



## Impact of *Saccharomyces Cerevisiae* Boulardii Supplementation as Probiotic on Productive Performance and Economic Efficiency of Growing Rabbits

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### Abstract

Our study was carried out at the farm of Faculty of Agriculture, Ain Shams University, Egypt. The average temperatures were 18.4°C and 23.9 °C from December 2017 - February 2018 to study the effects of *Saccharomyces cerevisiae* boulardii supplementation (as feed additives) on productive performance of growing rabbits. Sixty growing rabbits of the NZW (New Zealand White Rabbits), (4 weeks old) and weighted (603.62 gm mean body weight) were randomly distributed into 4 treated groups, n=15 rabbits per each group. Rabbits of supplemented groups were given 100 (R1), 200 (R2) and 400 (R3) gm/ton feed of *Saccharomyces cerevisiae* boulardii mixed in the diet for 6 successive weeks. Individual live body weight was noted weekly from start till the end of the experiment. At the end of the experimental period, 10 rabbits (from each group) were fasting for 12 hrs, then slaughtered for carcass traits measure. Experimental lighting system was 16-hours photoperiod /day (16L: 8D) through both daily natural and the artificial fluorescent lighting. A pelleted ration of 17.3% crude protein, 13.37% crude fiber and 2510 kcal of digestible energy per kg feed was offered *ad libitum* all the time. Results re-

vealed significant ( $P \leq 0.05$ ) increases in the final body weight and daily weight gain with *saccharomyces cerevisiae* supplementation when compared with control group. Though, significantly ( $P \leq 0.05$ ) improved feed conversion ratio in all treated groups compared with control one were noticed. Feed intake was the lower in treated groups than control group. There were significant ( $P \leq 0.05$ ) increasing in hot carcass weight and carcass percentage with respect to the control group. Supplemented *Saccharomyces cerevisiae* reduced ( $P \leq 0.05$ ) the liver, heart, lungs and kidneys percentages compared the control group. Supplemented rabbit feeds with *saccharomyces cerevisiae* boulardii in their diets had highly increasing in relative economic efficiency and clear improvement of net revenue than control group.

**Keywords:** *Saccharomyces cerevisiae*, additive, carcass, economic, rabbits.

### 1 Introduction

Insufficient quantity of animal protein source is a main problem in developing nations including Egypt. Rabbits are suitable sources of palatable and beneficial meat, little fats and cholesterol concentrations, therefore its appro-

priateness as special diet (Owen 1981). Rabbits are simple stomach herbivores. Its digestive structure is suitable for high fiber contents like cellulose in the diet. Several studies were reported that elevated cellulose diets are advantageous for depressing death rates by the mechanism of their appendix vigor which motivates their ileum.

Inclusion of living yeast in animal diet has been shown to impact the digestibility, nutritive efficiency of feed utilization, and production of experimental animals. Bio-active yeast elevates digestibility and nutritive efficiency of feed utilization through secretes enzymes (Ozcan 2001). Basavaraj et al (2011) stated that rabbits might be able to convert 20% of the proteins in diets which they consume into edible meat whereas beef could be converted only 8-12%.

It is well acknowledged that feed additives could be used safely in rabbit's ration to improve their production. Feed additives additional to diets in very minor quantities with the objective of obtaining some different effect. The mechanism of probiotics has not been well clarified, but it might include: (1) encouragement of enzyme created by the host, (2) decrease of toxin production, (3) competitions for adhesion to epithelial cells and augmented resistance to colonization, (4) manufacture of some vitamins or antimicrobial constituents, (5) encouragement of the immune system of the host and finally (6) decline of stress of rabbits (Falcao-e-Cunha et al 2007, Shehata and Tawfeek 2010).

Medical antibiotics are still commonly used to decrease mortality rates in rising rabbits, while there are development concerns over medicine residues in meat foodstuffs and rises in resistance of bacteria due to the prophylactic use of these antibiotics. As a result of this, the usage of replacements of antibiotics has received reintroduced emphasis (Bovera et al 2012a). Yeast in diets has been recognized as a probiotic in animal's feed (Saegusa et al 2004). In rabbits, supplementation of live yeast as feed additives provided some progressive effects on growth performance and fitness status (Maertens and De Groote 1992). These

positive effects vary depending on its dose in diet, rabbit's age, livestock experimental conditions.

Onifade (1998) reported that supplementation of yeast on animal feeds due to yield numerous advantageous impacts. Though, the mode of action of live yeast for optimizing performance is not fully understood, but may be there are two probabilistic explanations. Firstly, action of yeast is most probably supportive the development of lactic acid bacteria. Secondly, a competitive rejection of pathogenic bacteria by yeast and its produces mainly the cell wall component (Onifade 1998). Cell wall of yeast is containing chitin, glucan and mannan which have been identified as immunostimulante (Li and Gatlin 2003). This study aimed to explore the effects of *Saccharomyces cerevisiae* supplement on the growth performance, carcass traits and economic efficiency of growing rabbits.

## 2 Materials and Methods

Experiment was carried out at the rabbit's farm of Faculty of Agriculture, Ain Shams University, Kaluobia governorate, Egypt. The average temperatures of the area vary between 18.4°C and 23.9 °C within the experimental period from December 2017 - February 2018 to study the effect of *Saccharomyces cerevisiae* boulardii as feed additives on productive performance of growing rabbits (*Oryctolagus cuniculus*). Sixty New Zealand White rabbits (NZW), (4 weeks old) and approximately (603.62 gm mean body weight) were randomly and equally distributed into four groups (n =15 rabbits per group). The animals were kept in individual commercial cages (40×35×30 cm, 0.14 m<sup>2</sup>) supported with drinking nipple and feeding hopper (35 cm available) each one. Lighting regime was (16L: 8D) 16-hours light /day through both natural photoperiod and fluorescent lighting. The basal diet was formulated to meet the recommended nutrient requirements of growing rabbits according to De Blas and Mateos (1998). They were allowed to a standard pellet diet (17.3% crude protein, 13.37% crude fiber and 2510 Kcal/kg-ration

DE). Feed and water were available *ad libitum*. The diet was exposed to chemical analysis according to AOAC (1999). Clean and fresh water were straightly available at all periods during the study which lasted for 6 weeks. Weekly live body weight was individually recorded at the experimental day one till the end of the experimental period. Finally, at the end of 10 weeks, 10 rabbits (from each group) were slaughtered for carcass traits.

Experimental design:

Group 1: Basal diet as a control group (C).

Group 2: Add 100 gm *Saccharomyces cerevisiae* \*/ton diet (R1).

Group 3: Add 200 gm *Saccharomyces cerevisiae* / ton diet (R2).

Group 4: Add 400 gm *Saccharomyces cerevisiae* / ton diet (R3).

Diet additives: \*= *Saccharomyces cerevisiae* was provided as Lallamend®-(Levucell strains)

Initial and final live body weight (IBW and FBW), feed intake (FI) was recorded weekly and (BWG) body weight gain, (FCR) feed conversion ratio were considered. At the end of the experimental, carcass characteristics were evaluated for 10 rabbits from each treatment. Finally, economic efficiency was determined. All data were exposed to analysis of variance according to the statistical analysis system (SAS 2002). The differences among groups means were Duncan's multiple rang test (Duncan 1955).

### 3 Results and Discussion

#### 3.1 Growth performance

Data in **Table 1** presented significant ( $P \leq 0.05$ ) increases in daily body weight gain, final body weight, relative growth rate and significantly ( $P \leq 0.05$ ) improved feed conversion ratio in treating individuals compared with control ones. Rabbits in group R3 recorded the heavier final body weight, highest daily weight gain, highest growth rate and best feed conversion ratio at the end of experiment. Also, treated groups were the lower feed intake. The mortality rate was not affected by treatment. The use

of some organic substances, possessed to improve the growth performance of animals, through enhancing feed efficiency and immune response. One of these substances is yeast (*Saccharomyces cerevisiae*). *Saccharomyces cerevisiae* have considered as a good source of probiotic and prebiotic organisms which could conserve rabbit growth rate characteristics, and likewise related with vital promoting effects. Results are in agreement with Nilay and Nurten (2014) who reported that supplementation of *Saccharomyces cerevisiae* to rabbit diet led to improving in LBW and BWG. In addition, Chuka and Didacus (2010) reported that rabbits fed diets supplemented with *Saccharomyces cerevisiae* had significant ( $P \leq 0.05$ ) higher values of BWG, feed utilization and FCR. Amber et al (2014) found that the addition of probiotic and prebiotic to rabbit diet had significantly improved ( $P \leq 0.01$ ) in final experimental animal weight, weight gain and relative growth rate. Kritas et al (2008) found that administration of the commercial probiotic Bio-Plus significantly improves average body weight and daily weight gain. Moreover, Toghiani et al (2011) stated that diet addition of probiotic (15mg/kg Protovin™) and prebiotic (1g/kg mannanoligosaccharide) statistically increased ( $P < 0.05$ ) broiler body weight at 28 and 42 days of age when compared with to the control chicks. Shrivastava et al (2012) who reported that adding yeast to growing rabbit feeds significantly improving finishing body weight, daily body weight gain and FCR.

On the other hand, Belhassen et al (2016) found no effects of yeast addition on growth traits, composition of caecal microbiota, slaughter traits were found.

#### 3.2 Carcass traits

Supplementation with *Saccharomyces cerevisiae* continuously after weaning till 70 days of age increased significantly ( $P \leq 0.05$ ) hot carcass weight and carcass% in respect to the control group (**Table 2**). While, there was an improvement in dressing% with supplementation of *Saccharomyces cerevisiae* but the differences were not significant. Supplemented *Saccharomyces cerevisiae* reduced

**Table 1.** Effect of feeding different levels of *Saccharomyces cerevisiae* on productive performance of growing rabbits at 70 days of age

Body weight at:	Body weight (g)				S.E.
	C	R1	R2	R3	
Initial body weight, g	598.95 <sup>a</sup>	609.50 <sup>a</sup>	600.00 <sup>a</sup>	606.04 <sup>a</sup>	15.96
Final body weight, g	1671.00 <sup>b</sup>	1776.87 <sup>b</sup>	1751.62 <sup>b</sup>	1998.41 <sup>a</sup>	37.80
Daily weight gain, g	25.53 <sup>c</sup>	27.79 <sup>b</sup>	27.42 <sup>b</sup>	33.15 <sup>a</sup>	3.49
Relative growth rate	93.88 <sup>b</sup>	97.53 <sup>b</sup>	97.17 <sup>b</sup>	105.72 <sup>a</sup>	2.29
Daily feed intake, g	110.33 <sup>b</sup>	115.14 <sup>a</sup>	91.52 <sup>c</sup>	89.69 <sup>d</sup>	4.51
Mortality %	10 <sup>a</sup>	10 <sup>a</sup>	10 <sup>a</sup>	10 <sup>a</sup>	0.0
Feed conversion ratio	4.32 <sup>a</sup>	4.14 <sup>a</sup>	3.34 <sup>b</sup>	2.71 <sup>c</sup>	0.09

a,b means with the same letter are not significant in the same row.

NS = Non significant \* = Significant ( $P \leq 0.05$ ) \*\* = Significant ( $P \leq 0.01$ )

**Table 2.** Effect of feeding different levels of *Saccharomyces cerevisiae* on carcass traits at 70 days of age

Item	Treatments				S.E.
	C	R1	R2	R3	
body weight at slaughter, g	1530.00 <sup>b</sup>	1548.66 <sup>b</sup>	1738.00 <sup>a</sup>	1761.66 <sup>a</sup>	24.60
Carcass %	54.05 <sup>b</sup>	61.32 <sup>ab</sup>	58.18 <sup>ab</sup>	64.48 <sup>a</sup>	2.66
Dressing %	52.55 <sup>a</sup>	59.80 <sup>a</sup>	57.07 <sup>a</sup>	60.87 <sup>a</sup>	2.68
Dressed head %	6.27 <sup>b</sup>	5.97 <sup>cb</sup>	5.67 <sup>c</sup>	7.08 <sup>a</sup>	0.12
Liver weight, g	50.00 <sup>ab</sup>	51.33 <sup>ab</sup>	56.66 <sup>a</sup>	44.00 <sup>b</sup>	2.28
Liver %	3.27 <sup>a</sup>	3.23 <sup>a</sup>	3.25 <sup>a</sup>	2.49 <sup>b</sup>	0.11
Heart %	0.45 <sup>a</sup>	0.34 <sup>a</sup>	0.46 <sup>a</sup>	0.39 <sup>a</sup>	0.07
Lungs %	0.65 <sup>a</sup>	0.63 <sup>a</sup>	0.49 <sup>a</sup>	0.56 <sup>a</sup>	0.06
Kidney %	1.05 <sup>a</sup>	0.88 <sup>ab</sup>	0.84 <sup>ab</sup>	0.56 <sup>b</sup>	0.09
Caecum length, cm	44.66 <sup>a</sup>	41.66 <sup>a</sup>	46.66 <sup>a</sup>	42.33 <sup>a</sup>	2.16
Two shoulders %	13.00 <sup>ab</sup>	13.83 <sup>a</sup>	12.46 <sup>b</sup>	13.54 <sup>ab</sup>	0.32
Two legs %	19.48 <sup>bc</sup>	20.98 <sup>a</sup>	18.84 <sup>c</sup>	20.70 <sup>ab</sup>	0.43
Thorax %	4.90 <sup>a</sup>	5.38 <sup>a</sup>	4.60 <sup>a</sup>	5.18 <sup>a</sup>	0.30
Lion %	10.12 <sup>a</sup>	11.71 <sup>a</sup>	10.06 <sup>a</sup>	10.82 <sup>a</sup>	0.54
Total giblets <sup>1</sup> %	4.77 <sup>a</sup>	4.46 <sup>a</sup>	4.56 <sup>a</sup>	3.46 <sup>b</sup>	0.19

a,b means with the same letter are not significant in the same row. NS = Non significant

\* = Significant ( $P \leq 0.05$ ) \*\* = Significant ( $P \leq 0.01$ ) 1 = Total giblets (liver + hurt + kedneys).

( $P \leq 0.05$ ) the liver, heart, lungs and kidney percentages compared with control group. Results shown that *Saccharomyces cerevisiae* could supplementing in rising rabbit diets but it had an improving effect in carcass characteristic comparable with control group. Agreement results were reported by Abdel-Khalek et al (2012). They showed that hot weight, carcass weight with head, net carcass, fore and lower portions and total edible meat were significantly ( $P < 0.05$ ) higher with 1.5% of probiotic EM1 in rabbit diet than in the control group.

### 3.3 Economic efficiency

**Table 3** revealed that treated rabbits with *saccharomyces cerevisiae* boulardii in their diets had a highly significant increase in relative economic efficiency than the control group. The relative economic efficiency of control, R1, R2 and R3 were 100, 102.15, 146.77 and 186.02, respectively. *Saccharomyces cerevisiae* supplementation of growing rabbits resulted in clear improvement of net income and relative economic efficiency when compared

**Table 3.** Effect of feeding different levels of *Saccharomyces cerevisiae* on economic efficiency at 70 days of age

Item	Treatments				S.E.
	C	R1	R2	R3	
Total feed cost (L.E.) /head	13.61 <sup>a</sup>	11.00 <sup>a</sup>	10.86 <sup>a</sup>	10.38 <sup>a</sup>	1.71
Selling price (L.E.)/head	66.74 <sup>b</sup>	70.31 <sup>b</sup>	69.98 <sup>b</sup>	79.72 <sup>a</sup>	1.65
Total feed intake kg/head	3.24 <sup>a</sup>	2.62 <sup>b</sup>	2.46 <sup>c</sup>	2.47 <sup>c</sup>	3.40
Net profit (L.E.)	46.90 <sup>c</sup>	49.45 <sup>bc</sup>	52.70 <sup>b</sup>	62.45 <sup>a</sup>	1.06
Net revenue (L.E.)	27.72 <sup>c</sup>	30.11 <sup>bc</sup>	33.57 <sup>b</sup>	42.56 <sup>a</sup>	1.51
Economic Efficiency	1.86 <sup>c</sup>	1.90 <sup>c</sup>	2.73 <sup>b</sup>	3.46 <sup>a</sup>	0.30
Relative economic efficiency%	100	102.15	146.77	186.02	

a,b,c means with the same letter are not significant in the same row.

NS = Non significant \* = Significant (P≤0.05) \*\* = Significant (P≤0.01)

C = Control, R1 = Basal diet+100 gm *saccharomyces*, R2 = Basal diet+200 gm *saccharomyces*, R3 = Basal diet+400 gm *saccharomyces* /Ton diet.

Feed intake cost = (Total feed intake × Kg feed cost) /L.E.

The Net revenue = (Price body weight gain – total feed cost) /L.E.

Economic efficiency (EE) = (Net revenue / total feed cost) /L.E.

Relative economic efficiency (%) = (EE for Tr/EE for control) x 100

Price of one kg pellets basal diet was 4.20 L.E. and kg of marketing live weight 40 L.E. Price of 1kg of *Saccharomyces cerevisiae* = 350 L.E.

with the control group. Agreement results were reported by Amber et al (2014) who found carcass percentage was significantly increased (P<0.01) by supplementing probiotic and prebiotics in a rabbit's diet.

### 3.4 Diet cost analysis

In our research, labor and carriage costs were not included, but the costs of supplementations were considered. Meanwhile labor and carriage costs were similar in all tested diets, the present comparisons are acceptable. Among the tested treatments, supplementation of *Saccharomyces cerevisiae* had the lowest cost of feed per live weight as well as dressed weight compared to non-supplemented ones. Current data revealed that supplementation of *Saccharomyces cerevisiae* is the best economical feeding strategies that would give extra revenue to the farmer.

## 4 Conclusion

The probiotic (*Saccharomyces cerevisiae*) bouldarii had a positive impact on growth traits, feed efficiency and economic efficiency of rabbits when add 200 or 400 gm/ton of feed.

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