REPLACEMENT OF COMMERCIAL DRY YEAST (*SACCHAROMYCES CEREVISIAE*) WITH ANIMAL PROTEIN CONCENTRATE AND ITS EFFECT IN SOME BLOOD PARAMETERS FOR FINGERLINGS COMMON CARP *CYPRINUS CARPIO* L.

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ABSTRACT

The experiment was conducted in the fish laboratory of Animal Production Department, Faculty of agricultural sciences, University of Sulaimaniya in Kurdistan region of Iraq for the period from 25/07/2015 to 15/10/2015. Starting with a period of the acclimatization for 21 days, to test the efficiency of using commercial dry yeast Saccharomyces cerevisiae as alternative protein source to animal protein concentrate (APC) used in the manufacturing of diets for common carp Cyprinus carpio L. by using 90 fish of common carp C. carpioat weights ranged 22-42 gm. Divided into 15 groups distributed at randomly on 15 plastic ponds by five treatments with three replicates per treatmentthetreatments contain different levels from APC and yeast S.cerevisiae as below: First treatment (Control T1) 100% APC/ 0.00% yeast S. cerevisiae, second treatment (T2) 75% APC/ 25% yeast S. cerevisiae, third treatment (T3) 50% APC/ 50% yeast S. cerevisiae, forth treatment (T4) 25% APC/ 75% yeast S. cerevisiae, fifth treatment (T4) 0.00% APC/ 100% yeast S. cerevisiae. T5 was significantly differences (P≤0.05) in counts red blood cells RBC as compared with other treatments, T4 was significantly differences (P≤0.05) Packed Cell Volume (PCV) as compared to the other treatments ,also treatments T3, T2 and T4 significantly increase (P≤0.05) in mean concentration of hemoglobin (MCHC) as compared to the other treatments, T2 was significantly increase (P≤0.05) in white blood cells counts WBC and granulocytes percentage as compared to the other treatments ,also treatments T2 and T3 significantly increase (P≤0.05) in monocytes percentage as compared to other treatments. The results of blood serum showed that T2

significant improvement (P \leq 0.05) in the level of Cholesterol concentration as compared to the other treatments, significant improvement (P \leq 0.05) in the level of Triglyceride concentration for T2 as compared with T1 and T5, T3 was significantly improvement (P \leq 0.05) in High-density lipoproteins (HDL) as compared to the other treatments, significantly improvement (P \leq 0.05) in low-density lipoproteins concentration LDL for othertreatments as compared with T1.

INTRODUCTION

The optimization of fish production requires research into feeding techniques, which promotes growth and at the same time reduces the quantity of waste products released in the water, fish feed consist of 60% production cost and the protein component is to be the most expensive in terms of overall feed cost (17). Increasing protein levels in feeds can lead to improved fish production, but excessive dietary protein is not economical for fish culture. The dietary protein level is one of the major factors influencing growth of fish, feed efficiency and water quality (17).

The increase in fish meal and decrease fisheries productivity consumption threatens the future is not reassuring for the whole aquaculture industry unless there is a quantum leap in providing sources of protein is fish for fish feed production, especially since the forecast growth in demand for the coming years twentieth powder and fish oil, which puts extra weight on the balances global fish stocks threatened to decline in the future (5).

(SCP) Proteins produced from yeasts and fungi consist of 50-55 % of the protein which is rich in fat and carbohydrates (15), as well as it has a balance of the essential amino acid ratios and high in vitamins B-complex and mineral such as phosphorus and potassium (19). The SCP product of bacteria contains a high proportion of protein exceeding 80% (6).

Using of dry yeast *S. cerevisiae* in the diets of fish was mainly in two different, they can either be additive food or as a component to replace traditional protein in diets, the image first represents dietary supplements Probiotics vitally effects contribute to improve the immune system for juvenile fish and strengthen coexistence symbiotic mechanisms in the gut environment (16).

The results of the study conducted by (2) shown an increase in the rate of common carp *C.carpio* fed a diet composed of equal proportions of bacteria *Lactobacillus* and *Bifidobacterium* derived from the intestines of common carp with dry yeast *S.cerevisiae*.

(3) test the effect of different levels of the FOS, yeast and their combination. Their results indicated that treatment with 2.5g/kg FOS was best treatment compared with treatments it had weight gain (28.133), daily growth rate (0.335), specific growth rate (138.913), relative growth rate (0.451), while T7 significantly differs from other treatment in their feed conversion (3.723), having a complementary relationship between them interpreted in the light of the outcome of the immune response of fish with the increase in the total counts of white blood WBC, other experiments dealt with the role of yeast extracts including - β glucan and positive effects and conducted on animals and humans and possess the properties of immune optimization (20).

The current study is designed to test the possibility of using commercial dry yeast *S. cerevisiae* as an alternative to the commercial concentrate of animal protein used in the diets of common carp *C. carpio* L. 1758 and the effect of different levels of substitution in some blood parameters.

MATERIALS AND METHODS

The experiment was carried out in fish lab./ Department of Animal Production/ College of Agricultural Sciences, University of Sulaimaniya for the period from 25/07/2015 to 10/15/2015, including a period of acclimatization fish for 21 days.

Experiment design: The experiment was designed with five treatments and with three replicates per treatment and within it six fish to be the total number of fish ninety fish to study the effect of replacement of different levels of Animal Concentrate Protein (APC) with dry commercial yeast *S. cerevisiae* in diets as below follows:

T1: the first treatment(control) 100% APC /0.00% yeast S. cerevisiae.

T2: The second treatment 75% APC / 25% yeast S. cerevisiae.

T3: third treatment 50% APC / 50% yeast S. cerevisiae.

T4: fourth treatment 25% APC / 75% yeast S. cerevisiae.

T5: fifth treatment 0.00% APC / 100% yeast S. cerevisiae.

Experiment fish: A total 280 common carp *C. carpio*used their weights ranged from 22-42 grams and lengths ranging from 8.10 to 9.13 cm for the treatments of the research plan, which was brought from one of the farms in Daqoq in Kirkuk province, After the arrival of the fish to the lab he was transferred to plastic containers and has processed quarantined from NaCL 3% for five minutes in order to disinfect and get rid of parasites sticking out even showing signs of stress evident on the movement of the fins and the way fish swim.Using of fifteen plastic oval tanks each capacity 80 liters, filled with 60 liters.

At the end of the experimental period, three fish were randomly taken from each experimental group. All fish samples were weighed individually. The blood samples from each fish of the different groups were collected by cutting of the caudal peduncle. Whole blood samples were collected in small plastic vials containing heparin for determination of some blood parameters and the concentrations were determined by using the hematology analyzer BC-2800 is a compact, fully automatic hematology analyzer with 19 parameters for complete blood count (CBC) test.

RBC (Red Blood Cell; 10¹²cells/l); WBC (White Blood Cell; 10⁹cells/l); Hb (Hemoglobin; g/l); MCH (Mean Corpuscular Hemoglobin; pg); MCHC (Mean Corpuscular Hemoglobin Concentration; g/l); PCV (Packed Corpuscular Volume; fl); GRAN (Granulocyte; %); Lymph (Lymphocyte; %); Mon (Monocyte; %); PLT (Platelet; 10⁹cells/l). Total Protein, Blood Sugar,Cholesterol Triglycerides (TG),)HDL(High Density Lipoprotein and Low Density Lipoprotein (LDL).

Statistical analyses was conducted using the completely randomized design CRD, means with significant differences were compared by Duncan's (1955) multiple range tests, according to P < 0.05 significance. Statistical analysis results are shown as mean values in tables. The statistical calculations of the results were completed using XLSTAT. Pro.one way (ANOVA). Different letters were given to different treatments.

RESULTS AND DISCUSSION

Results in Figure (1) and the table (1) T5 shown a significant difference (P \leq 0.05) in the red blood cells RBC counts compared with other treatments, as the highest value recorded was 1.081 (10¹² cells / L).



Figure 1: Effect of replacement of dry yeast *S.cerevisiae* in the red blood cells count of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

Results described in figure (2) and table (1) did not indicate presence of significant differences (P \leq 0.05) between the experimental treatments in the MCV.



Figure 2: Effect of replacement of dry yeast *S.cerevisiae* in the Mean Corpuscles Volume of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

The yeast *S.cerevisiae*acts in the fermentation of carbohydrates by metabolize them and produce CO_2 and alcohol, so they are used in pastries and alcohol production industry, also used the same yeast in aquatic vegetation development in aquaria by taking advantage of the generated CO_2 gas (11; Pedersen *et al.*, 2007). The role of yeast that's probably the reason for a relative increase in the dissolved carbon dioxide DCO_2 concentration, especially in the tank of T5 (100 % yeast) by the high level of use of yeast in which the friction feed in the water as well as the decomposition of the feed portion is accessible to (themissing) and this increase is offset by the relatively low DO_2 dissolved oxygen concentration

Because fish sensitive to any reduction in the concentration of DO_2 in the short term , making it doubled the production of red blood cells RBC from the spleen in the long term with the focus DCO_2 rarely a problem in fish ponds when the concentration of DO2 at the appropriate levels , but the fish resort to increase production RBC as a precautionary measure in order to physiologically adapt to the environment to support the continuing supply of body tissue portable oxygen on the roofs of RBC (12). On the other hand (7) observed that the number of red blood cells in the blood of fish affected by nutrition type, specifically the proportion and type of protein in the diet might be another reason for the high number of RBC fish that used diets T5 (100% yeast) and T4 (75% yeast) feeding them as was the quality of the protein had a tangible effect on the different results of the performance of growth and efficiency feeding the fish, in the same context, the different levels of yeast did not adversely affect the value of the approximate size of the cells MCV blood fish red blood compared with T1 (0.00% yeast).

Statistical results in figure (3) and table (1) show the presence of significant differences ($P \ge 0.05$) in Hb, despite recording numerical differences amongtreatments values T2 has received the highest value of 18.727 g / dl, and T5 came in at the lowest value of 16.639 g / dl.



Figure 3: Effect of different replacement levels of dry yeast *S.cerevisiae*in the level of hemoglobin of common carp*C.carpio* at the end of the experiment.

The results in Figure (4) and table (1) indicated that there were significant differences in MCHC among treatments, T3, T2 and T4 achieved (86.133 and 85.767, and 83.329) g / dl, respectively, high significant ($P \le 0.05$) in two treatments T5 at 79.106 and T1 (control) at 73.989 g / dl, which in turn got the lowest values registered with the significant difference ($P \le 0.05$) with all the treatments.



Figure 4: Effect of replacementlevels of dry yeast *S.cerevisiae* in MCHC of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

Table 1: Impact of replacement levels of *S. cerevisiae* in Red Blood Corpuscles counts,Hemoglobin, Packed Corpuscles Volumes, Mean Corpuscles Hemoglobin and Mean CorpusclesHemoglobin Counts of common carp *C. carpio* blood at the end of the experiment.

Turaturata	RBC counts	Hemoglobin	PCV	MCH	MCHC
Treatments	$(10^{12} \text{ cell /L})$	gm/dl	%	mg/dl	$fm(10^{-15})$
T1	0.05±0.859	0.10±17.567	0.06±18.567	0.01±73.989	0.05±210.989
0.00% yeast	bc	а	bc	С	а
Τ2	0.07±0.889	0.06±18.727	0.07±19.988	0.01±85.767	0.04±211.178
25% yeast	bc	а	b	а	а
Т3	0.02±0.773	0.11±17.511	0.07±17.522	0.01±86.133	0.01±214.028
50 % yeast	С	а	С	а	а
T4	0.02±0.925	0.05±17.744	0.07±22.700	0.03±83.329	0.03±212.489
75 % yeast	b	а	а	а	а
T5	0.14±1.081	0.02±16.639	0.04±19.106	0.03±79.106	0.01±204.420
100 % yeast	а	а	bc	b	а

Mean values with different superscripts within a column differ significantly (P≤0.05).

(8) reported that the liver, spleen and intestines are places responsible for blood production in fish and that any case of cases of damage or harm to those members can lead to a lack in the production of red blood cells and the size of stacked blood cells and a decrease in the concentration of blood hemoglobin (Hb) and then leading to anemia. And the fact that the results of this study confirm the non-significant differences in the vital functions of the members of the mentioned values later and this is reflected positively on the physiological health and efficiency of the fish which supports the using food performance for the use of the yeast *S.cerevisiae* as hygienically safe and vital value when used as an ingredient in the diets of fish, as it was for the yeast positive role was reflected in the improvement of the average concentration of hemoglobin in the blood of all treatments, compared with T1 (100% yeast) not included in the yeast composition.

The results of the PCV shown in Figure (5) and table (1) indicate that T4 ($P \le 0.05$) 22.70 % when compared with other treatments, as well as T2 at 19.988 % to T3 which in turn,

recorded the lowest rate among the treatments at 17.522 %, but not significantly vary with the treatments T1 and T5 (control) when the ratio (19.106 and 18.567) %, respectively.



Figure 5: Effect of replacementlevels of dry yeast *S.cerevisiae* in PCV of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

The significant among treatments indicates the existence of divergent effects to levels of yeast *S.cerevisae* on PCV% and Hb despite the absence of significant differences in the latter,

Table 2: The effect of replacement level of *S. cerevisiae* in White Blood Corpuscles counts,

 Granulocytes, Lymphocytes, and Monocytes of common carp *C. carpio*.

Tureturente	WBC counts	WBC counts Granulocytes Lymphocytes		Monocytes	
Treatments	10 ⁹ cell/L	%	%	%	
T1	0.02±102.283	0.11±0.900	0.02±94.967	0.10±1.000	
0.00% yeast	b	d	а	b	
T2	0.03±113.001	0.13±1.633	0.01±98.167	0.22±1.567	
25% yeast	а	а	а	а	
Т3	0.01±102.989	0.05±1.167	0.01±98.133	0.17±1.467	
50 % yeast	b	bc	а	а	
Τ4	0.03±104.033	0.04±1.333	0.01±97.733	0.08±1.300	
75 % yeast	b	b	а	ab	
Т5	0.02±104.678	0.05±1.067	0.04±96.633	0.04±1.333	
	b	cd	а	ab	

100 % yeast						
 n values with different concentrate within a solution differentiation of (D<0.05)						

Mean values with different superscripts within a column differ significantly (P \leq 0.05).

The statistical results reported in figure (6) and table (2) significant differences among

experimental treatments as T2 was significant (P≤0.05) as compared to all treatments.



Figure 6: Effect of replacementlevels of dry yeast *S.cerevisiae* in WBC counts of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

Figure (7) and table (2) shows outweigh (P ≤ 0.05) in the ratio of the count of granulocytes recorded in T2 as compared with all treatments 1.633 %, also T4 was significantly (P ≤ 0.05) at 1.333 % on treatments T5 and T1 (control) ratios (1.067 and 0.900) %, respectively.



Figure 7: Effect of replacementlevels of dry yeast *S.cerevisiae* in white blood fish common carp *C.carpio* cells at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

Figure (8) and table (2) shows that there were no significant differences among the treatments in the proportion of lymphocytes, T2 were the highest percentage of lymphocytes at 98.167 %, T1 (control) recorded lowest rate at 94.967 %.



Figure 8:Effect of replacementlevels of dry yeast *S.cerevisiae* in the percentage of white blood cells to the lymph fish common carp *C.carpio* at the end of the experiment.

Figure (9) and table (2) shows significant differences in T2 and T3 (P \leq 0.05) on T1 (control) in the proportion of Monocytes(1.567, 1.467 and 1.000) %, respectively, while the differences did not appear significant intreatments T4 and T5 with the rest of the treatmentswith ratio (1.300 and 1.333) %, respectively.



Figure 9: Effect of replacementlevels of dry yeast *S.cerevisiae* in Monocytes of common carp *C.carpio* at the end of the experiment. Different letters within the figure indicate the presence of significant differences ($P \le 0.05$).

The results of the present study was that the yeast used levels in the treatments had a positive impact on the improvement of the immune response of fish, the current findings may mean that the fish showed a positive reaction with low levels of yeast in diets, leading to improved immunological characteristics in the blood by creating capable Balanced Environment to simplify elements of food by metabolism (represented diet) and reducing the size of the complexes and obstacles digestion caused by high yeast levels and that it seems that common carp facing weak ability to digest toward it, may explain the dynamic interaction of this result is witnessed by T2 (25% yeast) and its impact on fish improved as the number of Lymphocytes, as well as granulocytes and the Monocytes compared with T1 (0.00% yeast).

(14) notices the interpretation of the natural state to form a fish blood cells that were fed diets contained dry yeast *S.cerevisiae* within the components to last the universe produces nutrients vital value is a group of vitamin B complex, as noted by (13). The use of yeast itself can increase the Granulocytes and the activity of phagocytic cells in the Nile tilapia *O.niloticus*, the results of the current study support the findings of (4) when studying the effect of yeast on the immunological characteristics in African fish *C.gariepinus* which assigned the cause of the fish immune for the improvement, according to numerous studies on the role of yeast and usability to improve the efficiency of the immune system.

Figure (10) and table (3) shows statistical increase($P \le 0.05$)of serum Total Protein (TP)intreatments T2 and T1 at (3.917 and 3.850) g/dl, respectively, on the *treatment* T4 and T5 when values (3.367 and 3.333) g / dl, respectively, was not significant differences between T3 which recorded 3.467 g / dl.



Figure 10: Impact of the replacement levels of dry yeast *S. cerevisiae* in the level of total protein in the blood of carp fish is common *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

(21) explained that the serum proteins in fish as possible to be affected significantly the quantity and quality of feed consumed, and the TP serum regarded as an important amino acid storage in fish bodies degrades when needed to supply acids secretary to build proteins according to the requirements of growth and perpetuation also it can be a source of energy in the body through its transformation into carbohydrate. TP plays important role in maintaining the natural balance of the body, as can many food components (10).

The results in Figure (11) and table (3) shown significantly higher ($P \le 0.05$) in the value of blood sugar recorded T2 with116.660 when compared with other treatments, T1 and T5 treatmentswith values 110.333 and 106.167 mg / dl, respectively, significantly higher ($P \le 0.05$) compared with the treatment T2 and T3, which got values (98.167 and 95.400) mg / dl, respectively.



Figure 11: Impact of the replacement levels of dry yeast *S. cerevisiae* blood sugar of common carp *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

The results show high proportion of blood sugar in the T1 (control) and treatments that contained a higher level of yeast may be due to the structure of the cell wall of yeast cells on carbohydrate compounds that were mentioned earlier, (1) found significant increase in the proportion of sugar serum blood of tilapia fish (*Sarotherodongalilaeus*) in the diet, with yeast *S. cerevisiae* compared with the control diet.

The results in Figure (12) and table (3) shown significant differences in the proportion of serum cholesterol between treatments T1 (control) is significantly higher (P \leq 0.05) at 136.66 mg / dlas compared with other experimental treatments, T2 decreased significantly (P \leq 0.05) compared with all treatments were recorded treatments T4, T3 and T5 any difference among them with 123.50 and 118.00 and 117.50 mg / dl, respectively.



Figure 12: Impact of the replacement levels of dry yeast *S. cerevisiae* cholesterol level in the blood of common carp *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

Statistical results shown in figure (13) and table (3) significant differences among treatments in the value of triglyceride TG observed, T4 was significant (P \leq 0.05) with 290.167 mg / dl,treatments T3, T1 (control) and T2 with278.667, 225.500 and 211.500 mg/dl with significant decrease (P \leq 0.05) between each one, while T5 did not record significant differences at 284.83 mg / dl with T3 and T4 in the value of TG.



Figure 13: Impact of replacement levels of dry yeast *S. cerevisiae* in the level of Triglycerides in common carp *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

The concentration levels of CH and TG were one of the most adequate indicators to describe the state of health of fish and take the changes in the index to understand the state of metabolism in the liver (22). Current results show low cholesterol concentration in fish blood serum fed levels of yeast compared to the first treatment, at the same time the second treatment achieved better reduction of cholesterol reflected in this result, TG which dropped their concentration in the second treatment also may be due to the role of yeast and food components that have improved CH and TG levels in fish blood serum.

The statistical values showed that HDL increased ($P \le 0.05$) intreatments T3, T2 and T4 with (47.667, 47.000 and 41.00) mg / dlrespectively on the treatment T5 and T1 (control)their values (38.833 and 37.500) mg/dl, respectively, were observed and there were a significant difference among them in the value of HDLas shown in Figure (14) and the table (3).



Figure 14: Impact of replacement levels of dry yeast *S. cerevisiae* in the level of HDL in common carp *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

Statistical of LDL shown in Figure (15) and table (3) T1 was significantly different (P \leq 0.05) with all treatments at 38.500 mg/dl T2 also differed significantly (P \leq 0.05) at 23.333 mg/dl treatments with T3, T4 and T5, with(19.500,12.500 and 19.667), respectively, while the results showed a significant increase (P \leq 0.05) in treatments T5, T3 and T4 compared with that recorded the lowest significant decrease in LDL ratio among the treatments.



Figure 15:Impact of replacement levels of dry yeast *S. cerevisiae* in LDL of common carp *C. carpio* at the end of the experiment. Various characters within the figure indicate the presence of significant differences ($P \le 0.05$).

According to the findings of this study it demonstrated that the use of yeast have good qualities of the blood serum by lowering the level of lipoproteins LDL in treatmentsin comparison with T1, which are free of yeast in their components.

(18) showed that the yeast *S.cerevisae* improve the level of high-density lipoproteins when their presence in the diets of the fish, and this implied by the results of the current study, one of the most important ways in which the yeast contributes to the reduction of LDL in the blood of fish that cited by (9) as proposed explanation for the low level of cholesterol in blood by the multicellular β - glucan in the cell wall of the yeast -like fiber plant cells.

Table 3: Impact of replacement level of S. cerevisiae in Total protein, Sugar, Cholesterol,Triglycerides, HDL and LDL of common carp C. carpio

Treatments	Total protein	Sugar	Cholesterol	Triglycerides	HDL	LDL
	gm/dl	mg/dl	mg/dl	mg/dl	mg/dl	mg/dl
T1 0.00% yeast	00.01±3.85 a	0.01±106.163 b	0.01±136.67 a	0.02±225.500 c	0.01±37.500 b	0.02±38.500 a
T2 25% yeast	917±3.50.0 a	0.03±98.167 c	0.02±111.00 c	0.02±211.500 d	0.07±47.000 a	0.03±23.333 b

T3	70.07±3.46	0.05±95.400	0.02±117.50	0.02±278.667	0.04±47.667	0.03±19.300
50 % yeast	ab	c	b	b	a	c
T4	70.06±3.36	0.03±116.660	0.05±123.50	0.01±290.167	0.08±41.000	0.08±12.500
75 % yeast	b	a	b	a	a	d
T5 100 % yeast	0.06±3.333 b	0.04±110.333 b	0.03±118.00 b	0.02±284.67 ab	0.05±38.833 b	0.08±19.667 c

Mean values with different superscripts within a column differ significantly (P≤0.05).

إستبدال الخميرة الجافة التجارية (Saccharomyces cerevisiae) بالمركز البروتيني الحيوانى و دوره في بعض صفات الدم لأصبعيات الكارب العادى .Cyprinus carpio L

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الخلاصه

نفذت التجربة في مختبر الأسماك التابع لقسم الانتاج الحيواني، كلية العلوم الزراعية، جامعة السليمانية في اقليم كردستان العراق للمدة من 2015/7/25 الى 2015/10/15 ابتداء بمدة اقلمة للأسماك بلغت 21 يوماً لاختبار كفاءة استبدال كمكون بروتيني بديل عن مركز البروتين الحيواني التجاري Saccharomycescerevisiae الخميرة الجافة التجارية ، تم Cyprinuscarpio. المستخدم في تصنيع علائق أسماك الكارب شائع (APC) الخميرة الجافة التجارية قسمت الأسماك الى 15 مجموعة وزعت عشوائيا على 15 .استعمال 90 سمكة كارب شائعراوز ان تراوحت بين 22-42 غم حوضاً بلاستيكياً بواقع خمسة معاملات وثلاثة مكررات لكل معاملة وكانت المعاملات تحتوي على مستويات مختلفة من ، APC وخميرة S.cerevisiea وخميرة روحاني 2016 السيطرة المعاملة الاولى (S.cerevisiea وخميرة APC)

/ 50% 20APC% 73 المعاملة الثالثة S.cerevisiea / 25% خميرة T2% ميرة T2% ميرة T2% 5.00% 75% 25% المعاملة الثانية 0.00% 75% المعاملة الخامسة S.cerevisiea / 75% خميرة T4% 25APC% 47% المعاملة الرابعة S.cerevisiea خميرة مقارنة مع بقية CBD% في عدد خلايا الدم الحمر 20.05 معنويا(T5. اختلاف S.cerevisiea / 100% خميرة مقارنة مع بقية المعاملات، كذلك PCY) في نسبة حجم خلايا الدم المرصوصة 20.05 معنويا(T4 المعاملات، اختلاف مقارنة مع بقية المعاملات، تفوق MCHC) في نسبة حجم خلايا الدم المرصوصة 20.05 معنويا(T4 المعاملات، اختلاف مقارنة مع بقية المعاملات، تفوق MCHC) في متوسط تركيز خضاب الدم 20.05 معنويا(T4 ور735 تفوقت المعاملات ونسبة خلايا الدم البيض الحبيبية مقارنة مع بقية المعاملات، فضلاً S.cerevisies معنويا(T2 معنويا(T2 تفوقت المعاملات) في نسبة خلايا الدم الوحيدة مقارنة مع بقية المعاملات. بينت نتائج تحليل 20.05 معنويا(T3 ور75 تفوق المعاملات) في مستوى الكولسترول والكليسر ايد الثلاثي مقارنة مع بقية المعاملات، فضلاً عن 20.05 معنويا(T3 معنويا (T2 مصل الدم تحسن

، T5 و T1 مقارنة مع HDL) في مستوى البروتينات الدهنية عالية الكثافة P≤0.05 معنوياً (T4و T3,T2تحسن المعاملات مقارنة مع بقية المعاملات.LDL) في مستوى البروتينات الدهنية الواطئة الكثافة P≤0.05 تحسن معنوي (T3سجلت

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