

## Probiotic Supplemented-diet Mitigated the Effects of Hot-Dry Season on Growth Performance and Welfare of Rabbits in Zaria, Kaduna State

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**Target Audience:** Animal Scientists and Students, Feed Millers, Livestock Farmers, Agricultural Policy Makers

### Abstract

Probiotics such as yeasts and their extracts have been described as excellent sources of natural antioxidants, and could help promote growth and alleviate oxidative stress in rabbits during thermal stress situations. A feeding trial was conducted to evaluate the effect of *Saccharomyces cerevisiae* (SC) supplemented-diets on the growth performance and serum malondialdehyde (MDA) concentration of rabbits reared during the hot-dry season (temperature-humidity index:  $34.11 \pm 1.10^\circ\text{C}$ ) in Zaria, Kaduna State. Sixty healthy weaned crossbred rabbits, aged between 5-6 weeks with live weight of  $605.97 \pm 14.72$  g (mean  $\pm$  standard deviation) were used. The rabbits were divided into five treatment groups; SC0 receiving a control diet without supplementation of SC, and SC2, SC4, SC6 and SC8 receiving the control diet supplemented with SC at the rate of 2, 4, 6 and  $8 \times 10^9$  colony forming units/kg, respectively. Results showed that there was significant ( $P < 0.05$ ) difference in the growth performance (feed intake and body weight gain) across the treatment groups. Rabbits in SC6 had the best growth performance indices. They consumed significantly ( $P < 0.05$ ) more feed (84.69 g/day) and had the highest final body weight gain (1515.25 g). Additionally, SC supplementation improved the welfare of the rabbits, as there was significant ( $P < 0.05$ ) reduction in serum MDA concentration of rabbits fed SC supplemented-diets. Although further studies are required on other biomarkers of oxidative stress, baker's yeast containing SC containing SC improved growth performance and ameliorated the adverse effects associated with heat stress conditions.

**Keywords:** Rabbits; Probiotic; Growth performance; Welfare; Hot-dry Season

### Description of Problem

Rabbit production has been on the increase in Nigeria in recent years (1). However, the growth performance and welfare of rabbits are negatively affected by thermal environmental conditions of high ambient temperature (AT) and high relative humidity (RH), characteristic of the hot-dry season in Nigeria. These environmental conditions have

been described to be thermally stressful to livestock (2), and have been established to be a limiting factor for their performance in warm countries (3, 4).

One of the strategies used in alleviating oxidative stress caused by thermal stressful situations in rabbits, include the administration of antioxidants to supplement endogenous antioxidant (5). Yeasts and their extracts are

sources of natural antioxidants (6, 7). Therefore, the present study was undertaken to investigate the effect of probiotic supplemented-diet on growth performance and serum MDA concentration of rabbits reared during the hot-dry season in the Northern Guinea Savannah zone of Nigeria.

## Materials and Method

### *Study area and thermal environmental conditions*

The study was conducted at the rabbitry unit of the Skills Acquisition and Entrepreneurship Development Centre (SAEDC) of the National Agricultural Extension and Research Liaison Services (NAERLS), Ahmadu Bello University, Zaria (11° 12' N, 07° 33' E), located in the Northern Guinea Savannah zone of Nigeria. The experiment was conducted during the hot-dry season (March to April), frequently described as thermally stressful to livestock (8, 9, 10). To measure AT and RH, wet- and dry-bulb temperatures of the rabbitry were recorded according to the procedure described by (11). Temperature-humidity index (THI) was calculated using the method of (3) for rabbits:  $THI: db - [(0.31 - 0.31(RH)) (db - 14.4)]$  where db = dry-bulb temperature (in degrees Celsius) and RH = relative humidity percentage/100. The values obtained for THI were then classified as follows (3): <27.8 = absence of heat stress, 27.8 – 28.9 = moderate heat stress, 28.9 – 30.0 severe heat stress and 30.0 and more = very severe heat stress.

### *Experimental animals, diets and procedures*

Sixty healthy weaned crossbred rabbits of both sexes, aged between 5 - 6 weeks with live weight of  $605.97 \pm 14.72$  g (mean  $\pm$  standard

deviation) were used for the feeding trial. The rabbits were divided by simple randomisation into five groups of 12 animals per treatment (3 replicates; 4 rabbits per replicate), after balancing for live weight: SC0 receiving a control diet without supplementation of SC, and SC2, SC4, SC6 and SC8 receiving the control diet supplemented with SC at the rate of 20, 40, 60 and 80 g per kg for 8 weeks (corresponding to 0, 2, 4, 6 and  $8 \cdot 10^9$  colony-forming unit/kg, respectively). A commercial baker's yeast, Vahine® (Avignon, Montoux, France), containing SC was used for the dietary supplementation. Proximate analysis of the basal mixture (control diet; SC0) which contained maize, soybean, maize offal, brewer's dried grain, groundnut cake, blood meal, rice offal and bone meal as main ingredients, showed that it contained 16.0% crude protein, 14.1% crude fibre, 3.9% ether extract, and 10.2% ash/kg feed. The rabbits were housed in a well-ventilated rabbitry in three tier-wire cages. Each cage measured 70x60x50 cm in length, width and height, respectively. The experiment lasted 56 days. Data on growth performance were collected according to the procedures described by (11). Blood sample collection and serum evaluation for serum MDA concentrations were carried out according to the procedures described by (12).

### *Statistical analysis*

The data obtained were subjected to one-way ANOVA test in a completely randomized design using SAS 9.1 software package (13), with the type of diet SC level serving as the main source of variation. The means were compared using Duncan's New Multiple

Range Test (14). Statistical significance was set at  $P < 0.05$ .

### Results

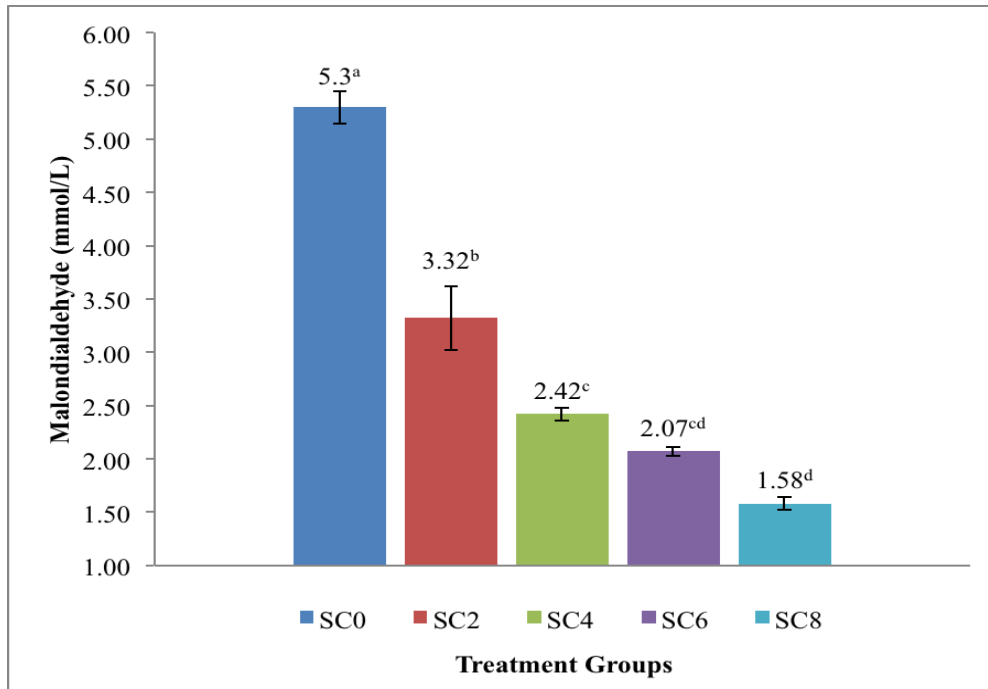
The period was characterised by high AT and RH values: on average  $36.24 \pm 1.16$  °C (range: 31-39.4 °C) and  $82.01 \pm 2.19\%$  (range: 70.5-92%), respectively. The average THI obtained during the period was  $34.11 \pm 1.10$ °C, indicating exposure of the rabbits to very severe heat stress. Results from growth performance evaluation indicated that there was significant ( $P < 0.05$ ) difference in the feed

intake and body weight gain across the treatment groups (Table 1). Rabbits in SC6 had the best growth performance indices. They consumed significantly ( $P < 0.05$ ) more feed ( $84.69$  g/day) and had the highest final body weight ( $1515.25$  g). Overall Pearson correlation coefficients for body weight gain and feed intake was positive and significant ( $r = 0.738$ ,  $P < 0.05$ ). As depicted in Figure 1, there was a significant ( $P < 0.05$ ) reduction in serum MDA concentration as the level of SC supplementation increased in the diets.

**Table 1: Growth performance indices of rabbits fed varying levels of *Saccharomyces cerevisiae* (SC) supplemented diets (n = 60)**

	Dietary treatments <sup>1</sup>					SEM
	SC0	SC2	SC4	SC6	SC8	
Initial body weight (g)	613.08	609.50	600.83	603.67	602.42	1.90
Feed intake (g/day)	65.14 <sup>d</sup>	68.98 <sup>c</sup>	82.90 <sup>a</sup>	84.69 <sup>a</sup>	74.78 <sup>b</sup>	1.12
Daily weight gain (g/day)	7.96 <sup>c</sup>	6.63 <sup>d</sup>	8.88 <sup>b</sup>	10.85 <sup>a</sup>	7.94 <sup>c</sup>	0.21
Final body weight (g)	1281.67 <sup>c</sup>	1166.25 <sup>d</sup>	1346.75 <sup>b</sup>	1515.25 <sup>a</sup>	1269.75 <sup>c</sup>	17.10
Feed cost/kg gain (₦)	490.77 <sup>d</sup>	768.44 <sup>a</sup>	674.33 <sup>b</sup>	567.38 <sup>c</sup>	690.42 <sup>b</sup>	15.75

<sup>1</sup> SC0, SC2, SC4, SC6 and SC8 contained 0, 2, 4, 6 and  $8 \cdot 10^9$  colony-forming units of SC per kg, respectively. <sup>a-d</sup> = Means in the same row with different superscript letters are significantly ( $P < 0.05$ ) different; SEM = Standard error of the mean.



**Figure 1:** Malondialdehyde concentration of rabbits fed varying levels of *Saccharomyces cerevisiae* (SC) supplemented diets (n = 30). Means with error bars having different superscripts letters are significantly different (P<0.05)

The highest (5.3 mmol/L) and the lowest (1.58 mmol/L) MDA concentrations were recorded for rabbits in SC0 and SC8, respectively.

## Discussion

Although the proximate mechanism of action of SC as an antioxidant was not elucidated in the present study, (15) demonstrated that yeasts may directly digest fibre components and/or improve gut environments by the creation of favourable pH, supply of micronutrients and scavenging of oxygen-derived radicals, which is conducive for the growth of cellulolytic bacteria; hence, increased feed intake, nutrient utilisation and performance. The positive result obtained on the growth performance of rabbits in the present study by the addition of SC to diets of rabbits is consistent with the findings of similar studies in other animals as reported by (11).

The reduction in serum MDA concentration observed in rabbits fed SC supplemented-diets indicates a reduction in lipid peroxidation caused by the existing thermal stressful conditions. Yeasts and their extracts have been reported to excellent sources of natural antioxidant compounds (6, 7), and (5) reported that the administration of antioxidants to supplement endogenous antioxidants is done in rabbits to alleviate oxidative stress caused by thermal stressful situations. Therefore, the lower MDA concentrations values recorded for rabbits in SC supplemented groups indicate that they had lower free radicals-mediated cell damage and oxidative stress than the rabbits fed control diet.

## Conclusions and Applications

1. The supplementation of rabbit basal diet with baker's yeast containing SC at 40 and 60 g per kg improved growth

performance indices of rabbits during the hot-dry season.

2. Supplementation of rabbit diets with baker's yeast containing SC ameliorated the adverse effects associated with heat stress conditions as shown by the significant reduction in MDA concentration levels in the SC supplemented groups.
3. Baker's yeast containing SC is economic and could be a valuable and qualitative growth promoter for feeding rabbits.

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