PERFORMANCE, HAEMATOLOGY, AND SERUM BIOCHEMISTRY OF RABBIT BUCKS FED SUPPLEMENTAL LEVELS OF *SACCHAROMYCES CEREVISIAE*

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Abstract

This study was carried out to investigate the effect of Saccharomyces cerevisiae on the growth performance, haematological and serum biochemical indices of rabbit bucks. Eighteen (18) bucks were used for the study. They were assigned to three treatment groups with 6 bucks per treatment, replicated 3 times in a completely randomized design for twenty-eight (28) days. The bucks were allowed one week of acclimatization before the commencement of the study, during which they were fed commercial growers diets and forages. The bucks were fed a formulated ration supplemented with S. cerevisiae at 0.0, 0.3, and 0.6g, respectively, and were coded T1, T2, and T3, respectively. T1served as control. Growth parameters, haematological indices, and serum chemistry were measured in the course of the study. The data collected were subjected to analysis of variance (ANOVA) using SPSS version 21, and means were separated using Duncan of the same software. The results revealed that S. cerevisae did not have an effect ($p > 0.05$) on the growth parameters in the rabbit bucks. This study revealed that Saccharomyces cerevisiae did not have a significant effect ($p > 0.05$) on the packed cell volume (PCV) of bucks in the study, as T1, T2, and T3 all had similar ($p > 0.05$) PCV values of 39.00, 39.00, and 41.00% respectively. S. cerevisiae influenced ($p < 0.05$) serum enzymes but did not have a significant effect ($p > 0.05$) on total protein, blood urea, Alanine transaminase (ALT), creatinine, and glucose. In conclusion, dietary supplementation of S. cerevisiae at 0.60% did not have a significant effect on growth parameter or most haematological and serum biochemical indices.

Keywords: Yeast, rabbit bucks, *Saccharomyces cerevisiae, probiotics, growth promoters*

Introduction

The ban on the use of antibiotics as growth promoters in the EU has led to investigating different natural feed additives to replace dietary antibiotics (Mahrose *et al*. 2019). It is well known that high levels of antibiotics have been used in livestock and poultry production as growth promoters and for disease prophylaxis. However, a major problem with this practice is the occurrence of antibiotic residues in meat because of the wide use of antibiotics as well as antibiotic resistance in both humans and animals. It therefore, becomes imperative to search for new safe alternatives for improving growth performance, health and disease control in animals. Probiotics (bacterial and yeast cultures) are non-pathogenic microbial adjuncts, that have been used as feed supplements and also as growth promoters, improving the immune system of animals by promoting the composition and microbial balance in their guts (Besseboua and Ayad, 2021). The probiotic characteristics of S*accharomyces cerevisiae* have been documented (Belhassen *et al.*, 2016; Abd el-aziz, *et al.*, 2021; Besseboua and Ayad, 2021 and Adli *et al.*,

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2023). *Saccharomyces cerevisiae*, also known as baker's yeast, is rich in proteins, vitamins, and minerals (Piskur *et al.*, 2006). The choice for S*accharomyces cerevisiae* is based on availability in the study region, since all research is expected to address local problem(s).
However, there is a paucity of empirical studies on the effects of *S. cerevisiae* on rabbit bucks. Thus, this study was designed to evaluate the effect of *S, cerevisiae* on growth performance, haematological profile, and serum biochemical indices in rabbit bucks.

Materials and Methods

Experimental Site

The study was carried out at the Rabbitry Unit of the Teaching and Research Farm of the Department of Animal *Sc*ience, University of Uyo, Uyo, Akwa Ibom State. Uyo is located at $5^0$2'N and $7^0$55'E, with a mean annual temperature of between 26 ^{0}C and 28 ^{0}C, while the mean annual rainfall ranges from 2000 mm to 3000 mm (Solomon and Udoh, 2017).

Experimental Design

The study adopted a completely randomized design (CRD). Eighteen mongrel bucks, aged 20 - 24 weeks, were randomly assigned to three treatment groups. Each treatment was further replicated three times, with two bucks per replicate. The total period of the experiment was 28 days (4 weeks).

Animal and Management

The eighteen bucks were housed individually in a three–tier wooden hutch according to their treatments and managed under standard husbandry conditions with an ad libitum supply of feed and water. Other routine management practices were carried out in accordance with the best animal welfare principles.

Experimental Diet

The bucks were fed a formulated ration with the proportionate inclusion of *S. cerevisiae* in treatments two and three at 0.3 and 0.6 g, respectively, while treatment one, which served as the control, was not supplemented with *S. cerevisiae*. The diets were coded as T1, T2, and T3, respectively.

Data Collection

Growth Performance

To evaluate the growth performance of these bucks, their initial weights were recorded at the beginning of the experiment and thereafter on a weekly basis for the 4 weeks of the study. Other parameters evaluated, namely total and daily feed intake, total and daily weight gains, and feed conversion ratio (FCR).

Serum and Haematological parameters

Upon termination of the experiment, blood samples for biochemical and haematological analysis (2 mL each) were collected via the external ear veins of the bucks from each replicated. The samples for haematological analysis were collected into sample bottles containing ethylene diamine tetra acetic acid (EDTA) to prevent coagulation, while those for serum biochemistry were collected in plain sample bottles without EDTA. The blood samples were subjected to laboratory examinations using an auto analyser (Sysmex kx-21n). The serum blood samples were kept in a slope position until they were separated through centrifugation at 1000 rpm for 20 minutes, followed by cooling in a deep freezer. All samples were then taken to the laboratory within two hours after collection for analysis. The haematological parameters evaluated were packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), haemoglobin concentration (HGB), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), lymphocytes, eosinophils, monocytes, neutrophils, and basophils, while serum biochemical indices measured were total protein, urea, creatinine, aspartate aminotransferase (AST), alkaline phosphatase (ALP),

alanine amino transaminase (ALT), and glucose. Olorede *et al.* (1996) described the clinical routine procedures that were used to determine the serum biochemical indices.

Table 1: Composition of Experimental Grower Diet

Ingredient (%)	**T1 (0.00g *S. cerevisiae*)**	**T2 (0.3g *S. cerevisiae*)**	**T3 (0.6g *S. cerevisiae*)**
Maize	35.50	35.50	35.50
SBM	19.00	19.00	19.00
Wheat offal	26.00	26.00	26.00
PKC	15.50	15.50	15.50
Bone meal	3.00	3.00	3.00
Premix	0.25	0.25	0.25
Common Salt	0.25	0.25	0.25
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
**S. cerevisiae*	0.00	0.30	0.60
Total	**100**	**100**	**100**
Calculated Proximate Composition			
Crude Protein	17.11	17.11	17.11
Crude Fibre	6.65	6.65	6.65
Ether Extract	6.72	6.72	6.72
Calcium	1.15	1.15	1.15
Phosphorus	0.74	0.74	0.74
Lysine	1.00	1.00	1.00
ME	2644.20	2644.20	2644.20

Vitamin Premix supplied the following per kg of diet: vitamin A 10,000 i.u., vitamin D3 12,000 i.u., vitamin E 20,000 i.u., vitamin K 2.5 mg, thiamin 2.0mg, riboflavin 3.0mg, **S. cerevisiae*: *Saccharomyces cerevisae*; SBM: Soybean Meal; PKC: Palm Kernel Cake; ME: Metabolizable Energy

Statistical Analysis:

The data collected were subjected to analysis of variance (ANOVA) using SPSS version 21, and means were separated using Duncan of the same software to separate significantly different means.

RESULTS

Growth performance of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

The results on the growth performance of rabbit bucks fed diets containing dietary levels of *S. cerevisae* are presented in table 2. The results revealed that *S. cerevisae* did not exhibit an effect ($p > 0.05$) on the growth parameters of the rabbit bucks. The final weight was similar ($p > 0.05$) in the study but was not significantly increased in T3. The addition of *S. cerevisae* to the bucks' diets had no effect on total and daily weight gains, but it caused non-significant increases in groups treated with *S. cerevisae* compared to the non-treated group. The values obtained in the current investigation study were 1772.67, 1778.67, and 1819 g for T1, T2, and T3, respectively, for final weights, and 389.33, 395.00 and 444.00 g for T1, T2, and T3, respectively, for the total weight gain. Although there was no significant difference in the total and daily feed intake, rabbit bucks on T3 diets had an insignificantly ($p > 0.05$) lower feed intake. Bucks in T3

presented total feed intake of 2787.67 g, while T1 and T2 had total feed intake values of 3095.33 and 3204.00 g respectively. A non-significantly higher daily feed intake was observed in T2 ($p > 0.05$). Furthermore, better ($p > 0.05$) feed conversion in T3-treated bucks was noticed, but it remains insignificant ($p > 0.05$). FCR values in the study were 8.27 (T1), 8.12 (T2), and 6.41 (T3).

Table 2: Growth performance of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

Parameters	T1	T2	T3	SEM
Initial weight (g)	1383.33	1383.67	1375.33	65.96
Final weight (g)	1772.67	1778.67	1819.33	71.64
Total weight gain (g)	389.33	395.00	444.00	32.31
Daily weight gain (g)	13.90	14.11	15.86	1.15
Feed intake (g)	3095.33	3204.00	2787.67	142.49
Daily feed intake (g)	110.55	114.43	99.56	5.09
Feed Conversion Ratio	8.27	8.12	6.41	0.46

SEM is the standard error of mean; means without letters were not significant ($p > 0.05$)

Haematological indices of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

The dietary inclusion of *Saccharomyces cerevisiae* in the diets of rabbit bucks, as shown in Table 3, significantly affected white blood cells (WBC) ($p < 0.05$), platelets, and neutrophils in the bucks. However, other haematological parameters were not influenced by dietary levels of *Saccharomyces cerevisiae.* This study revealed that *Saccharomyces cerevisiae* did not have an impact in a significant manner on PCV ($p>0.05$), as T1, T2, and, T3 all had similar ($p>0.05$) PCV values of 39.00, 39.00, and,41.00%, respectively.

A higher WBC was observed with inclusion of *Saccharomyces cerevisiae* in the diets of the bucks when compared with those without *Saccharomyces cerevisiae* in their diets (T1) ($p < 0.05$) . Bucks fed T3 and T2 had WBC values 5.23 and 5.17 $\times 10^9$/dL, respectively, while bucks on T1 diet had a WBC value of 3.80 $\times 10^9$/dL. Significantly higher ($p<0.05$) platelet was observed in bucks fed T2 in the study, while similar ($p>0.05$) lower values were recorded in T1 and T3, respectively. S*accharomyces cerevisiae* did not have an effect on RBC, as the values recorded were statistically similar ($p > 0.05$). The MCV, MCH, and MCHC were all similar ($p > 0.05$) across dietary treatment groups. Haemoglobin was not impacted by S*accharomyces cerevisiae* in the study, as the values observed were 13.27, 13.10, and 13.38 g/dL, respectively, for T1, T2 and T3. Similarly, lymphocytes, eosinophils, basophils, and monocytes all showed no significant alteration ($p>0.05$) with inclusion of S*accharomyces cerevisiae* in the bucks' diets. However, neutrophils were substantially increased ($p<0.05$) in bucks fed the T1 diet compared to those fed T2 and T3 diets respectively.

Table 3: Haematological indices of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

Parameters	T1	T2	T3	SEM
Packed Cell Volume (%)	39.00	39.00	41.00	0.69
White Blood Cells ($\times 10^9$/dL)	3.80^b	5.17^a	5.23^a	0.29
Platelet	174.67^b	339.67^a	221.67^{ab}	30.61
Red Blood Cells ($\times 10^{12}$/L)	5.87	5.77	5.97	0.18
MCV (fl)	66.67	68.67	70.00	1.45
MCH (pg)	23.00	23.67	23.00	0.32
MCHC (%)	34.00	33.67	33.67	0.15

Haemoglobin (g/dL)	13.27	13.10	13.38	0.28
Lymphocytes (%)	47.00	59.00	59.00	2.71
Eosinophil (%)	2.67	2.67	2.00	0.53
Monocytes (%)	2.00	2.00	1.67	0.11
Neutrophils (%)	48.67[a]	35.67[b]	37.67[ab]	2.67
Basophil (%)	0.00	1.00	0.00	0.17

MCV: mean corpuscular volume; MCH: Mean corpuscular haemoglobin; MCHC: Mean corpuscular haemoglobin concentration; SEM: Standard error of means; Means with different superscripts are significant ($p<0.05$).

Serum biochemistry of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

The result on serum biochemical indices of male rabbits fed different levels of dietary *S. cerevisiae* are presented in table 3. The present study showed that *S. cerevisiae* influenced serum enzymes ($P<0.05$), but did not have any significant effect on total protein, blood urea, ALT, creatinine and glucose ($p > 0.05$). The values of total protein observed in the study were 60.67, 56.00, and 60.67 g/dL for T1, T2, and T3, respectively. Similar urea values were recorded for all treatments in the study ($p > 0.05$). Lower aspartate aminotransferase (AST) and alanine alkaline phosphatase (ALP) were detected when adding *S. cerevisiae* to the bucks diets ($p < 0.05$). AST was higher (168.67 µ/L) in the control group (T1), while bucks on T2 diet presented the least AST value. Alkaline phosphatase was higher in bucks' diet that did not contain *S. cerevisiae.* Alanine aminotransaminase (ALT) did not show any significant statistical variation with dietary inclusion of *S. cerevisiae* in the bucks' diets ($p > 0.05$). Creatinine values were 154.00, 119.33, and 133.00 mg/dL for T1, T2, and T3, respectively. Glucose values were also similar across diets ($P>0.05$). The values obtained in the study were 5.60, 5.55, and 6.30 g/dL for T1, T2, and T3, respectively.

Table 4: Serum biochemistry of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

Parameters	T1	T2	T3	SEM
Total protein (g/dL)	60.67	56.00	60.67	1.03
Urea (mmol/L)	7.90	7.30	7.40	0.18
AST (µ/L)	168.67[a]	91.67[b]	112.00[ab]	15.00
ALP (µ/L)	31.00[a]	24.67[b]	26.00[ab]	1.13
ALT (µ/L)	46.67	37.67	37.00	3.15
Creatinine (mg/dL)	154.00	119.33	133.00	8.17
Glucose (g/dL)	5.60	5.55	6.30	0.21

AST: Aspartate aminotransferase; ALP: Alkaline phosphatase; ALT: Alanine transaminase; SEM: Standard error of means; Means with different super Scripts are significant ($p<0.05$).

Discussion

Growth performance of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

The reported findings in this study showed that the diet with *S. cerevisiae* did not affect the weight of the animals. The reported findings are not in line with those of Besseboua and Ayad (2021), who noticed a decrease in the animals' weight. The insignificant effect of *S. cerevisiae* on the growth parameters in rabbit bucks confirmed earlier studies by Seyidoglu and Galip (2014) and Belhassen *et al.* (2016), who reported no significant differences in the growth performance of rabbits fed diets supplemented with *S. cerevisiae*. Kimsé *et al*. (2012), in their investigation, noted that yeast did not affect final body weight, daily weight gain, or feed intake in New Zealand rabbits. Abdel-Aziz *et al*. (2021) also demonstrated insignificant improvement

in the growth performance of mice administered *S. cerevisiae*. However, Saied *et al.* (2011), and Onwurah and Okejim (2014), reported significant improvements with *S. cerevisiae* supplementation in broiler chicks and broiler chickens, respectively. These variations may be attributed to the species of animals, age, dose, and environmental conditions.

Haematological indices of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

The WBCs, platelets, and neutrophils of rabbit bucks fed diets supplemented with *S. cerevisiae* were significantly different in the study as compared to the control group, while other haematological parameters remained the same. This observation agrees with the reports of Seyidoglu and Galip (2014) and Belhassen *et al.* (2016), who noted that *S. cerevisiae* in the diets of rabbits had no effect on some haematological parameters, although they detected a slight increase in (PCV) and, haemoglobin (HGB) concentrations in rabbits supplemented with yeast, which differ with this study. The significant effect of *S. cerevisiae* supplementation in bucks' diets on WBC in the current study supports the reports of Paryad *et al.* (2008) and Mulatu *et al.* (2019), who recorded significantly elevated WBCs in their studies, which differs from the reported findings of Besseboua and Ayad (2021), for the established parameters. Mulatu *et al.* (2019) revealed that WBCs, packed cell volume (PCV) and haemoglobin (HGB) were higher in chickens fed diets containing *S. cerevisiae*. Elghandour *et al.* (2019) noticed that yeast-fed rabbits had more WBCs, and LCTs, compared to the rabbits fed the control diet. The significant increase in the WBC, platelets, and decrease in neutrophils suggests improved immunity, better clotting factors, and reduced parasitism in the bucks, supporting the earlier report of Kazuun and Kazuun (2019), who reported that probiotics have immune-stimulatory effects.

Serum biochemistry of rabbit bucks fed diets containing dietary levels of *Saccharomyces cerevisiae*

Total protein, urea, ALT, creatinine, and glucose were not influenced by *Saccharomyces cerevisiae* supplementation in the bucks' diets in the current study. Serum total protein is a marker of the synthetic function of the liver and a valuable guide to assess the severity of liver damage (Osigwe *et al.* (2017). The similarity, therefore, in the study suggests no liver damage in the bucks. Low or high total protein is an indication of liver disorders and malnutrition (Augustine *et al.*, 2020). The insignificant effect of *S. cerevisiae* on ALT, urea, and creatinine in this study is similar to the findings of Abd El-aziz *et al.* (2021). Similar results were demonstrated by Seyidoglu and Galip (2014), who supplemented 3 g of yeast per kg in rabbit diet, and Ozsoy and Yalcin (2011) with Saccharomyces *cerevisiae* in broiler turkey. The reduction in AST and ALP may be triggered by the presence of *S. cerevisiae* in the bucks' diet. According to Alagbe and Adegbite (2019), serum enzyme values are triggered by the presence of anti-nutrients or toxic substances in the feed of animals. Raised ALT and AST have been identified by Yin and Tong (2014) to bebiomarkers of hepatocellular damage, which is induced by these enzymes leaking into the blood stream. Hence, the results in this present investigation indicated that the hepatic functions of the bucks were not compromised in the course of the study.

Conclusion

The present findings showed that dietary supplementation of *S. cerevisiae* at 0.60% did not exhibit a significant effect on growth parameters or most haematological and serum biochemical indices in rabbit bucks, therefore implies that the inclusion of *S. cerevisiae* in the rabbit bucks diet may not be necessary since it has very minimal effect growth and most blood parameters add to the total cost of production.

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