Evaluation Of Dried Brewers Yeast As A Feed Additive For Lohman Broiler Chicks Diet

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ABSTRACT

The effect of feeding different levels of yeast on growth performance, blood constituents, meat composition and nutrient digestibility of Lohman chicks was studied . An experiment of 4 weeks duration was conducted on 200 one day-old chicks. There were 4 dietary treatments each consisting of 5 replicates with 10 chicks in each replicate. The treatments were 0% (control) , 0.1 , 0.2 and 0.4 % yeast respectively. Data were obtained for body weight , daily gain , feed intake and feed conversion ratio during the experimental period (0 – 28 d of age). At the end of the experiment meat composition , nutrient digestibility, concentration of proteins, glucose, cholesterol, total lipids, phospholipids in serum, and hemoglobin were evaluated . Results showed that chicks fed 0.2 % yeast had higher body weight gain (BWG), feed intake (FI) and the better feed conversion ratio (FCR). Chicks fed ration containing 0.2 and 0.4 % yeast had significantly reduced serum total lipids, and cholesterol concentrations , and showed significant increase in serum phospholipids and total protein of their concentrations .While the level of 0.1 and 0.2 % yeast increased the protein and glycogen % and reduced the fat % of both breast and leg meat composition parameters. Significant increase in the nutrient digestibility coefficient including crude protein , crude fiber and nitrogen free extract percentages were recorded in 0.2 % yeast group, and above this level they decreased. It is concluded that dietary brewer yeast could improve the performance, blood and meat constituents of broiler chicks.

INTRODUCTION

Brewers yeast is a natural source of protein and B-complex vitamins. The commercial preparations in either powder or compressed are added to the animals feeds for their nutritional contents *(1)* and as it provides the highest activity at the lowest used cost .

Yeast is a general term including single-celled usually rounded fungi. They are fermenters of carbohydrates and are fed to colonize the intestinal environment and promote a better flora balance *(2).*

Yeast has beneficial affects on broilers performance *(3),* modulation of intestinal microflora and pathogen inhibition *(4),* intestinal histological changes *(5),* reduce mortality *(6),* immunomodulation *(7),* certain haematobiochemical parameters *(3),* improve sensory characteristics of dressed broiler meat *(8)* and meat quality of broilers *(5).*

As we know, the gastrointestinal tract is developmentally very active in the early period post hatch in poultry species *(9)*. The intestinal crypt that form on the day of hatch become defined in the first 48 to 96 hours and continue to grow rapidly during the first 7 day *(9).* The intestinal villi increase significantly in diameter during the first 7-10 days after hatch *(10).*

Broiler starter and growing ration components include protein and energy which are high with the use of traditionally costly feeding ingredients such as maize and soy bean meal . So that , the cost of production these rations also becomes high. It could be reduced with the use of less costly feed ingredients such as industrial by-products Brewers dried yeast grains which is high in metabolizable energy and crude protein and hence could be used to reduce quantity of soybean used in broiler ration.

This study was designed to investigate the effect of three different levels of yeast supplemented to broiler chicks diets on performance (live body weight, feed consumption, feed conversion, and economic efficiency) , nutrient digestion coefficient, meat composition and blood constituents of Lohman chicks .

MATERIAL AND METHODS

Experiments

This study was carried out in January, on two hundred one day old broiler chicks. They were randomly distributed into one control group and three treatments groups, each contains 50 broiler chicks. The level of brewer yeast prepared daily and added freshly to the diets , at concentrations of 0 , 0.1 , 0.2 and 0.4% for control, 1st, 2nd and 3rd groups respectively .

The chemical composition of diets is given in Table 1 as reported by AOAC *(11)*. The chemical composition of brewer yeast is shown in Table 2 *(18)*. Feed and water was provided *ad libitum*. The birds were weighed at 1st day, at the end of first , second , third and fourth weeks age (Table 3). And similarly feed consumption was recorded and the mean of each group was obtained in Table 4 . Body weight gain , feed intake and feed conversion ratio was recorded as follow(Table 5):

Feed conversion ratio (FCR) =

$$\frac{\text{feed intake / bird / w}}{\text{body gain / bird /w}} .$$

Nutrient digestion coefficient was determined at the 3rd week using total collection method of the feces and consumption by broiler chicks of each group over 72 hours .The fecal samples were dried in an oven at 80°C ,weighed and milled prior to chemical analysis *(11)* (Table 6) .

At the end of 4th week , six broiler (3 male and 3 female) were selected from each group. They were individually slaughtered, scalded, plucked, and allowed to drain. Eviscerated carcasses were chilled in a cold room (2°C) for 24 hours . Breast meat and thigh meat were chemically analyzed for moisture, crude protein, fat, ash, and glycogen *(11)* (Table 7) .

Blood samples were collected from five slaughtered birds from each group where haemoglobin *(12)* , serum total protein *(13)*, cholesterol *(14)*, total lipids *(15)*, phospholipids and glucose *(16)*, were assessed (Table 8) .

Statistical analysis : All data were analyzed by T- test *(17)* .

RESULTS AND DISCUSSION

The live body weight

In Table 3 the live body weight of broiler chicks was not significantly affected during the starter phase (day 1 to 2 weeks) by adding brewers dried yeast, except at 0.2% level . The most significant affection of yeast feeding level was at two weeks old. It seems that a period of adaptation is needed before the effects of yeast supplementation can be significant because the changes in the intestinal morphology take time *(19)*.

However, during the grower phase (3and 4 weeks) supplemental brewers yeast by 0.2% improved the live body weight which was highly significant than at 0.1% and improved significantly comparing with the control. Similar result was reported in finisher broiler (20). Yeast helps chicks get on feed quicker, increases rate of gain revealed that yeast primarily targeted at grain or grain by-product components of the diets by its direct benefits on the digestibility of vegetable proteins and fibrous matter in the ration and indirect, when yeast and metabolic enzymes breakdown the fibrous and nutrient components of the ration. At the end the yeast improve digestion by providing the digestive enzymes, as amylase, protease, lipase and invitase for starch, protein and fat digestion respectively *(21)*.

Also, yeast possesses a natural attractive flavor which can improve the palatability of the feed *(22)*, and contains B-complex vitamins which aid feed digestibility and nutrient absorption. Another, yeast contents were unknown growth factors with B-complex vitamins, which may be essential for the nutrition of specific gastro-intestinal microorganisms and for the host animal metabolism .

Supplementation of feed with yeast improved broiler body weight, as yeast improve the intestinal mucosal aspects, ,and produce new

epithelial cells in intestinal mucosal crypts and migrate along the villi to the top *(23)* .Then greater villi height increases the activities of enzymes secreted from tips of villi resulting in improving digestibility *(23).*

A significant lower pH of intestinal content (duodenum, ileum, caecum) with increase in length and width of intestinal villi and decrease depth of crypts was recorded *(24)*.

Our results denoted that body weight was not affected by brewer yeast except at 14 , 21 and 28 days of age, the body weight of birds supplemented probiotic was either significantly higher or tended to be higher than that of control birds *(25)* .This body weight was insignificantly improved as the probiotic level increased in diet.

On contrast it has been reported that body weight gain was not affected by yeast supplementation *(26)* , the reason of variation might be related to the species, strains, or concentration of yeast used.

The feed consumption

The present results in Table 4 revealed a highly significant decrease of feed consumption with the dietary supplementation in all yeast levels at the end of 4^{th} week comparing with the control group within each column . A high feed consumption was recorded when yeast was supplemented compared to the control *(27).*

These increases is related to yeast contents of metabolites such as peptides, organic acids oligosaccharides, amino acids, flavor and possibly some unidentified growth factors which have been proposed to produce beneficial responses in animal production *(19,23).*

In contrast, other studies *(19,24)* recorded that feed consumption was not affected by dietary yeast supplementation .This may be due to the difference in the level of yeast used.

The feed conversion

In Table 5 the feed conversion of Lohman chickens was significantly increased at 0.1% level yeast at the end of 1^{st} week while it was decreased at 0.4% at the end of 1^{st} week . And at 0.1 and 0.2 % levels of yeast supplement feed conversion at the end of 2^{nd} ,3^{rd} ,and 4^{th} week were significantly decreased.

The improvements in feed conversion is due to the fact that diet contained yeast gave the better relative economic efficiency compared to the control diet , this improvement could be an improving the feed conversion or reducing the amount of feed required to produce body weight gain *(26,28)*.

An improvement in feed conversion by increasing the dietary yeast was without affecting feed consumption. Yeast feeding to chicks improve feed conversion and feed intake at 1.5 % yeast level not above or under this level *(29).* It seems that feed digestion is alter by adding more yeast which alter the bird growth too.

Economic efficiency of chick fed experimental yeast diets at the end of 1^{st} -2^{nd} weeks old was better. Which could be due to improving feed conversion or reducing the feed required to produce body weight gain. The improvement of feed conversion with a reduction in cost of feeding in this study has previously been observed *(20,23,30,31)*. That improvement in feed efficiency may be partially attributed to the establishment of an intestinal bacterial population that favored nutrient retention . Feed conversion was not affected by dietary yeast supplementation *(24)*.

The reason for the variable effect of biological additives may be confounded by variations in gut flora and environmental conditions *(32)*. Several researchers reported that when chicks were housed in a clean environment, the probiotic didn't affect the growth performance *(33)* .This mean that greater response to antimicrobial agents was in a dirty environment

Nutrients Digestion Coefficient

Table 6 revealed a significant increases in the digestibility of crude protein ,crude fiber and nitrogen extract at the end of 4^{th} week under effect of the dietary brewer yeast 0.2% level .While the organic matter not affected significantly comparing with the control. Nutrient retention values seems to confirm that yeast as a growth performance especially that of protein *(30)*. Also, the significant retention value of crude fiber confirms yeast as possessing the ability to degrade fibrous materials in poultry

feeds. Ordinarily, poultry lacks the enzymes such as cellulases, hemicellulases and xylanases needed to digest high fiber diet.

Presumably, it thus appears that yeast primarily targeted at grains or grain by-products components of the diet will have both direct and indirect benefits on the digestibility of vegetable proteins and fibrous matter in the ration *(30).*

Indirect benefits of yeast can arise when yeasts and metabolic enzymes breakdown the fibrous and nutrient components of the ration *(21).*

Similarly tow published reports *(28,34)* showed a positive results on the nutrient digestion coefficient of dry matter, organic matter, ether extract ,crude protein, crude fiber and non - esterified fatty acids.

A non significant differences among this nutrient retention under yeast supplementation effect has previously been reported *(19)*.

The meat composition

Table 7 displays that both the protein and glycogen percentages were significantly increased at both 0.1 and 0.2 % brewer yeast diet supplementation comparing with the control group. Also fat % in chicken meat was significantly decreased at 0.2 % and 0.4 % of yeast supplement .Whereas moisture and ash percentages of chicken meat were not influenced by yeast feed supplementation in all used levels .

Meat of chicks fed yeast may contain less fatty acids, which means that it was significantly less in lipid deposition than control chicks *(23)*.

Yeast feeding improved the chemical composition of breast and leg meat of broiler chicks *(29)*.

Meat of supplemented chicks was higher in their dry matter and crude protein percentages at 1.5 and 2% yeast levels compared with control

Direct microbial feeding resulted in lower tibia ash than of birds fed control diet *(36)*. And meats from broiler chicks fed diet containing chromium enriched yeast exhibited increased water holding capacity *(37)*.

Moisture , protein , fat , and ash percentages were not influenced by addition of natural feed additives *(28)*.

Blood constitutents

Table 8 showed significant increases in hemoglobin level of broiler chicks fed brewers yeast diets at 0.2 and 0.4% comparing with the control chicks. A positive correlation between dietary levels of yeast *(sacchromyces cervisiae)* and hematological indices in broiler chicks , suggested that these correlations may be an additional mechanism of growth promotion by supplemental yeast *(38).*

Also, a significantly higher hemoglobin in chicken fed diet containing 0.2% granular sacchromyces cervisiae (yeast) was previously demonstrated *(39).*

On contrast a varied hemoglobin content from 4.2-7.2 gm /dl (marginal decline) with increasing yeast sludge levels, was cited *(27)* This may be due to the supplementation of diet by the yeast.

The yeast diet at level 0.2 % and 0.4 % caused a highly significant increase in total protein and phospholipids , while total lipid and cholesterol concentrations were significantly decreased at the end of 4th week (Table 8).

Serum protein was responsive to protein intake and quality of yeast diet supplemention *(29)*.

In contrast several studies *(27,28,39)* indicated that feed yeast supplementation had no significant effect on serum total protein of broiler chicks.

Lower serum cholesterol in this study and previous severally *(29,32,34,38,39)* investigation may be due to serum cholesterol regulation by probiotics which contributed to the deconjunction of bile, since the excretion of deconjugated bile acid is enhanced and cholesterol is its precursor, more molecules are spent for recovery of bile acids which synthesized by yeast *(40).* As a result of increased synthesis of bile acids , the level of serum cholesterol was expected to reduce.

Cholesterol level in avian blood are affected by age , heredity , nutrition and various diseases.

In contrast to our study , *(28)* recorded insignificant affections plasma cholesterol by yeast.

Our results revealed a highly significant increases of serum phospholipids in broiler chick while in rabbits low level of serum phospholipids was induced by supplementation of the diet by S.C. yeast *(38)*.

Table 1.Composition and calculated analysis of experimental diets according to NRC *(16).*

Ingredient	Groups			
Brewers dried grains %	0.0	0.1	0.2	0. 4
Yellow corn	64.0	64.0	64.0	64.0
Soybean meal 48.5 %	27.5	27.5	27.5	27.5
Wheat bran	4.25	4.25	4.25	4.25
Bone meal	2.80	2.80	2.80	2.80
Lime stone	0.60	0.50	0.42	0.35
Vit +Min . mix (1)	0.25	0.25	0.25	0.25
NaCl	0.30	0.30	0.30	0.30
Dl –Methionine	0.10	0.13	0.16	0.18
L.lysine	0.00	0.03	0.06	0.08
Calculated values Crude protein %	21.0	21.02	21.0	21.03
ME.K cal / kg	2902	2902	2904	2903
Lysine %	1.01	1.01	1.01	1.01
Methionine	0.40	0.42	0.44	0.45
Methionine +Cys %	0.73	0.75	0.75	0.76
Calcium %	1.15	1.15	1.15	1.15
Av .P. %	0.50	0.51	0.52	0.50
Determined values Dry matter %	89.01	89.23	89.81	89.15
Crude protein %	19.57	19.72	19.90	19.60
Crude fiber %	3.00	3.51	3.88	3.24
Ether extract %	2.79	2.83	2.91	2.80
Price 1.E / ton	852	855	858	864

(1)vitamins and mineral mixture provide /kg of diet were :vit.A 1000 I.U, E 10mg,K_3 1mg ,B2 1.5 mg ,pantothenic 10 mg ,B 12 0.01 mg ,Niacin 20mg, Biotin 0.05 mg ,choline chloride 500 mg ,Zn 45 mg ,Cu 3 mg ,Mn 40 mg ,Se. 0.1 mg ,Iodine 1 mg .
Brewers dried grains costs = 3 LE /kg during the experiment.

Table 2. Chemical composition of dried brewers yeast *(18)*.

Protein %.	Fiber %	Ca %	Phosphorus available %	Lecithin %	Methionine %	Cystine %	Metabolize energy Kcal /kg
44.6	3	0.13	1.43	3.8	0.8	0.50	2425

Table 3. Live body weights (B. wt.)(gm) of Lohman chickens as affected by different dried brewers yeast levels during day — 4 weeks old .

Body weight / Dietary dried brewers yeast (%)	Initial B. wt.	Age (week)			
		1st	2nd	3rd	4th
Control	45.2±0.2	137.6±0.5	282.9± 2.6	472.6± 8.1	725.7±5.2
0.1	45.6±0.2	133.5±0.7	283.4± 3.1	486.9±7.0*	763.6±8 *
0.2	45.3±0.2	134.6±0.6*	302.7±5.8*	525.3±3.9**	808.4±11**
0.4	45.4±0.1	136.7 ± 0.4	282.4 ± 4.6	474.8 ±6.3	724.1±9.2

*Significant at $P < 0.05$, ** Significant at $P < 0.01$.

Table 4.Feed consumption (gm / bird / period)of Lohman chickens as affected by dietary dried brewers levels during day - 4 weeks old

Dietary Dried brewers yeast (%)	Feed consumption (week)			
	1st week	2nd weeks	3rd weeks	4th weeks
Control	136.8± 1.2	216.5± 2.0	390.3 ±0.29	497.3 ± 5.3
0.1	161.5±0.8*	212.6± 2.5	374.1 ± 3.1	389.6 ± 6.1**
0.2	132.9 ±1.6	220.7±1.9	388.8 ± 2.8	415.6 ± 6.3**
0.4	103.2±2.3*	193.8 ±3.1	384.4 ± 4.0	322.3 ± 4.2**

*Significant at $P < 0.05$, ** Significant at $P < 0.01$.

Table 5. Feed conversion and economic efficiency of Lohman chicken as affected by different dietary dried brewers yeast levels during day - 4 weeks old (mean ±S.E).

Dietary dried brewers yeast (%)	Feed /gain ratio				Economic efficiency Day-4 wks	
	day-1wk	1-2wks	2 - 3wks	3 - 4wks	Feed cost LE(1)	Selling revenue LE(2)
Control	1.48±0.3	1.49±0.3	2.05 ±0.2	1.96±0.2	62.04× 0.85	4.42
0.1	1.83±0.1*	1.42±0.4	1.84 ±0.3*	1.4±0.2**	56.88 ×0.86	4.66
0.2	1.49±0.3	1.31±0.2	1.74 ±0.3*	1.5±0.3**	57.89 ×0.86	4.95
0.4	1.14±0.2*	1.3±0.08	1.99 ±0.3	1.3±0.2**	53.23×0.86	4.40

*Significant at $P < 0.05$, ** Significant at $P < 0.01$.

Table 6. Nutrients digestion coefficient (%) of Lohman chicks as affected by different levels of dried brewers yeast at the end of 4th week old (mean ±S.E).

Dietary dried brewers yeast (%)	Digestion Coefficient (%)				
	Crude protein	Crude fiber	Ether extract	Nitrogen Free extract	Organic matter
Control	80.3± 0.59	22.1 ±0.19	77.9± 0.58	80.4 ± 0.22	79.2± 0.70
0.1	81.7 ± 0.47	24.5 ±0.2	78.1± 0.74	82.0 ± 0.19	80.9± 0.52
0.2	85.8±0.58 *	26.1±0.28*	79.2± 0.61	84.9±0.35*	82.7± 0.63
0.4	79.5 ± 0.62	20.1±0.40	76.3± 0.38	75.8±0.61*	77.1± 0.46

*Significant at P < 0.05 , ** Significant at P < 0.01.

Table 7. Meat composition (mean ±S.E) of Lohman chicken at the end of 4th week old as affected by different dietary dried brewers yeast levels.

Dietary dried brewers yeast (%)	Meat composition (%)				
	Moisture	Protein	Fat	Ash	Glycogen mg/100 gm
Control	70.8±1.6	73.2±2.9	8.87±.59	4.95± 0.36	192.5 ± 8.3
0.1	70.5±2.3	75.9±2.6 *	7.5±0.34	5.01± 0.42	219.4±7.9 *
0.2	69.9±1.7	77.1±3.3*	6.12±0.3*	5.18 ± 0.6	224.1± 9.2*
0.4	71.0±1.5	74.1±3.1	5.8±0.8*	5.03± 0.5	200.3±7.1

*Significant at P < 0.05 , ** Significant at P < 0.01.

Table 8. Blood constituents of Lohman chicken as affected by different dietary dried brewers yeast levels at the end of 4th week old.

Dietary dried brewers yeast (%)	Parameters					
	Haemo-globin (gm/100ml)	Total protein (gm/100ml)	Glucose (mg/100ml)	Total lipids (gm / l)	Cholest-erol (mg/100ml)	Phospho-lipids mg/100ml
Control	10.2±0.12	5.64±0.4	181±6.2	107.2±4.6	176±5.8	228±17.2
0.1	10.9±0.1	5.91±0.3	179.2±2.8	85±6.2*	143±9.2*	275±20.1
0.2	11.8±0.1*	6.97±0.6*	190.1±5.3	78.9±2.5**	128±4.3**	341±13**
0.4	11.7±0.2*	6.68±0.5*	183.6±3.9	75.5±7.3**	131.2±9**	310±19.3*

*Significant at P < 0.05 , ** Significant at P < 0.01

CONCLUSION

The results of this study indicated that feeding chicks on diets containing yeast additives improved chicks performance (live body weight, feed consumption, feed conversion, relative economic efficiency values), which pronounced by decrease in cholesterol and lipids. Also it improved chicks meat protein and serum total protein compared to the control group, in addition to a decrease in meat fat percentage. Thus yeast offers potential advantages as feed supplement during the

grower phase. And its efficiency will depend on the quantitative and qualitative characters of yeast used in the production .

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الملخص العربى

تقييم استخدام الخميرة الجافة كإضافة غذائية لعليقة بدارى لوهمان للتسمين

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تمت دراسة تأثير اضافة مستويات مختلفة من الخميرة إلى علائق الدجاج لوهمان على أداء النمو ، تكوين الدم واللحم وكذلك على معدلات هضم المواد الغذائية . وأجريت التجربة على عدد ٢٠٠ كتكوت لوهمان عمر يوم وأستمرت لمدة ٤ أسابيع . هناك أربع مجموعات تحت كل مجموعة خمسة مكررات وبكل مكررة ١٠ كتاكيت في كل تكرار. وكانت المجموعات : تحتوي على إضافة الخميرة صفر % (الضابطة) ، ٠,١ ، ٠,٢ و ٠,٤ % على التوالي . وتم تسجيل بيانات عن وزن الجسم ، والزيادة اليومية ، تناول العلف ونسبة التحويل خلال الفترة التجريبية (٠ -- ٢٨ يوما من العمر) . وفي نهاية التجربة تم قياس مكونات اللحوم ، وهضم المواد الغذائية ، وتركيز البروتينات والسكر والكولسترول والدهون الكلية ، والدهون الفوسفاتية في مصل الدم ، وجرى تقيم الهيموجلوبين في الدم .

وأظهرت النتائج ان :

١- إضافة الخميرة بنسبة ٠,٢ % كان لها تأثير ايجابيا على زيادة وزن الجسم ، ومعدلات النمو واستهلاك العلف ونسب التحويل .

٢- أن تغذية الدجاج التي تحتوي على مستوى ٠,٢ % و ٠,٤ % من الخميرة كان له تأثير

معنويا على خفض نسب كل من الدهون الكلية ، وتركيزات الكولسترو و زيادة كبيرة في كل من تركيزات الدهون الفوسفاتية والبروتين الكلي في المصل.

٣ - وفي حين أن مستوى ٠,١ % و ٠,٢ % من الخميرة كان له تأثير معنويا على زيادة نسب كل من البروتين والجليكوجين وخفض نسبة الدهون الكلية فى محتويات لحوم الصدر والوراك .

٤- وزيادة كبيرة في في معامل هضم الغذاء بالمستوى ٠,٢ % من الخميرة بما في ذلك البروتين الخام والألياف الخام واستخراج النسب المئوية والنيتروجين.

أيضا أوضحت هذة التجربة أن إضافة الخميرة إلى النظام الغذائي يمكن أن يحسن معدلات النمو ومحتويات الدم واللحم المكونة لدجاج التسمين .