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Baker's Yeast (*Saccharomyces cerevisiae*) and its application on poultry's production and health: A review

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Abstract

The poultry population has substantially grown in recent years, and measures to ensure meat quality have also improved significantly. The exponential growth of the human population eventually resulted in increasing meat demand. In particular, poultry meat has been the more favorable and nutritive option. Research on feed additives has sparked an interest in many poultry specialists looking for ways to increase poultry performance. The use of baker's yeast, *Saccharomyces cerevisiae*, as an antibiotic alternative by acting as prebiotics and probiotics has received significant attention. Baker's yeast contains β-glucans and mannan-oligosaccharides as its main components. Recent studies have shown that baker's yeast, as an alternative protein source, positively affects poultry growth performance, blood parameters, and immune response. Furthermore, the application of baker's yeast as a fermented feed additive showed promising results for poultry production. The use of baker's yeast in the diet improves the morphological structure of the poultry gut, thus increasing growth performance. More informatively, it stimulates feed intake, increases body weight gain, and improves the feed conversion ratio. Baker's yeast also improves the immune system of poultry animals by reducing various numbers of harmful microorganisms by combating poultry diseases more effectively and eventually increasing poultry health. This paper aims to synthesize all aspects of the effect of baker's yeast on the poultry industry and the role and application of baker's yeast in poultry productivity.

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Introduction

In recent years, the interest in bio-additives has been increased by optimizing the use of organic additives or new ingredients arising from biotechnological processes, which leads to the application of living organisms and their metabolites in diverse industries. Notably, poultry production faces significant challenges to meet the global demand for meat and eggs due to the steady increase in the global population. Many countries are gradually phasing out prophylactic antibiotics in animal feed to overcome antibiotic resistance in livestock (1). Baker's yeast from *Saccharomyces cerevisiae* (*S. cerevisiae*) contains essential nutrients that could be used as a source of amino acids and vitamins in the diet, as well as immune enhancers. Baker's yeast was investigated as a potential feed additive for poultry production (2-5). First, baker's yeast or *S. cerevisiae* increased poultry performance by increasing feed intake and nutrient absorption in the digestive system by increasing the morphological features of the intestines (4-6). Second, *S. cerevisiae* could be an alternative to antibiotics by reducing risks from various diseases (7). Last, the use of baker's yeast for feed fermentation was also discovered (8,9). The application of baker's yeast was shown in studies of fermented cottonseed meal (10), fermented white rice (11), fermented brown rice (8,12), fermented rice bran (13), and deoil rice bran (9). Moreover, the positive effects of baker's yeast on laying hens were documented. The triglyceride and cholesterol in the blood of laying hens decreased, egg quality increased, and egg production was recorded in the studies of Mirza *et al.* (4) and Yalcin *et al.* (14). As mentioned above, the application of baker's yeast previously proves its functions in health and growth performance. In addition, baker's yeast is considered one of the technological solutions to develop organic, clean, and sustainable agricultural production methods while also improving the quality of poultry products.

Therefore, research on baker's yeast has become popular. This review summarizes all aspects of baker's yeast *S. cerevisiae* and its roles in poultry performance and provides transparent, applicable information for broilers and laying poultry.

Nutrition compositions

According to Walker *et al.* (15), yeasts are single-celled microorganisms and are eukaryotes with diameters ranging from 3 to 40 microns. As imparted by Klis *et al.* (16), yeast contains a high level of digestible protein and an abundance of vitamins and essential elements. Remarkably, yeast is a crucial protein and amino acids source for poultry growth. Baker's yeast, in particular, is high in thiamin and riboflavin vitamins, as well as nicotinic acid, pantothenic acid, biotin, Mg, and Zn. The dry matter content of dried baker's yeast was 91%; crude protein was 44.4%; ether extract was 0.52%; crude fiber content was 0.33%; crude ash content was 5.01%; calcium content was 0.28%; total phosphorus content was 1.21%; and metabolizable energy was 10.79 MJ/kg, which were analyzed in the study of Yalcin *et al.* (17). The sources of β-glucans, metabolites, and several industrial enzymes are also widespread in yeast (18). Chitin, β-glucans, and α-mannan are the main polysaccharides in yeast cell walls, accounting for 90% of their weight (dry matter). Yeast cells can detect and interact with each other by the carbohydrate component β-mannan of mannoprotein, which also allows us to determine the yeast's immunological specificity (19). *S. cerevisiae* is currently widely used as a protein source in animal diets to improve growth performance and is formed from inactivated cells. Although *S. cerevisiae* contains high amounts of protein and other nutrients, it is not used for human nutrition directly (20). The use of living yeast cells detoxifies mycotoxins, other bacterial toxins, and their receptors in the mucous membrane and *Vibrio cholera* toxin. Diets containing these toxins cause damage in several organs; however, the presence of *S. cerevisiae* has been shown to reduce this damage and minimize animal stress while also providing enzymes, vitamins, and protein (21). The detailed composition and amino acid contents of yeast *S. cerevisiae* are shown in table 1 and 2 (22).

Table 1: Chemical composition of baker's yeast, active dry

Criteria	Nutrition value per 100 g	
	Amount	Unit
Protein	40.4	g
Energy	325	Kcal
Dietary fiber	26.9	g
Carbohydrates	41.2	g
Total lipid	7.61	g
Vitamin C	0.3	mg
Choline	32	mg
B1	11	mg
B2	4	mg
B3	40.2	mg
B5	13.5	mg
B-6	1.5	mg
B9	2340	μg
Na (Sodium)	51	mg
Ca (Calcium)	30	mg
Fe (Iron)	2.17	mg
Mn (Manganese)	0.312	mg
Mg (Magnesium)	54	mg
K (Potassium)	955	mg
P (Phosphorus)	637	mg
Zn (Zinc)	7.94	mg

Table 2. Essential and nonessential amino acids in baker's yeast, active dry

Criteria	Nutrition value per 100 g	
	Amount	Unit
Tryptophan	0.54	g/100 g
Threonine	1.99	g/100 g
Isoleucine	1.89	g/100 g
Leucine	2.92	g/100 g
Lysine	3.28	g/100 g
Methionine	0.59	g/100 g
Phenylalanine	1.75	g/100 g
Valine	2.31	g/100 g
Arginine	2.03	g/100 g
Histidine	0.91	g/100 g
Cystine	0.5	g/100 g
Tyrosine	1.13	g/100 g
Alanine	2.32	g/100 g

Mode of action of baker's yeast

The mechanism of yeast can be classified into two parts: pharmacokinetics and pharmacodynamics (23). Suarez and Guevara (23) showed that the use of yeast as a probiotic and prebiotic is determined by its biological regulatory effect through its various mechanisms: the elimination of pathogens from microbial antagonism, the stimulation of the animal's immune system, the attachment and removal of pathogens and an increase in the activity of enzyme-specific bacteria. It was discovered that yeast, *S. cerevisiae*, yeast cell wall, and yeast derivatives had a positive effect on broiler growth in trials, confirming that yeast can modulate the growth of gut microbes and assist the process by which volatile fatty acids are produced to improve nutrient absorption (24). In figure 1, biotherapeutic mechanisms of action are used by yeast in pathogen control.

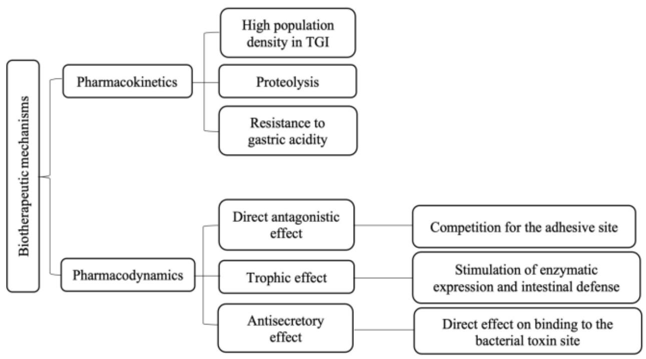

Figure 1: Biotherapeutic mechanisms of action used by yeast in pathogen control (23).

The mode of action for poultry production is divided into two primary principles. This is illustrated in figure 2, and the first action is to improve poultry performance. The second action is to improve poultry health. Thus, it has a function to improve poultry production. *Saccharomyces cerevisiae* promotes the immune system in animals by modulating and altering cytokines. This recent advancement for livestock immunity partly helps control animal diseases. The pH level in the gut is also decreased by using *Saccharomyces cerevisiae* (25). Enzymes from yeast and their metabolites, including vitamins and amino acids, could affect poultry performance (23).

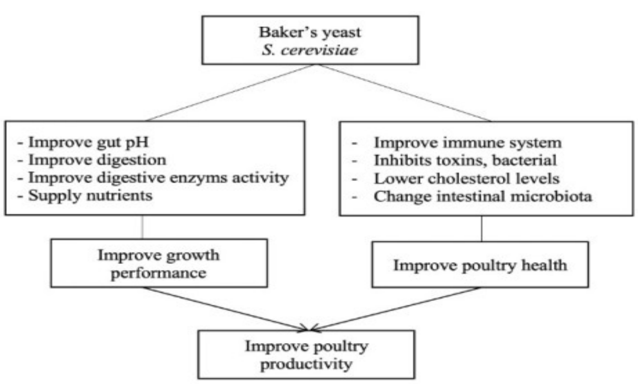

Figure 2: The mode of action of *Saccharomyces cerevisiae* for poultry production (25).

The applications of baker's yeast for broiler poultry

In particular, yeast or baker's yeast is a potential feed additive for poultry diets that has been explored by various scientific studies worldwide. To improve poultry performance, baker's yeast could be supplemented directly in the diets. The use of baker's yeast as a probiotic in the poultry diet showed promising results in poultry performance. First, baker's yeast adjusts the intestinal microflora of poultry and controls bacterial pathogen colonization in the gastrointestinal tract of poultry. Thus, it improves meat quality and sensory characteristics.

On the other hand, the results have been inconsistent when probiotic or prebiotic yeasts have been used as an alternative to antibiotics in feed for healthy, stressed, or diseased broilers. This was due to various factors, including the yeast (*S. cerevisiae*) composition, the method of yeast processing, the dosage or level of administration, feed ingredients, kind of breed and age of the birds, and variations in the poultry rearing environment (26). Table 3 shows the details of baker's yeast supplementation in the poultry diet (27-34).

Table 3 shows the basic information from previous research on *S. cerevisiae*. There have been few recent studies on waterfowl for meat purposes, such as geese and ducks. Most research has shown a positive effect of *Saccharomyces cerevisiae* on broiler poultry growth performance, particularly in chickens, turkeys, and Japanese quails. However, research on meat characteristics and meat quality is limited. The improvement in broiler growth performance was evident through feed intake, daily weight gain, and feed conversion ratio. Specifically, *Saccharomyces cerevisiae* fed directly into broiler diets might be utilized in place of antibiotics to improve growth performance and nutritional digestibility (6). The increase in average weight gain in live yeast-supplemented groups with a reduced feed conversion ratio throughout the finisher phase might be associated with increased nutrient retention in broilers. Yeast is an excellent source of small peptides containing free amino acids. This ensures a rapid rate of digestion and absorption, which could significantly enhance feed utilization. According to a recent study by Sousa *et al.* (35), feeding broilers yeast resulted in increased body weight gain and a decreased feed conversion ratio during the finisher phase, but no alterations in feed consumption were identified in broilers. In the same study, yeast improved protein digestibility in broilers.

Similarly, supplementing broiler diets with yeast-derived products may boost body weight gain and feed conversion ratio (36). Moreover, Wang *et al.* (37) found an increase in nutritional digestibility, histomorphology, nutrient absorption, and physiological responses of broiler chicks given yeast at various graded supplements, which led to the improved growth performance of broilers. He *et al.* (6) showed that improvements in intestinal morphology, including increased villus height, were beneficial for nutrient utilization, stress resistance, and gut barrier function in livestock animals. Thus, it improves the growth performance.

Table 3: The recommended amount of *Saccharomyces cerevisiae* supplemented in the poultry diet

Poultry	Supplementation	Reference
Chickens	In the long term, baker's yeast with 1.4% supplementation improves Cobb 500 chicken's feed conversion ratio and average daily weight gain.	(27)
	Supplemented 0.4% baker's yeast for Cobb 500 broiler chicks increased the growth performance, including feed conversion ratio and daily weight gain.	(28)
	Feeding 2.5% baker's yeast for Cobb 500 broilers recorded a lower feed intake and better conversion ratio.	(29)
	Hubbard broiler chicks fed with 1% yeast had no detrimental effect on growth performance, and it could serve as an antibiotic for growth performance.	(30)
	Hubbard chicks fed 1% baker's yeast improved growth performance with the highest weight gain and lowest feed conversion ratio.	(5)
	Arbor Acres male broiler's growth performance increased with 1000 mg/kg live yeast in the diet.	(6)
	Ross 308PM showed significant growth-promoting effects with 5.0 and 10 g kg^{-1} *Saccharomyces cerevisiae*.	(31)
Turkeys	1, 2, and 3 g/kg did not have effects on growth performance	(32)
	Yeast combined with *Yarrowia lipolytica* showed the improvement of Turkey's performance.	(33)
	Three levels of *Saccharomyces cerevisiae* in the diets (0.0625; 0.125 and 0.25%) showed a positive effect on growth performance by improving feed efficiency.	(34)
Quails	Baker's yeast autolysate with 2% in feed improved the growth performance of Japanese quails.	(2)
	Baker's yeast with 1% for diets or 1% for drinking water improved growth performance for Japanese quails.	(2)

Applications of baker's yeast for laying poultry

The benefits of using *Saccharomyces cerevisiae* were observed in broiler poultry and laying poultry. Some previous studies showed that adding yeast cell walls to the diet of laying poultry increased the layer's productivity while also improving egg quality both internally and externally, thereby contributing to increased profitability. According to Koiyama *et al.* (38), supplementation with 553 ppm yeast in a layer diet could result in maximum egg production. Furthermore, a maximum albumen height of 8.06 mm and a maximum Haugh unit was determined at the 547-ppm supplementation and 535-ppm supplementation levels. The study also showed that the advantageous findings could be explained by the effect of mannan oligosaccharides in the gastrointestinal tract. The mannan-oligosaccharides played a role in preventing pathogenic bacteria from attaching to the intestinal wall. It also combines 1,3- and 1,6-D-glucans to stimulate the immune system and increase nutrient digestibility. Eventually, this improves the hen's productive performance.

Additionally, Bidura *et al.* (39) found that supplementation with yeast or *Saccharomyces* strain increased egg production (hen-day production) and the total egg weight in layers. According to Bidura *et al.* (40), supplementing laying duck diets with 0.20-0.30% *Saccharomyces* strain increased the egg mass, yolk color, yolk, and eggshell weight and interestingly decreased the cholesterol in egg yolk. In the study of Ezema and Eze (41), supplementation of 1.0 g/kg yeast for layers showed the optimum egg production results. Furthermore, according to Özsoy *et al.* (42), groups were given 0.1, and 0.2% yeast obtained the most significant egg weights compared to the control group (Table 4). In the same study, fatty acids, including myristoleic (C14:1) and hexadecenoic acid (C16:0) concentrations, were higher in the 0.1 and 0.2% yeast-supplemented groups than in the control group (43,44).

According to Liu *et al.* (45), the improvement of egg quality, hatching rate, and increased health of chicks might be related to enhanced egg quality and eggshell, which prevented the harmful bacteria from accessing the eggs. An increase in yolk pigment was also recorded when *Saccharomyces cerevisiae* was added to the diet. This was due to the presence of carotenoids in yeast that enhanced the color of the egg yolk (46). Lu *et al.* (47) also recorded that supplementation with yeast improved immunoglobulin A (IgA) in egg yolks. Thus, improving the chick's immune system and improving the performance of old layers. The older the chicken is, the fewer eggs it can lay. Duan *et al.* (48) also confirmed that older layers reduce egg production because absorption and digestibility decreased as their age increased.

Therefore, supplementation with yeast was used for this purpose because yeast contains enzymes and organic acids (45). Moreover, the use of *Saccharomyces cerevisiae* also affected the amount of cholesterol in eggs. The effect of yeast on the egg yolk cholesterol level was shown in the study of Yalcin *et al.* (14). There was a significant reduction in egg yolk cholesterol in the groups fed 1 and 2 g/kg

Saccharomyces cerevisiae: yolk egg cholesterol was 14.58 mg/g yolk and 14.54 mg/g yolk, respectively. These values were lower and better than those without yeast 16.78 mg/g. Supplementation with *Saccharomyces cerevisiae* yeast or its products reduced the cholesterol levels in egg yolks. This can be explained by how yolk cholesterol was reduced by reducing the absorption and synthesis of cholesterol in the gastrointestinal tract. Ezema and Eza (41) showed that *Saccharomyces cerevisiae* in diets reduced the egg's cholesterol content. Supplementation with 0.6 g, 0.8 g, and 1.0 g of S. cerevisiae resulted in the following cholesterol contents: 510.60 mg/dl, 595.70 mg/dl, and 476.60 mg/dl, respectively. Compared to the non-yeast treatment, which resulted in a cholesterol level of 824.50 mg/dl. Moreover, the addition of yeast autolysate at a concentration of 4 mg/kg^{-1} resulted in the reduction of 14.2 mg g^{-1} yolk cholesterol compared to the control treatment without yeast autolysate 16.4 mg g^{-1} yolk. Yalcin *et al.* (49) also suggested that *Saccharomyces* strains remove cholesterol.

Table 4: The effect of *Saccharomyces cerevisiae* on the Haugh unit

Author	Amount of yeast	Haugh unit	
		Control	Additive
Koiyama *et al.* (38)	450 ppm *Saccharomyces cerevisiae* in the diet of Hy-Line W-36 laying hens	87.17 HU	89.30 HU
Alabi *et al.* (43)	Isa brown hens fed with 0.75% *Saccharomyces cerevisiae*	71.6 HU	83.1 HU
Yalcin *et al.* (14)	Eggs from Hyline Brown laying hens showed the highest Haugh unit at the treatment of 1 g/kg *Saccharomyces cerevisiae*	81.95 HU	82.26 HU
Özsoy *et al.* (42)	Laying hens fed with 0.2% *Saccharomyces cerevisiae* showed the highest egg Haugh unit	79.86 HU	81.18 HU
Yalcin *et al.* (17)	Baker's yeast with 12% inclusion in Japanese quails (*Coturnix coturnix japonica*) diet improved Haugh unit	83.4 HU	84.1 HU
Hameed *et al.* (44)	The supplementation of 0.2% *Saccharomyces cerevisiae* improved the Haugh unit of Novogen white light hen's diet	79.86 HU	81.1 HU

The application of baker's yeast in fermented feed

Maicas (50) demonstrated that traditional fermentation techniques for wines, beers, and fermented food are facilitated mainly by *Saccharomyces cerevisiae* strains, the most prevalent and commercially available yeast. Yeasts are also critical in treating wastewater and the creation of biofuels. From a biological standpoint, fermentation occurs when the pyruvate created during glucose metabolism is broken down into ethanol and carbon dioxide by yeasts (and some bacteria).

Notably, yeast or baker's yeast is used for diet directly and fermenting agricultural products useful for animal nutrition. Baker's yeast itself contains a high nutrient value for animal diets. Furthermore, baker's yeast plays a vital role in the fermentation process of agricultural products or byproducts to improve the nutrient values of those products through the abovementioned process. The application of baker's yeast (*S. cerevisiae)* on carcass traits was also recorded and had numerous positive influences on carcass weight, carcass percentage, and carcass composition. According to Linh *et al.* (11), after fermentation, filtrate from yeast-fermented rice contains a highly nutritious byproduct that helps local chickens improve their growth performance and carcass characteristics. It notably improved 20% over the diet without aqueous yeast-fermented rice. This was due to the fermentation process improving nutrients from aqueous and solid fermented products. In the same study, the carcass weights of crossbred chickens increased with increasing levels of yeast-fermented rice in the diets. In particular, the treatment with 4% aqueous yeast-fermented rice increased the chickens' carcass, thigh, and breast weights. When using *S. cerevisiae* to ferment brown rice, Christ-Ribeiro *et al.* (8) recorded an increase in protein, ash, and fiber content and decreased carbohydrate and lipid content. Azrinnahar *et al.* (9) also recorded the improvement of feed conversion ratio and body weight gain of broilers fed with fermented feed, with a maximum 10.18% increase in supplemented groups compared to the control group. Yeast secretes enzymes during the fermentation process, creating nutrients available for bird absorption.

Additionally, some secretions from the yeast cell wall, such as mannan-oligosaccharides and fructooligosaccharides, can prevent the action of intestinal pathogens. The experiment from Sun *et al.* (10) with different yeasts yielded the same results while using baker's yeast to ferment the cottonseed meal. The feed mixture increased the number of beneficial bacteria, which improved the broiler's gut health and eventually improved the growth performance. According to Kang *et al.* (13), fermented rice bran has a positive effect on the growth performance of broilers. A significant effect on white blood cells and lymphocytes was also recorded. Based on the results, Kang *et al.* (13) suggested that the effect might be due to the composition of fermented rice bran, which included more than 120 antioxidants, vitamins, proteins, minerals, carbohydrates, and essential fatty acids.

Blood parameters

According to Kang *et al.* (13), hematological parameters are significant markers of an animal's pathological, physiological, and nutritional response. The changes in these parameters can interpret the impact on the animal performance of nutritional components and additives delivered in the diet. Yeast, which is utilized as a probiotic and prebiotic in poultry diets, acts as a stimulator of bile acid secretion. Yeast is used to recovering bile acid, resulting in more cholesterol as the precursor of the bile acid. This aids in the reduction of blood serum cholesterol levels (9). In some research, it is the notable reason for reducing cholesterol (29). The effect of baker’s yeast (*S.* cerevisiae) on blood parameters has been shown in previous studies through cholesterol, albumin, and hemoglobin concentrations. The most significant effect of baker’s yeast (*S. cerevisiae)* is reducing cholesterol in plasma and increasing albumin. However, the reduction effects are not similar. This is due to many internal and external factors, such as poultry breed, baker's yeast, and environment. It is possible that giving live yeast to broilers will help improve their lipid metabolism. Ahmed *et al.* (30) also recorded that the variable results could be attributed to various factors, such as the dose or kind of yeast used, the experimental settings, the primary food, or the breed of poultry utilized. According to the findings of He *et al.* (6), Live yeast prevented cholesterol oxidation, resulting in decreased lipid deposition in blood vessels. Thus, his study proposed that live yeast might have anti-cholesteric influences on chickens. According to Bolacali and Irak (2), feeding baker's yeast increased the amount of albumin in quail blood. The presence of high albumin levels in male quail may be correlated with its beneficial effects on protein metabolism, and the presence of a high protein nutrient in the autolysate may indicate his finding.

Mulatu *et al.* (29) showed that normal hematological parameters could be used to determine an animal's nutritional status. Furthermore, Al-Nasrawi *et al.* (5) reported that various biochemical features of experimental birds suggested a considerable reduction in cholesterol levels in the blood compared to the control without yeast. The presence of glucan rolls in the diet, and more specifically in the cell walls of yeasts, might be responsible for lowering cholesterol levels. As a result of interaction with bile salt acids in the intestinal tract, cholesterol is produced. This stimulates the production of cholesterol (5). The fermentation process for glucan fiber occurs within the intestinal tract, allowing for the production of short-chain fatty acids such as propionate, acetate, and butyrate, which are then taken into the liver via the portal vein.

Furthermore, this fiber remains in the gut, resulting in reduced sugar absorption, followed by a decrease in insulin levels in the blood. This will further result in a decrease in the production of cholesterol. In addition, undissolved fibers result in the decreased absorption of fats, including cholesterol, through the viscous intestines, further lowering cholesterol levels (5).

Use of baker’s yeast against disease and promote immunity

Various scientific studies on yeast-based diets have consistently shown that the immune system is greatly improved. Baker's yeast improves poultry health by improving the immune system's response and preventing the entry of poultry diseases. Several previous studies have studied the effect of baker's yeast on the immune response. The microbial population that resides within the poultry digestive system is essential for gut homeostasis and various physiological activities within the bird and the bird's overall health and well-being. They are crucial in the digestion of nutrients, the inhibition of pathogens, and the interaction of the gut-associated immune system (51). As concluded by Wang *et al.* (37), the addition of 0.5 g/kg yeast (*S. cerevisiae*, 1.0 £1010 CFU/g feed) could be used to improve gut morphology. Thus, it is possible to improve poultry health. It is widely known that mannan-oligosaccharides produced by yeast, *S. cerevisiae*, effectively prevent pathogenic bacteria from adhering to the intestinal wall and stimulate the immune system when combined with 1,3 and 1,6-D-glucans in yeast (38).

According to Suarez and Guevara (23), the addition of *S. cerevisiae* in meals, which may contain some toxins, could help prevent severe organ damage caused by these toxins. The adsorption to *S. cerevisiae* cell walls and the changes in the composition of the blood membrane after patulin exposure all contributed to the mycotoxin-removing effect (21,52,53). *S. cerevisiae* was chosen for its potential to alleviate animal stress while also delivering vitamins, enzymes, and proteins. In addition, Delgado *et al.* (54) have shown that the use of *S. cerevisiae* as a nutritional additive also has a prebiotic effect that helps to minimize the occurrence of diarrhea. When diarrhea occurs, the duration of the diarrhea is reduced. The inflammation caused by *Salmonella* lipopolysaccharide was alleviated (55) after the addition of 0.5 g/kg diet yeast *S. cerevisiae* (1.0 £ 1010 CFU/g feed), and the performance of *E. coli* lipopolysaccharide was improved (37) by using 0.5 g/kg yeast (*S. cerevisiae*, 1.0 £1010 CFU/g feed). Additionally, it has been observed that yeast can help control the spread of undesirable intestinal infections in broiler chickens by providing competitive binding sites to pathogenic bacteria (26). Moreover, the reduction of NF-κB expression and ileal toll-like receptor four was recorded in the study of Wang *et al.* (56) when using 0.5 g/kg live yeast (*S. cerevisiae*) in the diet. Kiarie *et al.* (7) showed that in broilers subjected to coccidia vaccination, supplementation with 5 g/kg yeast *S. cerevisiae* autolysate in the diet increased the secretion of IgA from the intestinal mucosa, as well as the cell-mediated and humoral immune responses. Therefore, oocyst shedding was decreased. Using *S. cerevisiae* in broiler diets at concentrations of 0.5 and 1.0 g/kg, He *et al.* (6) reported that yeast (*S. cerevisiae)* could be used as an alternative to antibiotics in broiler chickens to improve serum antioxidant capacity, intestinal morphology, and immune function. Yeast contains mannan-oligosaccharides and β−1,3/1,6-D-glucan, which are considered the molecules responsible for animal immune stimulation (6). Its function in improving immunoglobulin production in poultry was also investigated (57). Thus, yeast has the function of improving the immune system and its response. He *et al.* (6) concluded that adding 1000 mg/kg yeast to the diet improved the IgM concentration for Arbor Acres male broilers at 21 days of age and improved the IgG concentration at 42 days of age. In the research of Sun *et al.* (10), serum IgG of Arbor Acres broilers for both the ages of 21 days and 42 days was increased when supplemented with baker's yeast.

Conclusion

As a potential feed additive, baker's yeast will play a crucial role in poultry production by enhancing poultry performance through increased nutrient absorption and digestibility. Poultry health will also be elevated through the improved immune response and normal blood parameters. Applying baker's yeast in a diet could improve both the production and reproduction aspects. Baker yeast could be supplemented in the diet directly or by using it to ferment agricultural products that will further increase the nutrient composition of those ingredients.

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خميرة الخبز (*Saccharomyces cerevisia*) وتطبيقاتها على انتاجية وصحة الدواجن: مراجعة بحثية

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الخلاصة

ازداد الاهتمام بتربية قطعان الدواجن في السنوات الحديثة وتطورت المعايير المعتمدة لضمان نوعية اللحوم ونظرا للنمو السكاني المتزايد ازدادت متطلبات الحاجة الى اللحوم وأصبحت لحوم الدواجن بصورة خاصة الاختيار الغذائي الأفضل واثارت البحوث عن الإضافات الغذائية اهتمام العديد من المختصين بالدواجن للبحث عن سبل تزيد من كفاءة الأداء الإنتاجي في الدواجن. إن استخدام خميرة الخبز (*Saccharomyces cerevisiae*) لاقى اهتماما كبيرا" كبديل للمضاد الحيوي من خلال استخدام البروبيوتيك والبربيوتك. حيث تحتوي خميرة الخبز على البيتاكلوكاان و متعدد السكر مانان كمكونات رئيسية .واوضحت الدراسات ان خميرة الخبز كمصدر بديل للبروتين توثر وبشكل إيجابي على النمو والأداء الإنتاجي ومؤشرات الدم والاستجابة المناعية في الدواجن .فضلا عن ان استخدام خميرة الخبز كاضافات غذائية مخمرة قد أظهرت نتائج واعدة في انتاج الدواجن حيث ان استخدام خميرة الخبز مع العلف يحسن التراكيب المظهرية لمعدة الدواجن وبالتالي تزيد من النمو والأداء الإنتاجي فهي تحفز وبشكل بارز استهلاك العلف والزيادة الوزنية وتحسن من كفاءة التحويل الغذائي كما وان خميرة الخبز تحسن الجهاز المناعي في الدواجن من خلال اختزال إعداد الكائنات الدقيقة الضارة كوسيلة للتصدي لامراض الدواجن بكفاءة عالية والحفاظ على صحة الدواجن وهدفت الدراسة الى الالمام بكل جوانب تاثير خميرة الخبز على صناعة الدواجن ودورها واستخداماتها في إنتاجية الدواجن.