplemented with 0.25g of MOS or 0.2% of S.C had significantly higher globulin-γ, IgM, IL2 and IL10 than other supplements. On the other hand, Chicks fed basal diet supplemented with 0.25g of MOS had significantly lower α–globulin than other supplements. Moreover, chicks fed basal diet supplemented with 0.2% of S.C had significantly lower INFγ than other supplements (Table 5).

Supplementation of either S.C or MOS at all tested levels increased significantly percentage of dressing and total edible parts and decreased abdominal fat and inedible parts compared with control. Also, feeding diet with different supplementations significantly increased percentage of spleen and decreased that of bursa of Fabricius compared to control diet. While, no significant differences between groups concerning percentage of thymus (Table 5).

Feeding diet with different supplementations increased protein and TAC and decreased fat and fiber in meat compared to control group. However, Chicks fed basal diet supplemented with 0.25g % of MOS had significantly higher fat and TAC than other supplements (Table 6).

All treatments of either SC or MOS decreased total bacterial count, Salmonella, E.Coli and Proteus compared to control group. However, Chicks fed basal diet supplemented with 0.25g of MOS had significantly lower count of Salmonella, E.Coli and Proteus than the other supplemented groups (Table 7).

DISCUSION

The present study indicates that the addition of either S.C or MOS to diets improves the growth, FCR, economical efficiency, production index and the digestibility of dry matter, crude protein and ether extract while, decreased FI of treated chicks compared to the control one. The improvements in FCR could be attributed to the increase in growth rate and decrease in feed intake. The present results are in line with those obtained by Zhang et al. (2005); Paryad and Mohmoudi (2008); and Abou El-Naga (2012). They indicated that SC enriched growth performance of broiler chicks. The enhanced growth performance of broilers on SC could be attributed to many beneficial effects like its source of Vit B, cellulotic enzymes, phytase and its cell wall components of MOS and gulcomannan, thus SC may improve intestinal lumen health and nutrient utilization (Zhang et al., 2005). In agreement with the current results, Spring et al. (2000) and Zhang et al. (2005) indicated that SC improved the efficacy of the immune system, and increased digestion and absorption of nutrients, which resulted in better performance. In addition, Koc et al. (2010) indicated that S.C in the diet has been shown to improve the bird performance and decreased mortality. This improvement may be related with the balanced microbial population in the gastrointestinal tract which has an important role in the health and performance of the broilers (Thong song et al., 2008).

On the other hand, Abd-Elsamee et al. (2015) and Attia et al. (2014) indicated that

the addition of MOS to diets improve the growth of broiler chicks compared to the un- supplemented, control one . The growth promoting effects of MOS was attributed to its influence on gut morphology and thus intestinal health and function as shown by increasing the population of beneficial bacteria (Yang et al., 2008; Bovera et al., 2010a, b; Cheled- Shoval et al., 2011). In addition, MOS can enhance the utilization of nutrients in the intestine. It is also capable of stimulating specific microbial populations resulting in improving fiber fermentation with a reduction in starch and sugar utilizing bacterial populations (Bovera et al. 2010a; b). It is known also that MOS can improve the growth performance and gut morphology by binding the mannose receptors on the type 1 fimbriae of some pathogen bacteria to prevent their attachment to the intestinal mucosa (Spring et al., 2000; Cheled-Shoval et al., 2011; Attia et al., 2011). Moreover, due to the ability of MOS to limit the growth of potential pathogens in the digestive tract of animals, the digestive tract remains healthy, and its functions more efficiently and more nutrients are available for absorption (Bozkurt et al., 2008). In addition, MOS can enhance the utilization of nutrients in the intestine, through improving fiber fermentation (Kocher et al., 2004); improve ileum structure and increase villi height of broilers (Zhang et al., 2005), as well as increasing butyrate supply from fermentation that leads to the development of intestinal epithelium, cell differentiation and increase immune response, probably due to the higher number of T-cells in the intestine (Peuranen et al., 2004).

Results obtained revealed that all supplementations of either SC or MOS decreased serum AST, ALT, urea, creatinine, serum total lipids, triglycerides, cholesterol, HDL, LDL, MCV and MCH and increased glucose, urea /creatinine ratio, T3, T4, TAC, GSH, GPX, SOD, RBC's hemoglobin, PCV, WBC's, lymphocyte, total protein, globulin, α–globulin, globulin-γ, LA, BA, LTT, phagocytic activity, phagocytic index, IgA, IgM, IgG, INFγ, IL2 and IL10 compared to control group. Similar to the present study, Paryad and Mahmoudi (2008) and Husseini (2011) showed that SC at 0.15% significantly increased plasma total protein, albumin, globulin and WBCs while, decreased H/L ratio in broilers. In addition, Paryad and Mahmoudi (2008), Saleh El-Din and Abd El-Hamid (2012) found that broiler chickens fed SC at 0.02 % had higher antibody titers against NDV than the control at 38 d of age. The positive effect of SC on immune response could be attributed to its cell wall components of chitin, mannan and glucan which have an immunostimulant effect (The beneficial influence of MOS on blood constituents are in line with those reported by El-Sheikh et al. (2009) who reported that hemoglobin, RBC, WBC, total protein, albumin, and globulin were greater in hens supplemented with MOS than the control treatment. Attia et al. (2014) reported similar results. In this respect, Riad et al. (2010) found a significant increase in counts of erythrocytes, leukocytes, lymphocytes, and Heterophils and Heterophils/lymphocytes ratio in biological additives compared to the control ones. However, values were better with the addition of yeast + prebiotic, prebiotic, yeast than probiotic in the diet of broiler (0-42 d of age). Toloei et al. (2010) showed that MOS increased antibody titers against AIV in the fourth, fifth and sixth weeks of age. Abd-Elsamee et al. (2015) found that plasma total lipids and cholesterol were decreased ($p<0.05$) by MOS supplements. Moreover, mannan oligosaccharides can promote lactic acid bacteria activity, which can be effective in reducing the cholesterol level by producing enzymes that cause disintegration of bile salts making them unconjugated , as well as by reducing the pH in the intestinal lumen

(Sarica et al., 2009). Yalcin kaya et al. (2008) found that dietary MOS lowered blood cholesterol of broilers. Besides, feeding broiler chickens prebiotic increased serum total proteins and globulins (Vytautas et al., 2006).

Mannan oligosaccharides can enhance immune response by promoting the growth of lactic acid bacteria, and they simultaneously produce antibacterial substances and stimulate the production of immunoglobulin, especially IgA (Sarica et al., 2009). Adding MOS to broiler diets enhanced immunity and markedly increased concentrations of IgA antibodies (Kogan and Kocher, 2007; Rehman et al., 2009) and resulted in a significant increase in the antibody titer against SRBCs (Riad et al., 2010). In this connection, El-Sheikh et al. (2009) showed that in Mandarah chickens, antibody response against infectious bursal disease virus (IBDV) were increased in MOS treated group compared to control group.

The present study revealed that all supplementations of either S.C or MOS increased percentage of dressing, total edible parts and spleen and decreased abdominal fat, inedible parts and bursa compared with control. Feeding diet with different supplementations increased protein and TAC and decreased fat and fiber of meat compared to control group. Chicks fed basal diet supplemented with 0.25g % of MOS had significantly higher fat and TAC than other supplements. In agreement with the current results, Pelicano et al. (2004a, b) showed that S.C. significantly increased carcass yield of free range broiler chickens, while percentage of proventriculus, gizzard, liver, pancreas and relative weight and length of duodenum, jejunum, ileum and cecum were not significantly affected by yeast origin. Furthermore, Yousefi et al. (2008) reported that carcass yield and intestinal pH were significantly different ($p<0.05$) among birds fed either probiotics or organic acids. Birds fed diets supplemented with probiotic had a better carcass yield than birds fed the control. Taheri (2000) showed that addition of yeast to broiler diets induce to decreasing immune organs. Also, Abdel-Azeem et al. (2005) reported that yeast or fungi had a positive effect on percentage dressing, liver, gizzard, heart, giblets and abdominal fat. Riad et al. (2010) reported that chicks fed yeast as an additive were significantly higher in carcass weight, carcass and dressing percentage than the control. On the other hand, the present data disagree with those reported by Husseini et al. (2008) and Momtazan et al. (2011) who found that Probiotics and Saccharomyces cerevisiae had no effect on hot and cold carcass weight, carcass yield, the weight of carcass parts and the abdominal fat pad. Also, Mohamed et al. (2008) indicted that addition of MOS significantly ($p<0.05$) reduced the percentage of abdominal fat in the carcass. Also, Ayed et al. (2010) reported that SAF-mannan addition to broilers diet resulted in heavier ($p=0.033$) hot carcass but had a relatively higher abdominal fat content ($p=0.054$) compared to the control group. On the other hand, the present data disagree with those reported by Ghosh et al. (2008) and Khalaji et al. (2011) who showed that carcass, breast, thigh, gizzard, duodenum, jejunum and ileum relative weight as well as duodenum, jejunum and ileum relative length were not affected by MOS dietary treatments. Also, Manna oligosaccharides did not affect carcass yield of broilers (Sarica et al., 2009; Koch et al., 2010; Yalçın kaya et al., 2012). Abd-Elsamee et al. (2015) reported that no significant effects were observed for any of the supplemented diets for the relative weights of thymus, spleen, bursa of Fabricius or thyroid gland compared to the control group.

All supplementations of either SC or MOS decreased total bacterial count Salmonella, E.Coli and Proteus compared to control group. Chicks fed basal diet supplemented

with 0.25g of MOS had significantly lower Salmonella, E.Coli and Proteus than the other supplemented groups. In agreement with the current results, Koc et al. (2010) showed that supplementation of S.C. either singly or in combination with MOS positively influenced the ileal microbiota. Coliform bacteria normally host the intestinal tract of warm-blooded animals (Hartel et al., 2000). In addition, MOS may also serve as an alternate attachment site in the gut for Gram-negative bacteria with mannose-specific type-1 fimbriae, which adhere to intestinal epithelial cells to initiate colonization. These pathogenic bacteria attached to MOS present in the intestinal tract and pass through the gut instead of binding to the epithelial cells (Bovera et al., 2010a, b).

IN CONCLUSION,

Under such experimental conditions, both SC and MOS are shown to be effective in improving productive performance, immune response and general health of Sasso chicks.

Table (1): Production performance, economical efficiency and production efficiency index of broiler local strain (Sasso) fed diets supplemented with SC and MOS during days 7-53 of age.

Items	**Control**	**S.C 0.1 %**	**S.C 0.2 %**	**MOS 0.25g**	**MOS 0.5g**	**SEM**	**P value**
Live body weight (g) at:							
7d	128	126	126	126	127	3.95	0.978
53d	1790^{b}	1965^{a}	1960^{a}	2000^{a}	2002^{a}	37.6	0.0001
Body weight gain (g) from:							
7-53d	1660^{b}	1839^{a}	1834^{a}	1874^{a}	1875^{a}	37.1	0.0003
Feed intake (g) from:							
7-53d	4009^{a}	3970^{b}	3821^{c}	3718^{d}	3699^{d}	53.3	0.0009
Feed conversion ratio (g feed/g gain) from age:							
7-53d	2.35^{a}	2.16^{b}	2.08^{c}	1.98^{d}	1.97^{d}	0.052	0.0002
Economical efficiency and production index:							
Economical efficiency	39.5^{c}	66.7^{b}	86.2^{a}	95.9^{a}	82.9^{a}	6.22	0.004
production efficiency index	137^{c}	159^{b}	170^{a}	179^{a}	180^{a}	4.30	0.001

$^{a, b, c, d}$ Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Table (2): Nutrients digestibility of broiler local strain (Sasso) fed diet supplemented with SC and MOS at 7-53 days of age

Items %	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	SEM	P value
Dry matter	67.2[b]	70.3[a]	70.1[a]	69.5[a]	69.6[a]	0.72	.044
Crude protein	62.2[b]	68.2[a]	68.5[a]	68.5[a]	68.9[a]	1.33	.008
Ether extract	67.4[b]	72.8[a]	75.5[a]	74.6[a]	76.8[a]	1.64	.006
Crude fiber	13.1[b]	15.3[ab]	16.0[ab]	16.6[ab]	18.4[a]	1.10	.039
Ash retention	32.2	34.4	33.3	32.8	34.6	1.25	.592

[a, b,] Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Table (3): Biochemical constituents of blood serum of broiler local strain (Sasso) fed diet supplemented with SC and MOS during days 7-53 of age

Items	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	SEM	P value
Urea (mg/dl)	2.53[a]	2.15[b]	2.25[b]	2.10[b]	2.10[b]	0.959	0.022
Creatinine (mg/dl)	1.20[a]	0.800[b]	0.850[b]	0.684[c]	0.850[b]	0.01	0.0004
Urea/ Creatinine	2.01[c]	2.68[b]	2.67[b]	3.08[a]	2.47[b]	0.728	0.0001
AST(U/L)	61.3[a]	57.5[b]	57.0[b]	59.5[b]	57.5[b]	6.43	0.049
ALT (U/L)	39.0[a]	33.5[b]	31.5[b]	32.5[b]	30.0[b]	4.82	0.037
ALT/AST	0.636	0.582	0.552	0.546	0.521	0.0002	0.081
Alkaline phosphatase (U/100ml)	12.33	12.00	10.50	12.00	12.50	1.45	0.110
Glucose (mg/dl)	190[b]	220[a]	222[a]	235[a]	237[a]	44.6	0.015
T. Lipid (mg/dl)	510[a]	410[b]	420[b]	410[b]	400[b]	12.9	0.012
Triglycerides (mg/dl)	189[a]	177[b]	171[b]	172[b]	171[b]	196	0.015
Cholesterol (mg/dl)	227[a]	214[b]	212[b]	209[c]	217[b]	265	0.004
HDL(mg/dl)	41.7	40.5	42.5	41.5	42.0	9.83	0.066
LDL(mg/dl)	147[a]	138[b]	135[b]	133[b]	140[b]	53.5	0.035
T3 (ng / ml)	2.09[b]	2.26[a]	2.25[a]	2.25[a]	2.25[a]	0.038	0.045
T4 (ng / ml)	11.0[b]	14.5[a]	15.5[a]	14.5[a]	15.0[a]	0.027	0.036
TAC (Mmol/dl)	401[c]	415[b]	422[a]	426[a]	417[b]	1023	0.026
GPX (U/L)	38.0[b]	41.5[a]	44.5[a]	44.5[a]	44.5[a]	0.0011	0.036
GSH (U/L)	972[c]	980[b]	984[ab]	989[a]	979[b]	5686	0.031
SOD (U/L)	232[b]	247[a]	247[a]	246[a]	248[a]	361	0.042

[a, b, c,] Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean. AST = aspartate amino transferase; ALT = alanine amino transferase; HDL = high-density lipoprotein; LDL = low-density lipoprotein; T3 = Triiodothyronine; T4 = thyroxin; TAC = total antioxidant capacity; GPX = glutathione peroxidase; GSH = glutathione; SOD = superoxide dismutase

Table (4): Hematological traits of broiler local strain (Sasso) fed diet supplemented with SC and MOS during days 7-53 of age

Items	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	P value	SEM
RBC's (10^6/cmm^3)	1.27^{c}	1.70^{a}	1.55^{b}	1.75^{a}	1.55^{b}	0.002	0.019
Hemoglobin (g/100ml)	9.7^{b}	11.5^{a}	12.3^{a}	12.5^{a}	11.5^{a}	0.028	0.894
PCV %	32.3^{b}	38.0^{a}	35.5^{a}	36.0^{a}	37.5^{a}	0.043	8.92
MCV(um^{3})	25.5^{a}	22.4^{c}	20.9^{d}	20.6^{d}	24.2^{b}	0.001	45.6
MCH (Pg)	7.62^{a}	6.76^{bc}	7.94^{b}	7.15^{d}	7.42^{c}	0.002	4.65
MCHC (g/100ml)	30.1^{b}	30.3^{b}	34.7^{a}	34.7^{a}	30.7^{b}	0.001	0.331
WBC's (10^3/cmm^3)	22.7^{b}	27.5^{a}	26.0^{a}	27.5^{a}	28.5^{a}	0.004	4.89
Lymphocytes (%)	40.3^{b}	43.0^{a}	45.5^{a}	45.0^{a}	47.0^{a}	0.041	12.33
Monocytes (%)	15.3	16.0	14.0	14.1	15.5	0.177	1.84
Basophils, (%)	1.00	1.00	1.00	0.900	0.900	0.091	0.054
Eosinophils, (%)	10.7	13.0	11.0	11.5	11.1	0.146	2.08
Heterophils, (%)	32.7	27.0	28.5	28.5	25.5	0.082	5.65

a, b, c Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean. RBC's = red blood cell; PCV = packed cell volume; MCH = mean corpuscular hemoglobin; WBC's = white blood cell, MCV = Mean cell volume, MCHC= Mean Corpuscular Hemoglobin Concentration.

Table (5): Immune indices of broiler local strain (Sasso) fed diet supplemented with SC and MOS during days 7-53 of age

Items	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	P value	SEM
Total protein (g/dl)	5.33^{b}	6.51^{a}	6.55^{a}	6.50^{a}	6.35^{a}	0.019	0.25
Albumin (g/dl)	3.00	3.30	3.4	3.5	3.15	0.239	0.08
Globulin (g/dl)	2.33^{b}	3.21^{a}	3.15^{a}	3.01^{a}	3.20^{a}	0. 029	0.094
α–globulin (ug/dl)	0.877^{c}	1.20^{a}	1.10^{a}	0.960^{b}	1.15^{a}	0.045	0.011
β– globulin (ug/dl)	0.876	0.850	0.750	0.750	0.900	0.062	0.006
γ– Globulin (ug/dl)	0.600^{c}	1.19^{b}	1.30^{a}	1.30^{a}	1.15^{b}	0.0001	0.046
LA (IU %)	0.900^{c}	1.09^{b}	1.14^{a}	1.16^{a}	1.05^{b}	0.031	0.011
BA (%)	34.7^{b}	40.5^{a}	40.0^{a}	41.0^{a}	40.5^{a}	0.050	12.4
LTT(%)	21.3^{c}	25.0^{ab}	25.5^{ab}	27.0^{a}	23.4^{b}	0.007	3.70
PI (%)	1.57^{b}	1.85^{a}	1.95^{a}	2.00^{a}	1.85^{a}	0.017	0.036
PA (%)	15.0^{b}	19.0^{a}	20.5^{a}	20.5^{a}	20.5^{a}	0.001	2.83
IgA (mg/100 ml)	73.3^{b}	81.0^{a}	79.0^{a}	79.5^{a}	79.5^{a}	0.020	38.1
IgM (mg/100 ml)	216^{c}	229^{b}	236^{a}	239^{a}	230^{b}	0.046	324
IgG (mg/100 ml)	969^{b}	974^{a}	975^{a}	975^{a}	974^{a}	0.046	5628
INFγ (pg/mL)	4.09^{c}	4.80^{a}	4.22^{b}	4.83^{a}	4.63^{a}	0.0388	0.099
IL2 (pg/mL)	6.27^{c}	6.99^{b}	7.34^{a}	7.50^{a}	6.98^{b}	0.00108	0.083
IL10 (pg/mL)	16.1^{c}	17.8^{b}	20.7^{a}	21.1^{a}	17.9^{b}	0.00178	0.567

a, b, c, Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean. Phagocytic activity (PA), Phagocytic index (PI), lysozyme activity (LA), bactericidal activity (BA), Lymphocyte transformation test (LTT), Immunoglobulin A (IgA), Immunoglobulin G (IgG), Immunoglobulin M (IgM).

Table (6): Carcass characteristics, relative weight of immune organs and chemical composition of meat of broiler local strain (Sasso) fed diet supplemented with SC and MOS during days 7-53 of age

Items	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	P value	SEM
Carcass characteristics :							
Dressing, %	68.1^{b}	74.4^{a}	71.0^{a}	71.9^{a}	76.7^{a}	0.0310	2.5
Total edible parts, %	70.1^{b}	76.7^{a}	79.9^{a}	78.5^{a}	80.5^{a}	0.324	2.627
Abdominal fat, %	1.849^{a}	0.971^{b}	0.308^{c}	$0.682b^{c}$	0.983^{b}	0.0032	0.162
liver %	2.28	2.22	2.46	2.61	2.10	0.088	0.115
gizzard %	1.24	1.66	1.94	1.59	1.25	0.071	0.05
heart %	0.454	0.486	0.453	0.389	0.407	0.083	0.02
Pancreas %	0.196	0.214	0.195	0.185	0.194	0.068	0.01
Proventriculus %	0.307	0.338	0.388	0.321	0.318	0.069	0.01
Intestinal length %	2.05	1.66	1.75	1.59	1.82	0.061	0.066
Intestinal Weight %	3.02	2.65	3.37	2.97	3.24	0.082	0.139
Inedible parts %	29.3^{a}	23.9^{b}	20.1^{d}	22.0^{c}	19.8^{cd}	0.010	0.726
Immune organs :							
Spleen, %	0.175^{c}	0.213^{b}	0.259^{a}	0.261^{a}	0.269^{a}	0.0002	0.01
Bursa, %	0.254^{a}	0.064^{c}	0.076^{c}	0.083^{c}	0.109^{b}	0.0001	0.01
Thymus,%	0.266	0.400	0.382	0.525	0.441	0.0876	0.01
Chemical composition of meat :							
Protein , %	22.0^{c}	24.0^{b}	26.9^{a}	27.3^{a}	25.4^{ab}	0.025	1.211
Fat, %	2.90^{a}	2.20^{c}	2.10^{c}	2.60^{b}	2.40^{bc}	0.001	0.115
Ash, %	12.8	12.7	12.1	11.9	12.7	0.739	0.570
Fiber, %	1.60^{a}	1.32^{b}	1.30^{b}	1.32^{b}	1.20^{b}	0.005	0.065
Carbohydrate, %	2.20	2.00	1.90	1.90	2.20	0.076	0.093
TAC (mg/dl)	416^{c}	427^{b}	428^{b}	435^{a}	426^{b}	0.035	20.071

a, b, c Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean. TAC = Total antioxidant capacity

Table (7): Bacterial count of broiler local strain (Sasso) fed diet supplemented with SC and MOS during days 7-53 of age

Items	Control	S.C 0.1 %	S.C 0.2 %	MOS 0.25g	MOS 0.5g	P value	SEM
TBC	2.68^{a}	2.29^{b}	2.15^{c}	2.17^{c}	2.28^{b}	0.002	0.091
Salmonella	0.925^{a}	0.832^{b}	0.785^{b}	0.705^{c}	0.790^{b}	0.019	0.030
E.Coli	1.14^{a}	0.825^{b}	0.865^{b}	0.755^{c}	0.880^{b}	0.0001	0.040
Proteus.	0.870^{a}	0.453^{b}	0.255^{c}	0.130^{d}	0.200^{cd}	0.0004	0.026

$^{a, b, c, d}$ Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.
TBC = Total Bacterial Count

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الملخص العربى
تأثير إستخدام الخميرة الجافة والمنان أوليجوسكاريد علي الأداء الإنتاجي وخصائص الدم البيوكيمياوية والهيماتولوجية والإستجابة المناعية لدجاج الساسو

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أجريت هذه الدراسة في وحدة بحوث الدواجن بمزرعة البستان، قسم الإنتاج الحيواني والداجني، كلية الزراعة جامعة دمنهور. هدفت هذه الدراسة إلى تقييم تأثيرإضافة الخميرة الجافة والمنان أوليجوسكاريد على أداء النمو، والكفاءة الإقتصادية، والصفات البيوكيميائية والهيماتولوجية للدم والإستجابة المناعية عند عمر53 يوماً لكتاكيت الساسو. إستخدم في هذه التجربة عدد ثلاث مائة من كتاكيت الساسو غير المجنسة عمر 7 أيام و التي وزعت علي خمسة معاملات بكل منها عدد 60 كتكوت موزعة علي ستة مكررات بكل مكررة عشرة طيور. إستخدمت المجموعة الأولي للمقارنة (كنترول) المعاملات رقم 2 ، 3 غذيت علي علائق تحتوي علي مسحوق الخميرة الجافة بمستويات 0,1 و 0,2%، بينما غذيت المعاملات رقم 4 ، 5 علي علائق تحتوي علي المنان اوليجوسكاريد بمعدل 0,25 و 0,5 جم /كجم علف.
أظهرت النتائج حدوث زيادة معنوية في وزن الجسم الحي ومعدل الزيادة في وزن الجسم وحدوث إنخفاض في إستهلاك العلف وكذلك حدوث تحسن في الكفاءة الغذائية والكفاءة الإقتصادية و وزن الذبيحة في المجموعات التي غذيت علي الخميرة والمنان اليجوسكاريد مقارنة بمجموعة الكنترول. أظهرت النتائج أيضاً حدوث زيادة معنوية في مستوي بروتينات و ألبيومينات الدم والجلوبيولينات المناعية في المجموعات المضاف إليها الخميرة والمنان مقارنة بمجموعة الكنترول. بينما كان هناك إنخفاض معنوي في مستوي الدهون الكلية في الدم و الكوليسترول وكذلك إنخفاض مستوي HDL- LDL في المجموعات المغذاة علي الخميرة والمنان أوليجوسكاريد مقارنة بمجموعة الكنترول. تم تسجيل زيادة في مستوي جلوكوز الدم وكذلك زيادة في تركيزات هرمونات الغدة الدرقية وأيضاً تحسن في مستويات إنزيمات الأكسدة المختلفة في سيرم الدم في المجموعات المغذاة على الخميرة والمنان أوليجوسكاريد مقارنة بمجموعة الكنترول. حسنت الإضافات المستخدمة من وظائف الكبد والكلى مقارنة بالكنترول. من ناحية أخرى أدت هذه الإضافات إلي زيادة معنوية في عدد كرات الدم البيضاء، كرات الدم البيضاء الليمفاوية، كرات الدم البيضاء المتعادلة، زيادة بروتين السيرم الكلي جلوبيولين السيرم والألفا والجاما جلوبيولين بالمقارنة مع مجموعه الكنترول. وأدت جميع الإضافات إلى زيادة مستوى إنزيم (SOD) و الجلوتاثيون(GSH) والجلوتاثيون بيروكسيديز والقدرة المضادة للأكسدة والنشاط البلعمى ودليل النشاط البلعمى ومعامل تحويل الخلايا الليمفاوية ونشاط مقاومة البكتريا والنشاط الليسوسومى بالمقارنة مع مجموعه الكنترول.
أدت جميع الإضافات إلى زيادة الجلوبيولينات المناعية (IgY - IgM - IgA) بالمقارنة مع مجموعة الكنترول. كما أدت إلى حدوث زيادة في نسبة البروتين وإنخفاض الدهون والألياف في اللحم في الكتاكيت المغذاة على الخميرة والمنان اليجوسكاريد، كما حدث تحسن في القدرة المضادة للأكسدة في لحوم كتاكيت الساسو المغذاه علي هذه الإضافات والذى يتفق مع نتائج القدرة المضادة للأكسدة في سيرم الدم. أدت جميع الإضافات إلى حدوث إنخفاض في أعداد الكائنات الحية الممرضة في الأمعاء في المجموعات المغذاه علي الخميرة الجافة و المنان أوليجو سكاريد مقارنة بالكنترول.
مما سبق يتضح أن إضافة كلاً من مسحوق الخميرة الجافة أو المنان أوليجوسكاريد إلي علائق دجاج الساسو بأي من المستويات المدروسة أدت إلي تحسن في الأداء الإنتاجي والإقتصادي والفسيولوجي والمناعي لكتاكيت الساسو تحت ظروف إجراء هذه الدراسة.