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# THE EFFECT OF DRIED YEAST (*SACCHAROMYCES CEREVISIAE*) SUPPLEMENTATION ON GROWTH PERFORMANCE, CARCASS CHEMICAL ANALYSIS, IMMUNITY, ILEUM VILLI HIGHTS AND BACTERIAL COUNTS OF BROILER CHICKENS

**By**

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**Abstract***: An experiment was conducted to evaluate the effect of Diamond V XP Yeast Culture supplementation on growth performance, carcass chemical analysis, feed conversion ratio, ileum total bacterial count, ileum villi height, immunity and mortality of commercial broiler chicken. A total of 3000 unsexed one-day old cobb broiler chicks were randomly divided into equal two major groups each of four replicates , Chicks in group 1 were fed the starter and finisher diets that did not supplemented with dried yeast .The chicks of group 2 were fed the control starter and finisher diets plus 5g / kg and 2.5 g / kg of Diamond V XP™ Yeast Culture (**XP;** Diamond V Mills Inc. Cedar Rapids, Iowa USA through ARTAT Enterprises, Riyadh Kingdom of Saudi Arabia, respectively for 42 days. .Results indicated no significant difference in growth performance between yeast culture and control diet at 4, 5 and 6 wks of age. Intestinal villi volume density (at 42 d of age), carcass protein as percentage ofdry matter and antibody titers to Newcastle Disease (NCD) were significantly improved. Yeast supplementation to broiler diets had no significant effects on both carcass ether extract and ash as % DM, weight gain, and antibody titer against sheep red blood cells, however, yeast supplementation induced noticeable improvement in both mortality percentage and feed conversion ratio. From a commercial point of view, improved feed conversion with yeast supplementation is beneficial. It worth to note that although birds fed yeast culture could reach approximately the same body weight of the control birds at 42 days of age , with less feeding costs, mortality was less with high carcass protein content. These trends need to be confirmed in a trial with more replicates.*

## INTRODUCTION

Over the last several years considerable attention has been given to the use of probiotic, yeast, and other natural feed additives in poultry feeds. Much of this interest has been generated because of increased public awareness and objection to use antibiotics as a growth promoter.

Yeast have been added to formulated diet for more than hundred years, Saccharomyces cerevisiae , which is known as " baker yeast " rich in crude protein (40 – 45 % ) of high biological value and it is also rich in vitamin-B complex . Several vitamins were extracted from yeast, including biotin, niacin, pantothenic acid and thiamin. The quality of yeast protein is similar to that of soybean. Both are rich in lysine, and are excellent supplements to cereals, whose proteins are generally low in lysine (Reed and Nagodawithana, 1991). Yeast supplementation to broiler diets has significantly improved live weight , slaughter weights, average daily gains, feed efficiency, fibre digestibility and reduced mortality (Kumprecht et al., 1997, Adejumo et al ., 2004 and Hooge, 2004) . From the previous interesting observation , and as it is well known that the performance of the bird is a reflection of its physiological activity , therefore , the present work was carried out to study the effect of adding drying yeast (*Saccharomyces cerevisiae*) to broiler diets on its immune system , growth performance , carcass chemical analysis , feed conversion ratio , ileum villi hights and total bacterial counts.

## MATERIALS AND METHODS

This experiment was carried out at the Poultry Farm of the Agricultural Experimental Station, faculty of Agriculture and Veterinary Medicine, AI-Qassim University Saudi Arabia. A total number of 3000 one day-old unsexed Cobb broiler chicks were grown over 42-d period. Chicks were wing-banded, weighed individually and randomly divided into two equally major groups each contained four replicates of 375 birds each. Chicks in group 1 were fed the starter and finisher diets that did not supplemented with dried yeast (Table 1) .The chicks of group 2 were fed the control starter and finisher diets plus 5g / kg and 2.5 g / kg of Diamond V XP™ Yeast Culture as recommended by (**XP;** Diamond V Mills Inc. Cedar Rapids, Iowa USA through ARTAT Enterprises, Riyadh Kingdom of Saudi Arabia, respectively. The starter diet was replaced by the finisher diet at the end of the third week of the study. Feed and water were provided *ad libitum*. Ventilation, and temperature were controlled by a

DicamFSC2.2M master unit (Farm Energy and Control Services Ltd (Farmex), Pinewood, Reading. RG303VR UK.). All diets were formulated to provide the recommended requirements for broilers according to NRC , (1994 ).At 14 days of age, Individual body weights ,food consumption and mortality rate were recorded on a weekly basis. At 21 and 35-d of age, 10 chicks from each group were used to measure immunity against New Castle disease and Sheep Red Blood Cells (SRBC) according to Allan and Gough (1974) and Wegman and Smithes (1966), respectively. At 42 days of age, 5 birds from each group were randomly selected, starved over night and sacrificed for total bacterial count, carcass chemical composition and ileum villous height measurements.

Villi height and crypt depth was determined according to a procedure outlined by Wae and Dunnil (1982). Changes in size of intestinal villi were measured using a morph metric method. Briefly, tissue samples were collected from the those received yeast .Then , it fixed in 10% buffered neutral formalin, and processed for paraffin embedding. Sections approximately 5-6 µm thick were extracted, stained with Masdson's trichrome and examined with a light microscope fitted an eyepiece measuring graticule. Point counting was performed in 5 sections taken from each sample. The volume density (Vv) of the intestinal villi of control and supplemented birds was obtained by using the following formula: Vv ratio = a/A, where a is the number of points falling on villi and (A) is the total number of points counted. The relative standard error RSE was calculated as follows: RSE= $(\sqrt{1-Vv})/\sqrt{n}$; where n is the number of points falling on the villi. The minimum sample size was obtained by using the following formula: $Pc= (\sqrt{1-Vvn/RSE})^2$, where Pc is the total number of points falling on the intestinal villi and Vvn is the cumulative mean.

Carcass moisture, fat, protein and ash were analyzed according to AOAC methods (1990), and expressed as percentage of dry matter. The ileal bacterial count was enumerated using the pour plate technique (Maturin and Peeler, 1998) . Ten-fold dilution was prepared from each sample in peptone water. Three empty sterile Petri plates were inoculated from each dilution by transferring 1 ml from the dilution into each plate. The inoculums were thoroughly mixed with sterile molten plate count agar (Win lab, Leicestershire, England) that was kept in water bath at 50ºC. Agar plates were allowed to solidify and then incubated at 37 ºC for 24 h. Bacterial colonies were counted in plates using an electronic counter. Colony forming units (CFU) per one gram of ileum content were calculated by multiplying the mean count by the dilution factor. Data were analyzed using GLM procedure of the SAS (1996). Data of

growth parameters were analyzed using the following linear model: $\mathbf{X_{ijk} = \mu + R_i + A_j + B_k + AB_{jk} + e_{ijk}}$ Where: $X_{ijk}$ = Observation on $ijk^{th}$ trait; $\mu$ = Overall mean; $R_i$ = Effect of $i^{th}$ replicate, $A_j$= Effect of $j^{th}$ yeast treatment (i= 1, 2; 1= control, 2= with yeast); $B_j$ = Effect of $k^{th}$ sex (k= 1, 2; 1= males, 2= females); $AB_{ij}$ = Effect of two-order interaction of $A_j$ and $B_k$; *eijk* = Random error.

Data of carcass composition, villi volume, and total anti-body titer and ileum total bacterial counts were analyzed using the same previous model after deleting the sex effect from the model. All data expressed as percentages were subjected to arc-sin transformation before being analyzed to approximate normal distribution.

## RESULTS AND DISCUSSION

Effect of yeast culture supplementation on broiler performance is summarized in Table(2). Body weight of broiler chicks were unaffected by supplementation of yeast with the exception of broiler chicks supplemented with dried yeast which having a lower body weight ($P$<0.05) at 3 weeks of age. Broiler chicks had numerically lower body weights during 4, 5 and 6 weeks of age than control birds. This finding disagree with the result of kemal *et al* (2001) who reported that body weight of broiler at 37 days of age was better with *Saccharonmyces cerevisiae* supplementation than those of the control group (P<0.05).Throughout the experiment period ,although the daily feed consumption was numerically higher for the control group., Feed conversion ratio was numerically improved for birds supplemented with yeast culture. This finding is in agreement with Banerjee and Pradham (2006) who reported that live yeast supplementation to broiler chick significantly improved feed conversion ration . Moreover, they attributed this improvement to better nutrient digestibility and nitrogen retention due to the activity of the probiotic. Villi volume was significantly greater ($P$<0.05) in broiler chicks supplemented with dried yeast ( Table 3 & Fig. 1 ) than those un supplemented . so, the absorption and utilization of nutrients were improved in the gut . In this respect, Banerjee and Pradham (2006) indicated that live yeast supplementation significantly increased the number and height of intestinal villis over those of non-supplemented chicks. It may be appeared that the live yeast improved intestine maturation and villis formation which increasing the surface of nutrient absorption .Then , it resulted to improve feed conversion ration . Results of table (2) indicated that broiler chicks supplemented with dried yeast had lower total bacterial counts in ileum than those of the control ones Table

(3). Supplemented diet with dried yeast may be acts on the gut environment, lowering the pH in various intestine segments (Banerjee and Pradham, 2006).Moreover, they added that a low ph creates a hostile environment for pathogens which reducing their chance of survival and colonization in the gut. The low pH could be due to the hydrolysis of starch by live yeast, with production of extra lactic acid, hydrogen peroxide and acetic acid. Antibody titer concentration to NCD was greater ($P<0.05$) in broiler chicks supplemented with yeast culture than control birds (Table3). Moreover, no significant effect of yeast culture on antibody titer concentration to SRBCs was observed (Table 3). Adding yeast culture to the basal diet resulted in greater ($P<0.05$) protein deposition in the carcass than that of the control group (Table 4). Dry matter, ether extracts and ash content of the carcass were similar for the control birds and those receiving dried yeast. This indicates that addition of dried yeast to broiler rations improved feed efficiency by aiding in protein deposition in the carcass.

The influence of yeast culture supplementation on the mortality of the broiler chicks is presented in Table (5) . The addition of dried yeast to the basal diet of broiler chicks slightly increased the percentage of survivability compared with those of control group.

So, in the basis of these results it is possible to derive economic benefits by feeding dried yeast through increasing feed efficiency, improving immunity and reducing mortality, without any adverse effect on the growth rate.

**Table (1).** Chemical analysis of starter and finisher diets

| Items | Diet | |
|---|---|---|
| | Starter | Finisher |
| Corn,yellow % | 44,08 | 55,0 |
| Soybean meal 44 % | 43,4 | 35,0 |
| Vegetable oil % | 8,53 | 6,52 |
| Bone meal % | 2,5 | 2,0 |
| Lime stone % | 0,5 | 0,8 |
| NaCl % | 0,3 | 0,3 |
| Premix (vita.+mine.)% | 0,3 | 0,3 |
| Methionine % | 0,39 | 0,08 |
| Total | 100 | 100 |
| Calculated nutritive values | | |
| ME ( K.cal./Kg ) | 3200 | 3200 |
| Crude protein % | 23 | 20,4 |
| Methionine+ Cystine % | 1,02 | 0,73 |
| Lysine % | 1.3 | 1.1 |
| Calcium% | 1.1 | 1,05 |
| Available Phosphorus % | 0.46 | 0.38 |

**Table 2.** Effect of yeast culture supplementation on the broiler performance (Mean±SE)

| Items | Basal diet | Basal diet + Yeast Culture |
|---|---|---|
| **Live weight (g)** | | |
| At 2 wks | *327.13 ± 2.99[a] | 319.75 ± 3.01[a] |
| At 3 wks | 582.31 ± 5.53[a] | 562.96 ± 5.48[b] |
| At 4 wks | 978.60 ± 8.41[a] | 953.51 ± 8.32 [a] |
| At 5 wks | 1484.10 ± 10.71[a] | 1477.42 ± 10.61[a] |
| At 6 wks | 2069.32 ± 15.06[a] | 2056.49 ± 14,87[a] |
| **Weight gain/bird (g)** | | |
| 3 – 4 wks | 56.31 ± 0.81[a] | 55.50 ± 0.81[a] |
| 4 – 5 wks | 72.28 ± 3.95[a] | 74.78 ± 3.91[a] |
| 5 – 6 wks | 83.67 ± 1.60[a] | 82.35 ± 1.58[a] |
| 2 – 6 wks | 62.18 ± 0.51[a] | 61.99 ± 0.51[a] |
| **Feed intake** | | |
| 3 – 4 wks | 101.05 ± 0.96[a] | 98.87 ± 0.96[a] |
| 4 – 5 wks | 124.8 ± 2.00[a] | 123.35 ± 2.00[a] |
| 5 – 6 wks | 156.72 ± 1.63[a] | 153.10 ±1.63[a] |
| 2 – 6 wks | 113.40 ± 0.99[a] | 111.35 ±0.99[a] |
| **Feed conversion** | | |
| 3 – 4 wks | 1.82 ± 0.029[a] | 1.77 ± 0.029[a] |
| 4 – 5 wks | 1.74 ± 0.02[a] | 1.65 ± 0.02[b] |
| 5 – 6 wks | 1.93 ± 0.10[a] | 1.86 ± 0.100[a] |
| 2 – 6 wks | 1.84 ± 0.02[a] | 1.79 ± 0.02[a] |

Means in the same row followed by different letters differ significantly (P< 0.05) .

**Table 3.** Effect of dried yeast culture supplementation on intestinal villi volume density VvVilli, total bacterial count ( $X10^4$) and mean antibody titers to NCD and SRBCs.

| Items | Basal diet | Basal diet + Yeast Culture |
|---|---|---|
| Intestinal villi volume ratio | 0.436±0.01[a] | 0.478±0.016[b] |
| Total microbial count $X10^4$ | | |
| At 21d | 4333.3±112.85[a] | 2500.0±188.67[a] |
| At 42 d | 4544.0±140.48[a] | 1691.8±218.68[b] |
| Mean antibodies titers to: | | |
| NCD | 2.800±0.359[b] | 4.300±0.578[a] |
| SRBCs | 4.30±0.517[a] | 3.700±0.335[a] |

Means in the same row followed by different letters differ significantly (P< 0.05).

**Table 4**. Effect of yeast culture supplementation on broiler carcass composition (Mean ±SE).

| Items | Basal diet | Basal diet +yeast culture |
|---|---|---|
| DM | 30.09±0.64[a] | 30.60 ±0.71[a] |
| E.E* | 29.68±2.34[a] | 28.42 ± 2.41[a] |
| CP* | 63.41±1.80[b] | 66.02 ±1.036[a] |
| Ash* | 6.91±0.36[a] | 5.56 ±0.38[a] |

*On dry matter basis. Means in the same row followed by different litters differ significantly (P< 0.05).

**Table (5).** Effect of yeast culture supplementation on cumulative mortality percent.

| Age (Weeks) | Basal diet | Basal diet + Yeast Culture |
|---|---|---|
| 2 | 0.33 | 0.26 |
| 3 | 0.73 | 0.46 |
| 4 | 1.93 | 1.66 |
| 5 | 2.06 | 2.06 |
| 6 | 2.66 | 2.40 |

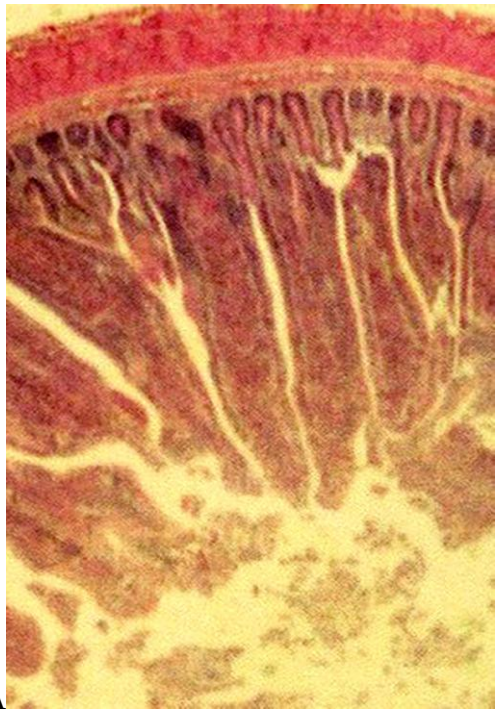
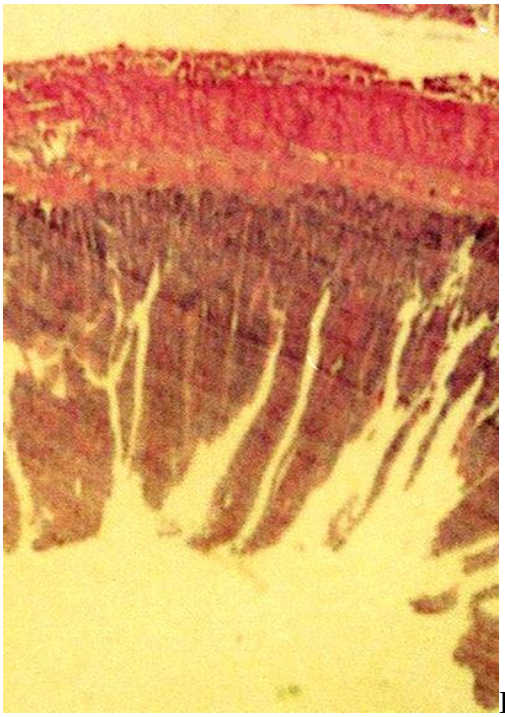
A   B

Fig.1: effect of yeast supplementation on intestinal villi volume( x = 400 ) ( A : basal diet + yeast & B : basal diet ).

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## الملخص العربي

## تأثير إضافة الخميرة الجافة على أداء النمو ، التحليل الكيميائي للذبيحة ، المناعة ، طول الخملات والعد البكتيري الكلى في كتاكيت اللحم

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أجريت هذه التجربة لدراسة تأثير إضافة الخميرة لعلائق كتاكيت اللحم على النمو،التحليل الكيميائي للذبيحة،معدل التحويل الغذائي ، عدد البكتريا الكلى في الأمعاء، طول الخملات ،المناعة ونسبة النفوق .

تم تقسيم عدد 3000 كتكوت لحم عمر يوم عشوائيا إلى مجموعتين متساويتان في العدد وكل مجموعة تحتوى على أربع مكررات وكل مكرر به 375 كتكوت- تم تغذية كتاكيت المجموعة الأولى (المقارنة) على العليقة البادئة لمدة 3 أسابيع ثم تم التغذية على العليقة الناهية لمدة ثلاثة أسابيع أخرى. أما المجموعة المعاملة فقد تم إضافة الخميرة بمعدل 5 جرام/كيلو جرام و 2.5 جرام/كيلو جرام من العليق البادئة والناهية على التوالي .

أظهرت النتائج عدم وجود فرق معنوي بين المجموعة المقارنة والمجموعة المعاملة في كل من كفاءة النمو عند عمر 6.5.4 أسابيع – حدث زيادة معنوية في كل من طول الخملات- % للبروتين في المادة الجافة و الأجسام المناعية لمرض النيوكاسل .

لم يؤدى إضافة الخميرة لعلائق الدواجن لاى فرق معنوي في كل من % للدهن في المادة الجافة ووزن الجسم المكتسب والأجسام المناعية ضد الكرات الدموية الحمراء للأغنام .

وقد أدى إضافة الخميرة إلى علائق دجاج إنتاج اللحم إلى تحسن ملحوظ في نسبة النفوق ونسبة التحويل الغذائي .من وجهة النظر الاقتصادية يمكن القول أن إضافة الخميرة لعلائق الدجاج اللاحم قد أدت إلى الحصول على وزن جسم معادل للمجموعة المقارنة عند عمر التسويق مع انخفاض في تكاليف التغذية ونسبة النفوق وزيادة المحتوى البروتينى في الذبيحة وهذه النتائج

تحتاج إلى تدعيم بإجراء المزيد من البحوث على استخدام الخميرة في علائق الدجاج اللاحم مع زيادة عدد الطيور والمكررات .