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Effect of antibiotic substitution with *Saccharomyces cerevisiae* and probiotic on hematic parameters and growth performance of broilers

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Abstract

The pan about the usage of antibiotics in chicken feed in different parts of the world, and rising customer demand for poultry products free of antibiotics has heightened the attention of poultry researchers and producers in identifying appropriate substitution to such alternatives. The present research was aimed to study the effects of dietary supplemented with *Saccharomyces cerevisiae*, probiotics and mixing of them (*S. cerevisiae* and probiotic) on growth performances, activity of the immunity organs (thymus and bursa of Fabricius) and hematological profile, a total of 60 one day old birds were randomly divided into 4 band (n=15) (T1-T4). T1 band (control), T2 provided with 3 g/kg of *S. cerevisiae*, T3 provided with 200g/1000L of water and T4 provided with mixing of *S. cerevisiae* and probiotic. body weight was measured at zero, 7, 14, 21, 28 and 35 days and represented highly significant at $P<0.05$ in T4 band in contrast to the last band, as well intestine weights and immunity organs weights in T2, T3 and T4 showed high significant variation at $P<0.05$ when compared with T1 (control band), in addition to the person correlation weights between T4 which showed height significant variation in intestinal weights with immunity organs and Bursa of Fabricius was highly significant with thymus gland, from our results we concluded that supplemented of chicken diet with *S. cerevisiae* and probiotic improved growth performance, immunity organs activity, hemoglobin concentration and packed cell volume.

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Introduction

While most of the commercial strains of broilers are characterized by a rapid rate of both growth and conversion, the expression of these bioactivities can be reach to the peak of their expression by the availability and the high efficiency of such an essential factor related to the intestinal tract of these broilers which translated by the high rate and high efficiency of both the digestion and the absorption (1,2) Antibiotics have been used to promote both the growth and control of the diseases in these broilers, however random and irrational usage of these antibiotic might cause a bacterial resistance, the dietary supplements are one of the important sources which, when added to the diet lead to an improvement-in the physical condition (3) and increasing body weight (4,5). *S. cerevisiae* are examples of these supplements (6-8). On the other side, Studies showed that *Saccharomyces cerevisiae* could be used as a substitute for improving the physical condition of the broilers as well as their immunity, specifically by improving the rate of digestion and the length of the villi (9-11). Both of these dietary supplements work directly on the Intestinal microflora by enhancing symbiosis through improving the proliferation of beneficial bacteria in the intestinal tract. Probiotics are another example of dietary supplements added to broilers food to enhance their nutritional value and maintain their gut health by increasing beneficial bacteria (12,13). These probiotics are also known for their role in boosting the immune system (14,15). Currently, the consumption of probiotics via food products are in high demand (16,17). the beneficial benefits of living probiotic cells in the gastrointestinal tract have been investigated (18-

20), where the researchers have been focusing on the immediate consequences problems of the gastrointestinal tract (21).

Thus, the current work was designed to study the effects of dietary supplements with *S. cerevisiae* and probiotics, a correlation between the lymphatic organs and the digestive system within the groups, and their effects on growth performance and hematobiochemical test of broilers chicken in Mosul City.

Methods and materials

Ethical approve

At the University of Mosul, faculty of medicine, and based on the conical of ethics of animal extermination, the current work was accepted according to UM.VET.2022.021.

Experimental design

The experiment was conducted in the animal house of the College of Veterinary Medicine, University of Mosul, A total of 60 birds one day old age and mixed gender were used in the current work. They were gained from a private hatchery, and the main material was saccharomyces cerevisiae and probiotics. The birds were randomly divided into four groups. T1 as a control, T2 supplemented with 3 g/kg of saccharomyces cerevisiae, T3 supplemented with probiotic 200g/1000L of drinking water according to the manufacturer's instructions and T4 supplemented with mixing of *S. cerevisiae* and probiotic. Throughout the experiment, food and water were provided ad libitum, and the Cobb Broiler management Guides recommendations for the environmental temperature program were followed.

Body weight

All broilers were wing-banded, and their body weights were determined-Randomly. broilers were assigned to remediation using individual broilers body weights after removing the lightest and heaviest ones, and chick's weights were taken at 0, 7, 14, 21, 28 and 35 on the last day of the experiment.

Somatic index

Furthermore, the immunity organs (Thymus and bursa of Fabricius) and intestine organs for each group were removed and weights during the 1st, 2nd, 3rd, 4th and 5th killing.

Collection of blood sample

Blood samples were collected at the 1st, 2nd, 3rd, 4th and 5th weeks of the experiment from the heart and wing veins according to the age of the birds. A total of 15 blood samples were collected from the treatment and control group into a clean and sterilized tube containing EDTA for measurement of blood hematology, including packed cell volume (PCV) and hemoglobin concentration (Hb) (22).

Statistical analysis

In order to determine the influences of *S. cerevisiae* and probiotics on hematobiochemical and growth performances of broilers in Mosul city, all results were statistically analyzed by using one-way ANOVA and T test at $P<0.05$ (23,24).

Results

Effects of *S. cerevisiae*, probiotic and their mixing on body weights

As shown in table 1, the effects of *S. cerevisiae* on BW during 7 and 14 and 21 and 28 and 35 days showed height significant variation at $P<0.05$ as well the T4 supplemented with a mixing (*S. cerevisiae* and probiotic) showed significant differences in contrast to the probiotic and control group.

Table 1: Effect of *S. cerevisiae* probiotic and mixing of them on bird's body weight (kg)

Groups	0 days	7 days	14 days	21 days	28 days	35 days
Control	39.40 ± 1.35^{ab}	77.40 ± 0.64^{d}	113.20 ± 1.56^{c}	205.00 ± 1.58^{d}	499.40 ± 2.30^{c}	$870.00\pm\pm1.58^{d}$
S. cerevisiae	38.20 ± 1.01^{b}	86.80 ± 0.90^{a}	139.00 ± 1.58^{a}	286.60 ± 2.51^{a}	57800 ± 6.44^{a}	1160.00 ± 1.58^{a}
Probiotic	32.80 ± 1.41^{c}	82.80 ± 1.39^{b}	125.40 ± 1.10^{b}	231.40 ± 1.34^{c}	503.40 ± 3.51^{c}	900.00 ± 6.04^{c}
Mixed	40.80 ± 1.50^{a}	80.80 ± 0.92^{c}	126.00 ± 1.58^{b}	246.60 ± 1.25^{b}	516.20 ± 1.35^{b}	1040.00 ± 1.58^{b}

*Indicates significant differences between the two treatments at $P<0.05$. NS indicates that there are no significant differences between the two treatments.

Effects of *S. cerevisiae*, probiotic and mixing on intestinal weights during the experimental periods

The effects of *S. cerevisiae* on intestine weights are presented in table 2, and the treated groups during the 2nd, 3rd, and 5th weeks showed highly significant variation when compared with the control group. As shown in table 3 the effects of probiotics on -intestinal weights represented significant height variation at 7 days during the experimental period-when compared with the control group. As represented in table 4 the effects of mixing *S. cerevisiae* and probiotics on the intestinal weight showed significant variation at 21 days in contrast to 35 days, while the 28 days represented a significant difference when compared with another group.

Table 2: Effects of *S. cerevisiae* on bird's intestine weights (kg) during 35 days

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	4.70	4.32	9.28	6.50	13.50	11.62	32.83	29.15	46.80	35.36
SD	0.25	0.20	0.95	1.54	0.39	0.74	4.77	1.57	0.36	6.32
T	2.102^{NS}		2.664^{**}		3.867^{NS}		1.270^{**}		3.130^{**}	
Sig.	0.103		0.05		0.018		0.273		0.035	

*Indicates significant differences between the two treatments at P<0.05. NS indicates that there are no significant differences between the two treatments.

Table 3: effects of probiotic on intestine weights (kg)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	1.45	5.40	4.32	9.15	6.50	12.23	11.62	33.12	29.15	45.60
SD	0.04	0.08	0.20	0.85	1.54	1.26	0.74	3.39	1.57	9.53
T	8.86^{**}		2.610^{NS}		0.721^{NS}		1.842^{NS}		1.551^{NS}	
Sig.	0.001		0.059		0.511		0.139		0.196	

*Indicates significant differences between the two treatments at P<0.05. NS indicates that there are no significant differences between the two treatments.

Table 4: Effects of *S. cerevisiae* and probiotic on intestine weights (Kg)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	1.05	4.44	4.32	7.32	6.50	18.08	11.62	41.56	29.15	42.22
SD	0.04	0.09	0.20	0.55	1.54	0.24	0.74	5.70	1.57	1.87
T	1.021^{NS}		0.869^{NS}		14.328**		3.636*		1.803^{NS}	
Sig.	0.365		0.434		0.000		0.022		0.146	

* Indicates that there are significant differences between the two treatments at P<0.05. ** Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Effects *S. cerevisiae* on immunity organs

The results in a table 5 showed significant height variation in the weight of immunity organs during 7, 14 and 35 days in contrast to weights of these organs at 21 and 28 that showed no significant differences in the bursa of Fabricius weights in contrast to the control group. The effects of *S. cerevisiae* on thymus weights showed height significance on thymus weights during 7, 14, 21 and 35 days in contrast to weights of these organs at 28 days that showed no significant differences in thymus weights when compared with the control group (Table 6).

Table 5: Effects of *S. cerevisiae* on bursa fabrics weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.08	0.15	0.13	0.22	0.22	0.65	0.39	1.36	0.66	0.80
SD	0.00	0.00	0.00	0.00	0.00	0.04	0.20	0.02	0.52	0.02
T	8.497		11.13		2.157		2.330		3.196	
Sig.	0.001^{**}		0.001^{**}		0.097^{NS}		0.080^{NS}		0.033^{*}	

* Indicates significant differences between the two treatments at P<0.05. **Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Table 6: Effects of *S. cerevisiae* on thymus weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.10	0.20	0.11	0.38	0.24	0.95	0.68	1.79	1.43	3.36
SD	0.00	0.04	0.00	0.00	0.00	0.04	0.00	0.08	0.60	0.00
T	3.990*		30.01**		12.322**		1.007NS		3.041*	
Sig.	0.016		0.00		0.000		0.371		0.038	

* Indicates significant differences between the two treatments at P<0.05. **Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Effects probiotic on immunity organs

Table 7 shows the effects of probiotics on immunity organs, Bursa, weights do not represent significant differences during 21, 28 and 35 days, while it showed the highest differences at 7 and 14 days, as well the thymus gland showed height significant variation at 7 days and 14 days, while weights during 21, 28 and 35 did not differ significantly between the group (Table 8).

Table 7: shows the effects of probiotics on bursa fabrics weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.211	0.132	0.351	0.218	0.437	0.393	1.720	0.660	0.850	0.610
SD	0.002	0.003	0.001	0.001	0.015	0.200	0.510	0.520	0.131	0.100
T	33.00**		28.721**		0.374NS		2.521NS		2.521NS	
Sig.	0.000		0.000		0.728		0.065		0.065	

**Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Table 8: Showed the effects of probiotics on thymus weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.057	0.097	0.207	0.106	0.308	0.236	0.795	0.680	2.300	1.432
SD	0.003	0.002	0.002	0.003	0.058	0.001	0.380	0.000	0.010	0.603
T	21.911**		48.519**		2.139NS		0.522NS		2.493NS	
Sig.	0.000		0.000		0.099		0.629		0.067	

* Indicates significant differences between the two treatments at P<0.05. **Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Effects *S. cerevisiae* and probiotic on immunity organs

The effects of mixing *S. cerevisiae* and probiotics on chicken immunity organs are represented in table 9. It showed significant differences in Bursa weight during 7 and 14 days and a significant difference in weights of gland during 35 days and did not are present significant differences between the group at 21 and 28 days. Table 10 showed no significant changes in thymus weights during 14 and 28 days, while it was highly significant during zero, 7, 21 and 35 days.

Table 9: Shows the effects of mixing of them on bursa weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.217	0.132	0.477	0.218	0.620	0.393	1.283	0.660	1.063	0.610
SD	0.004	0.003	0.006	0.001	0.050	0.200	0.145	0.520	0.165	0.100
T	29.963**		77.115**		1.901NS		2.000NS		4.069*	
Sig.	0.000		0.000		0.130		0.116		0.015	

* Indicates significant differences between the two treatments at P<0.05. **Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Table 10: Shows the effects of mixing-of them on thymus gland weights (%)

	7 days		14 days		21 days		28 days		35 days	
	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont	SAR	Cont
Mean	0.157	0.106	0.310	0.236	0.973	0.680	1.740	1.432	3.453	2.042
SD	0.003	0.003	0.053	0.001	0.075	0.000	0.200	0.603	0.445	0.748
T	22.706^{**}		2.417^{NS}		6.769^{**}		0.840^{NS}		2.810^{*}	
Sig.	0.000		0.000		0.130		0.116		0.015	

* Indicates significant differences between the two treatments at P<0.05. **Indicates that there are highly significant differences between the two treatments at P<0.01. NS indicates that there are no significant differences between the two treatments.

Effects of *S. cerevisiae*, probiotic and mixing of them on hematological parameters

Figure 1 and 2, showed the effects of *S. cerevisiae*, probiotic and mixing of them on hemoglobin concentration and packed cell volume during the experimental period. It was highly significant differences with T4. Furthermore, T2 and T3 showed significant variation in hematological parameters compared with T1 (control). Table 11 represents the correlation ship of mixing supplemented of *S. cerevisiae* and probiotic on immunity organs and intestine weights, there was a highly significant difference in intestinal weights with (bursa and thymus gland weights) as well bursa of Fabricius showed highly significant variation with thymus gland weights

Table 11: Shows the effect of the correlation ship of *S. cerevisiae* and probiotic on thymus, bursa and intestine weight

Organs	Bursa weights	Thymus weights
Intestine	0.771**	0.933**
Bursa of Fabricius	1	0.683**

** Indicates a highly significant correlation coefficient between the T4 at P<0.01.

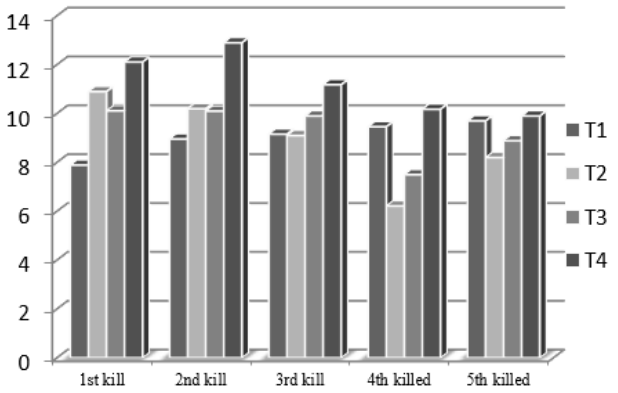

Figure 1: Effects of *S. cerevisiae*, probiotic and mixing of them on Hb concentration (gm/dl).

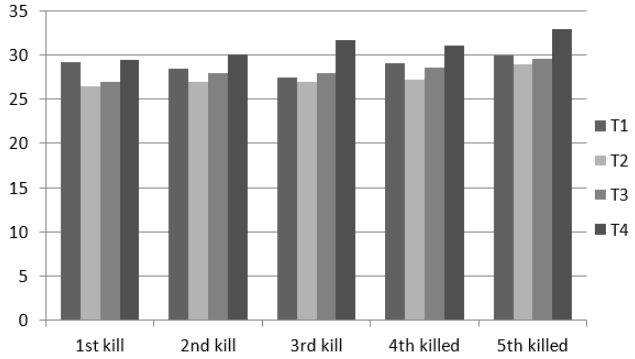

Figure 2: Effects of *S. cerevisiae*, probiotic and mixing of them PCV (%).

Discussion

S. cerevisiae has multiple beneficial effects on humankinds' health and animals. According to the critical structures of these materials, it has been used in broiler and livestock as a supplemented feed and as alternative material (25). Administration of *S. cerevisiae* and probiotics increased body weights of the chickens during the experimental period and these related to the effects of these yeast on intestinal microflora through promoting proliferation and growth of these microflora enhances the activity of the immune system (26). Additionally, the increased energy metabolism (27), and the highly significant variation in body weights in fourth group indicated that the combination of *S. cerevisiae* and probiotics improvement of growth of body weights better (28-30). Furthermore, supplemented of broiler feed with *S. cerevisiae* showed apparent effects on the internal organ's weights, an appropriate target for assessing immunological competency in poultry is lymphoid organs (31). In chicken, bursa of Fabricius is thought to be the main lymphoid organ and is a crucial organ in the differentiation of B lymphocyte (32). Our results showed an increase in the bursa weights at 1st, 2nd, 3rd, and 4th weeks and these contributed to the activity of yeast in increasing metabolic activity and enlargement of the lymphoid organs, an increase in bursa weight in *S. cerevisiae* feed chicken was related to IgA production as a boosted

immunity and these result agreement with Daneshmand *et al*. (33), and disagreement with Lin *et al*. (34) who mention that feeding of broiler with *S. cerevisiae* had no effects on the bursa weight.

Our results showed that supplemented broilers diets with T4 (mixing of *S. cerevisiae* and probiotic) had significant effects on Hb and PCV when compared with other groups and these results agree with Mulatu *et al*. (35) in addition to Özsoy and Yalçin (36) mentioned that supplemented chickens diets with *S. cerevisiae* showed height concentration of Hb, PCV, and WBCS and disagreement with Seyidoglu *et al*. (37), who mentioned that provided chicken diet with probiotics had no significant effects on blood parameters, and these attributed to species of bacteria that presented in *S. cerevisiae* and probiotic in stimulated the immunity system (38) and resist disease (39-43).

Conclusion

Using *S. cerevisiae* and probiotics as a safety material to the regular antibiotic used in the chicken industry, we were able to prevent infection through the action of T4 that showed the best influences on growth performance, improved immunity organs activity, and hematological parameters of broiler profile.

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Conflict of interest

The researcher acknowledges that there are non-conflicts of interest in this work.

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تأثير استبدال المضادات الحياتية بالخميرة والمعزز الحيوي على المعايير الدموية وأداء النمو للفروج

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الخلاصة

أدى الاهتمام المتزايد باستخدام المضادات الحياتية في أعلاف الدواجن وفي أجزاء مختلفة من العالم وعلاوة على ارتفاع طلب العملاء لمنتجات الدواجن الخالية من المضادات الحياتية الى زيادة اهتمام باحثي الدواجن والمنتجين لتحديد البدائل المناسبة لمثل هذه المواد. تهدف الدراسة الحالية لمعرفة تأثير إضافة بدائل المضادات الى علائق الدواجن و معرفة مدى تأثيرها على معايير النمو والمعايير الكيموحيوية، استخدام ٦٠ طائر وبعمر يوم واحد فقط والتي تم جلبها من مفقس النبراس قسمت الطيور عشوائيا الى أربعة مجاميع مثلت المجموعة الأولى السيطرة، والمجموعة الثانية عوملت بمقدار ٣غم/كغم علف من الخميرة الجافة والمجموعة الثالثة عوملت بمقدار ٢٠٠ غم/١٠٠٠ لتر ماء من المعزز الحيوي، أما المجموعة الرابعة فقد عوملت بمزيج من المادتين ولمدة ٣٥ يوم تم قياس وزن الجسم الحي خلال ٠، ٧، ١٤، ٢١، ٢٨ و ٣٥ يوماً من التجربة كما تم التضحية بالطيور خلال الأيام ٠، ٧، ١٤، ٢١، ٢٨ و ٣٥ وسحب الدم لدراسة المعايير الكيموحيوية بالإضافة الى اخذ وزن الأمعاء ووزن الأعضاء المناعية، أظهرت النتائج وجود فرق معنوي واضح بوزن الجسم الحي بالمجموعة المعاملة بالمزيج، كما اظهر معامل الارتباط وجود فرق معنوي بين الأمعاء والأعضاء المناعية بالإضافة الى وجود معامل الارتباط بين جراب فابريشيا والغدة التوثية. نستنتج من الدراسة الحالية أن استخدام المزيج له تأثير ملحوظ وواضح في تحسين كفاءة الجسم وتركيز الهيموكلوبين وحجم الخلايا المرصوصة.