EFFECTS OF LIVE SACCHAROMYCES CEREVISIAE AND YEAST CELL WALL ON PERFORMANCE OF BROILER CHICK

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ABSTRACT

The experiment was carried out to evaluate the effects of different levels life Saccharomyces cerevisiae and yeast cell wall individually or in combination on growth performance, of Ross unsexed broiler chicks from 0 – 36 days of age. There were 15 dietary treatments and control. The results indicated that weight gain, feed intake and feed conversion ratio were significantly influenced by the addition of Saccharomyces cerevisiae with or without yeast cell wall.

The results suggest that supplementation of S. cerevisiae with or without yeast cell wall to diets have a positive influence for improving performance of broilers flock

Key words: Saccharomyces cerevisiae, yeast cell wall, performance, broiler.

INTRODUCTION

The U.S National Food Ingredient Association presented, probiotic (direct fed microbial) as a source of live naturally occurring microorganisms and this includes bacteria and yeast. Probiotic strains have been shown to inhibit pathogenic bacteria both in vitro and in vivo through several different mechanisms without a healthy gastrointestinal tract (Sims *et al.*, 2004). The European ban urge to the development of alternative methods to promote health by replaced prebiotic or probiotic agents on the use of antibiotics in animal feed as a growth-promoting (Phillips, 2007; Rieder *et al*., 2013).

The inclusion of yeast products to broilers diets can increase growth performance, improve intestinal morphology, promote the development of immune organs, stimulate intestinal immunoglobulin secretion, and prohibit the colonization of pathogenic bacteria (Santin *et al*., 2001; Gao *et al*.,2008; Morales-López *et al.,* 2009; Haldar *et al*., 2011; Muthusamy *et al*., 2011; Reisinger *et al.,* 2012).

Prebiotics are "non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria, most identified prebiotics are carbohydrates and oligosaccharides with different molecular structures normally occurring in the animal diet. Mannan-oligosaccharides have been used in the same manner as the prebiotics, they do not selectively enrich for beneficial bacterial populations. Mannan-oligosaccharide are able to bind to mannose-specific lectin of gram negative bacteria pathogens that express in their excretion from the intestine (Francesca Gaggìa *et al*., 2010).

Mannan oligosaccharides are polysaccharide–protein complexes 1,3/1,6 β-glucans are two major components of the yeast cell wall (Shashidhara and Devegowda, 2003; Ganner and Schatzmayr, 2012) that are indigestible to monogastric animals and can inhibit colonization of pathogenic microorganism in the intestinal tract by binding pathogenic bacteria which possess mannose-specific type-I fimbriae and by its prebiotic activity (Shoaf-Sweeney and Hutkins, 2008; Ganner and Schatzmayr, 2012).

The objective of the present study was to evaluate the effect of life Saccharomyces cerevisiae and yeast cell wall on growth performance of broiler chicks.

MATERIAS AND METHODS

This study was carried out at Al-Nahda Poultry Farm Cairo–Alexandria desert road, Regional Center for Food and Feed (RCFF), Giza, Egypt during 2017. All chemical analyses were performed at the laboratories of the Regional Center for Food and Feed (RCFF), Agriculture Research Center, Giza, Egypt.

A total of 480 one-day old broiler chicks Ross 308 were equally divided into 16 treatment Cn= 30, 10 in each replicate as shown in Table (1).

Table (1): Experimental diets.

No.	Treatments per gm/ Kg Diet
Control	Negative control (no additive)
T1	0.5 gm Yeast Cell wall
T2	0.75 gm Yeast Cell wall
T3	1.0 gm Yeast Cell wall
T4	1.0 Life Yeast
T5	1.0 Life Yeast + 0.5 gm Yeast Cell wall
T6	1.0 Life Yeast + 0.75 gm Yeast Cell wall
T7	1.0 Life Yeast + 1.0 gm Yeast Cell wall
T8	2.0 Life Yeast
T9	2.0 Life Yeast + 0.5 gm Yeast Cell wall
T10	2.0 Life Yeast + 0.75 gm Yeast Cell wall
T11	2.0 Life Yeast + 1.0 gm Yeast Cell wall
T12	3.0 Life Yeast
T13	3.0 Life Yeast + 0.5 gm Yeast Cell wall
T14	3.0 Life Yeast + 0.75 gm Yeast Cell wall
T15	3.0 Life Yeast + 1.0 gm Yeast Cell wall

The chicks fed starter (1 – 12 days) grower (13 – 24 days) and finisher (25 – 36 days) diets.

Diets were formulated to cover all nutrient requirements of broiler chicks according to ROSS nutrition supplement 2009 (Table 2). Live body weight (LBW), body weight gain (BWG), feed consumption (FC) and feed conversion ratio (FCR) were weekly determined.

All data were analyzed statistically by using the general linear model procedure of the statistical analyses system (SAS). Overall data were analyzing using one-way ANOVA test. Significant of different between groups was determined using Duncan multiple range test (Duncan 1955). The statistical model performed as follow:

$$\mathbf{Y_{ij} = \mu + T_i + E_{ij}}$$

Where: Y_{ij} = is the experimental observation, μ = the overall Mean, T_i = is the effect of the dietary treatment and E_{ij} = random error.

Table (2): Composition and calculated analysis of the used dies.

Ingredients	Starter	Grower	Finisher
Yellow corn (7.5% CP)	52.000	59.595	60.300
Soybean meal (45.8% CP)	32.000	27.500	27.200
Corn gluten meal (60.8% CP)	8.500	6.500	5.100
Vegetable Soybean oil	3.000	2.900	4.390
Di-calcium phosphate	2.000	1.666	1.448
Limestone	1.100	0.770	0.675
Vit. & Min. Mixture (1)	0.400	0.300	0.300
Salt	0.400	0.300	0.300
L-lysine-HCl	0.350	0.288	0.136
DL-Methionine	0.165	0.106	0.780
Choline chloride	0.082	0.075	0.075
Total	100	100	100
Calculated values			
CP %	22.77	20.5	19.5
ME (KCal/Kg)	3026.07	3086	3167
Lysine %	1.360	1.190	1.050
Methionine %	0.580	0.480	0.430
Methionine + Cystine %	0.980	0.890	0.820
Cystine %	0.450	0.410	0.390
Calcium %	0.980	0.840	0.760
Available P %	0.380	0.420	0.380
Vitamins - minerals mixture supplied per kg of diet: Vit. (A), 12000 I.U., vit. (D3), 2000 I.U; vit. (E), 10 mg; vit. (K3), 2 mg; vit. (B1), 1 mg; vit. (B2), 5 mg; vit. (B6), 1.5 mg; vit. (B12), 10 µg; Biotin, 50 µg; Pantothenic acid, 10mg; Niacin, 30 mg; Folic acid, 1 mg; Manganese, 60 mg; Zinc, 50 mg; Iron, 30 mg; Copper, 10 mg; Iodine, 1 mg; Selenium, 0.1 mg and Cobalt, 0.1 mg.			

RESULTS AND DISCUSSION

Data presented in table (3) for starter period from the 1st day to 12 days old showed that, there were no significant difference between treatments on weight gain, feed intake and feed conversion ratio, compared with control, Fig (1).

Table (3): Effect of dietary treatments on BWG, FI and FCR of broiler chickens (1 – 12 days of age).

TREAT.	WG 1	FI 1	FCR 1
	Mean±SE	Mean±SE	Mean±SE
Control	0.221a	0.253 a	1.15 a
T1	0.218 a	0.252 a	1.15 a
T2	0.232 a	0.262 a	1.13 a
T3	0.242 a	0.277 a	1.15 a
T4	0.224 a	0.259 a	1.16 a
T5	0.232 a	0.265 a	1.14 a
T6	0.222 a	0.260 a	1.17 a
T7	0.219 a	0.260 a	1.19 a
T8	0.223 a	0.268 a	1.21 a
T9	0.230 a	0.257 a	1.13 a
T10	0.211 a	0.247 a	1.18 a
T11	0.212 a	0.255 a	1.21 a
T12	0.229 a	0.262 a	1.15 a
T13	0.231 a	0.274 a	1.19 a
T14	0.230 a	0.258 a	1.12 a
T15	0.223 a	0.275 a	1.24 a
MSE	0.010	0.010	0.035

WG 1: Weight gain, FI 1: Feed intake, FCR 1: Feed conversation ratio, T1, T2……T15: Treatments, [a]:

Santin *et al*., (2001) showed higher body weight gain and better feed conversion for the birds fed Saccharomyces cerevisiae cell walls supplemented diets at 7 days of age. KOC *et al*., (2010) reported that, inoculation of Saccharomyces cerevisiae in the diet has been improvement the bird performance and decreased mortality. Tagang Aluwong *et al*., (2013) observed a highly significant performance in birds fed diets supplemented with

Saccharomyces cerevisiae compared with control in 1st week and 2nd week of age.

This improvement may be due to the balanced microbial population in the gastrointestinal tract (Thongsong *et al*., 2008) and the trophic effect of this product on the intestinal mucosa (Santin *et al*., 2001) which has play an important role in the health and performance of the broilers during the first 7 days of a chicken's life. Flemming *et al.*, (2004) concluded that, the non-inclusion of any growth promoters in broiler diets may cause production losses.

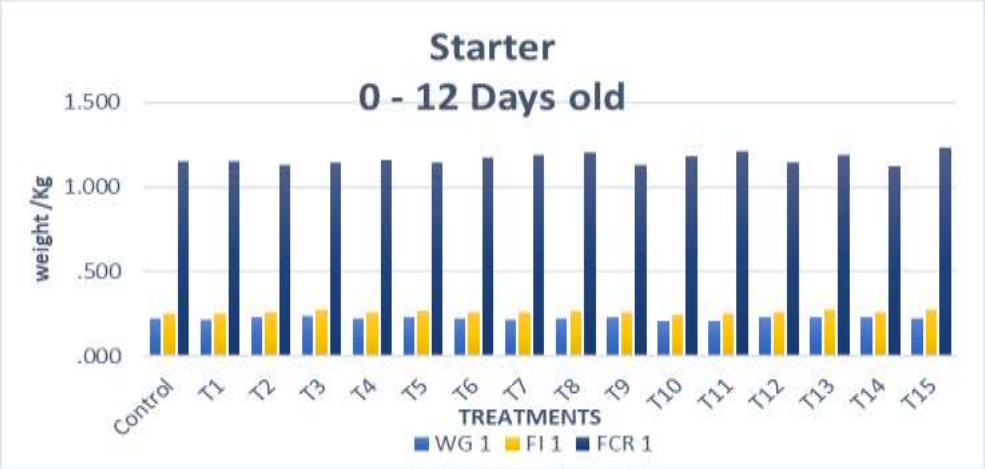

Fig. (1): Effect of dietary treatments on BWG, F1 and FCR of broiler chickens (1 -12 days of age)

The results in table (4) and Fig (2) in grower period form 13 days to 24 days old recorded high weight gain for T3 (0.813) for chicks feed basil diet supplemented with 1.0 gm yeast cell wall compared with control (0.690), and there was significant difference between treatments. The lowest weight gain was recorded for T11 (0.701) which fed diet contain 2.0 gm life yeast plus 1.0 gm yeast cell wall compared with control (0.690). These results agree with

Muthusamy *et al*., (2011) who study the effects of diet supplemented with 1 gm/kg of either whole Saccharomyces cerevisiae yeast and yeast cell wall on broilers, and concluded that, yeast cell wall may be a better dietary tool than the whole yeast cell as a performance enhancer for broilers.

KOC *et al*., (2010) supported that Saccharomyces cerevisiae in the diet has been shown an improvement the bird performance and decreased mortality. This improvement may be related to the balanced microbial population in the gastrointestinal tract (Thongsong *et al.*, 2008, Tagang Aluwong *et al*., 2013) which has play an important role in the health and performance and increased the ability to improve immune function and intestinal oxidative status of the broilers (Li *et al*., 2016).

On other side the results showed that, there were no significant difference between treatments on feed intake and feed conversion ratio, compared with control. The FCR, measured as kg feed/kg body weight gain, is presented numerical, but not significant, differences between treatments.

Table (4): Effect of dietary treatments on BWG, FI and FCR of broiler chickens (13 – 24 days of age).

TREAT.	WG 2	FI 2	FCR 2
	Mean±SE	Mean±SE	Mean±SE
Control	0.690 ^{d}	0.940 ^{a}	1.36 ^{a}
T1	0.720 ^{bcd}	0.985 ^{a}	1.37 ^{a}
T2	0.731 ^{abcd}	0.933 ^{a}	1.28 ^{a}
T3	0.813 ^{a}	1.080 ^{a}	1.33 ^{a}
T4	0.756 ^{abcd}	1.035 ^{a}	1.37 ^{a}
T5	0.779 ^{abc}	0.983 ^{a}	1.26 ^{a}
T6	0.770 ^{abcd}	1.027 ^{a}	1.33 ^{a}
T7	0.762 ^{abcd}	1.029 ^{a}	1.35 ^{a}
T8	0.739 ^{abcd}	0.967 ^{a}	1.31 ^{a}
T9	0.734 ^{abcd}	0.968 ^{a}	1.32 ^{a}
T10	0.724 ^{bcd}	1.000 ^{a}	1.39 ^{a}
T11	0.701 ^{cd}	0.945 ^{a}	1.35 ^{a}
T12	0.797 ^{ab}	1.021 ^{a}	1.28 ^{a}
T13	0.779 ^{abc}	0.990 ^{a}	1.27 ^{a}
T14	0.754 ^{abcd}	0.986 ^{a}	1.31 ^{a}
T15	0.804 ^{ab}	1.000 ^{a}	1.25 ^{a}
MSE	0.016	0.030	0.032

WG 2: Weight gain, FI 2: Feed intake, FCR 2: Feed conversation ratio, T1, T2,……T15: Treatments, ^{a}:

The results in table (5) and Fig (3) in finisher period form 25 days to 36 days old recorded that, the high weight gain for T7 (0.937) that feed basil diet contents of 1.0 gm life yeast plus 1.0 gm yeast cell wall compared with control (0.715), and there was significant difference between treatments. The lowest results were recorded for T1 (0.809) or control (0.715) which fed diets supplemented with 0.5 gm yeast cell wall or basel diet.

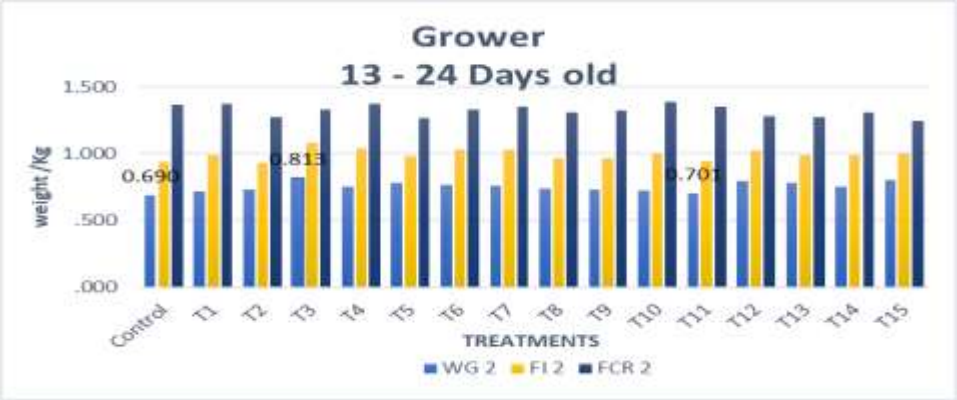

Fig. (2): Effect of dietary treatments on BWG, FI and FCR of broiler chickens (13 – 24 days of age).

The results agree with Gao *et al*., (2008); and Fasina and Olowo (2013) reveled that, growth performance of broilers was not affected by diets containing at least 750 mg/kg of yeast compared to the control group during day 0 to 21 but the effect on growth performance was found at the later period day 22 to 42.

Fig. (3): Effect of dietary treatments on BWG, FI and FCR of broiler chickens (25 – 36 days of age).

There was no significant difference between treatments on feed intake compared with control. Otherwise results of feed conversion ratio on T5 (1.22) and T6 (1.25) were more significant than control (1.58). Zhang *et al*., (2005) showed that, birds feed with yeast cell wall from 0 to 3 weeks of age, recoded a lower feed/gain ratio, whereas the birds feed with wall yeast at 4 to 5 weeks of age gave a lower feed/gain ratio compared with the control.

Table (5): Effect of dietary treatments on BWG, FI and FCR of broiler chickens (25 – 36 days of age).

TREAT.	WG 3	FI 3	FCR 3
	Mean±SE	Mean±SE	Mean±SE
Control	0.715 ^{d}	1.114 ^{a}	1.58 ^{a}
T1	0.809 ^{cd}	1.178 ^{a}	1.46 ^{ab}
T2	0.886 ^{abc}	1.141 ^{a}	1.29 ^{ab}
T3	0.889 ^{abc}	1.167 ^{a}	1.32 ^{ab}
T4	0.900 ^{abc}	1.156 ^{a}	1.29 ^{ab}
T5	0.936 ^{ab}	1.141 ^{a}	1.22 ^{b}
T6	0.889 ^{abc}	1.113 ^{a}	1.25 ^{b}
T7	0.937 ^{a}	1.190 ^{a}	1.27 ^{ab}
T8	0.884 ^{abc}	1.245 ^{a}	1.41 ^{ab}
T9	0.865 ^{abc}	1.106 ^{a}	1.29 ^{ab}
T10	0.846 ^{abc}	1.140 ^{a}	1.35 ^{ab}
T11	0.810 ^{bcd}	1.133 ^{a}	1.40 ^{ab}
T12	0.929 ^{abc}	1.229 ^{a}	1.32 ^{ab}
T13	0.904 ^{abc}	1.198 ^{a}	1.35 ^{ab}
T14	0.866 ^{abc}	1.191 ^{a}	1.38 ^{ab}
T15	0.859 ^{abc}	1.190 ^{a}	1.39 ^{ab}
MSE	0.024	0.041	0.062

WG 3: Weight gain, FI 3: Feed intake, FCR 3: Feed conversation ratio, T1, T2,……T15: Treatments, ^{a}:

These results are in line with the findings of KOC *et al.,* (2010). Saccharomyces cerevisiae in the diet has been shown an improvement at the bird performance and decreased mortality. Also, agreement with the results recorded that, a significant difference between treatments in body weight compared with control in week 4 by (Tagang Aluwong *et al.,* 2013).

This improvement may be related with the balanced microbial population in the gastrointestinal tract which has played an important role in the health and performance of the broilers (Thongsong *et al.,* 2008, Tagang Aluwong *et al.,* 2013) or increased antibody levels and reduced intestinal pathogenic bacterial numbers (Xiangyu Tian *et al*., 2016).

The results in table (6) and Fig (4) for bird's life form 1st days to 36 days old showed that, the high weight gain for T12, T5, T3 and T7 (1.679, 1.667, 1.655 and 1.652) respectively, that feed basil diet contents of 3.0 gm life yeast only, 1.0 gm life yeast plus 0.5 gm yeast cell wall, 1.0 gm yeast cell wall and 1.0 gm life yeast plus 1.0 gm yeast cell wall respectively compared with control (1.357), and there was significant difference between treatments. the bad result between treatments was recorded at T1 and T11 (1.482 and 1.464) respectively, for bird's diet contents of 0.5 gm Yeast Cell wall only and 2.0 gm Life Yeast plus 1.0 gm yeast cell wall compared with control (1.357).

The results were similar with Zhang *et al*., (2005) who recorded that, from 0 to 5 weeks of age, wall yeast and yeast cell wall gave higher body weight gains than the control. Also, in line with the findings of KOC *et al.,* (2010). Saccharomyces cerevisiae in the diet has been shown an improvement at the bird performance and decreased mortality. Also, Reisinger *et al*., (2012) observed a

positive influence by adding supplementation of yeast. Also there were agreement with the results recorded a significant difference between treatments in body weight compared with control at four week of age (Tagang Aluwong *et al.*, 2013).

Table (6): Effect of dietary treatments on BWG, FI and FCR of broiler chickens overall for (1 – 36 days of age).

TREAT.	WG 4	FI 4	FCR 4
	Mean±SE	Mean±SE	Mean±SE
Control	1.357 [c]	2.307 [a]	1.71 [a]
T1	1.482 [bc]	2.415 [a]	1.63 [ab]
T2	1.570 [ab]	2.336 [a]	1.49 [bc]
T3	1.655 [a]	2.524 [a]	1.53 [abc]
T4	1.609 [ab]	2.450 [a]	1.52 [abc]
T5	1.667 [a]	2.388 [a]	1.43 [c]
T6	1.612 [ab]	2.399 [a]	1.49 [bd]
T7	1.652 [a]	2.479 [a]	1.50 [bc]
T8	1.576 [ab]	2.480 [a]	1.58 [abc]
T9	1.552 [ab]	2.331 [a]	1.51 [abc]
T10	1.523 [ab]	2.387 [a]	1.57 [abc]
T11	1.464 [bc]	2.333 [a]	1.59 [abc]
T12	1.679 [a]	2.512 [a]	1.50 [bc]
T13	1.619 [ab]	2.461 [a]	1.52 [abc]
T14	1.574 [ab]	2.435 [a]	1.55 [abc]
T15	1.616 [ab]	2.465 [a]	1.53 [abc]
MSE	0.030	0.062	0.038

WG 4: Weight gain, FI 4: Feed intake, FCR 4: Feed conversation ratio, T1, T2,……T15: Treatments, [a]:

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 (Thongsong *et al.*, 2008; Tagang Aluwong *et al.*,

(2013) and Reisinger *et al*., (2012) who decided that, Apoptotic enterocytes were decreased by Supplementation of yeast. The improved health might have increased the absorption area in the gut (Santin *et al*., 2001).

On other side the results showed that, there were no significant difference between treatments on feed intake compared with control. Otherwise results highly recorded of feed conversion ratio decreased on T5 (1.43) and more significant than treatments compared with control (1.71) in the fifth week of the experiment. These results agree with (Tagang Aluwong *et al*., 2013).

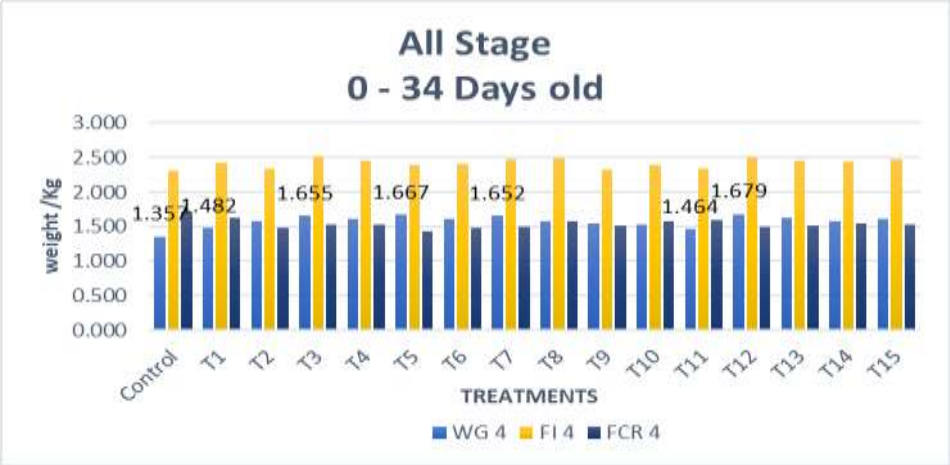

Fig. (4): Effect of dietary treatments on BWG, FI and FCR of broiler chickens overall for (1 – 36 days of age)

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تأثير استخدام الخميرة الحية وجدر خلايا الخميرة على الأداء الإنتاجي لكتاكيت التسمين

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المستخلص

أجريت هذه التجربة لتقييم آثر استخدام الخميرة الحية وجدار خلايا الخميرة على الأداء الإنتاجي على كتاكيت دجاج التسمين من عمر يوم حتى ٣٦ يوم. باستخدام ١٥ معاملة غذائية وعينة المقارنة بتركيزات (١، ٢، ٣) و (٠,٥، ٠,٧٥، ١) جم/ كجم عليقة والخلط بينهم على التوالي. تأثرت معدلات زيادة الوزن ومعدل تناول الطعام ومعدل التحويل الغذائي للكتكوت تأثرا معنويا بإضافة الخميرة الحية مع أو بدون جدار الخلية الخميرة.

وتشير النتائج إلى أن الإضافات العلفية باستخدام الخميرة الحية مع أو بدون جدار خلايا الخميرة إلى المقررات الغذائية لها تأثير إيجابي لتحسين الأداء لقطيع دجاج التسمين.