

# Research Article:

## Microencapsulated *Saccharomyces Cerevisiae* Var. *Boulardii* and IgA Secretion From Intestinal Epithelia in Wistar Rats



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## ABSTRACT

**Background:** Probiotics are live microorganisms with many health benefits for their host. The intestinal microbiota are the largest source of microbial variation and plays a significant role in host responses in health and disease. However, few studies have assessed the repercussions of probiotics regarding the morphology and immunology of the gastrointestinal tract in animal models. This study was designed to evaluate the effect of administering capsulated *Saccharomyces* species on gastrointestinal tract properties in rats.

**Materials and Methods:** In this study mice rats were feed with *Saccharomyces Boulardii* into two forms of capsulated and free. IgA was measured in duodenal and jejunal washings using ELISA assay according to the manufacturer's instructions.

**Results:** Probiotic *S. boulardii* could increase IgA secretion from duodenum and jejunum in comparison with the control group, and this increase was significant in microencapsulated *S. boulardii*-treated group and in the duodenum of *S. boulardii*-treated group ( $P < 0.05$ ). Interestingly, IgA secretion was significantly higher in the intestines of rats treated with microencapsulated *S. boulardii* ( $P < 0.05$ ).

**Conclusion:** It can be concluded that *S. boulardii* is a potential probiotic yeast with immunostimulatory effects which can be used in the treatment of gastrointestinal disorders.

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## Introduction

Probiotics are live microorganisms with many benefits for their host [1]. *Saccharomyces boulardii* is a well-known probiotic used for the treatment of diarrhea [2]. *S. boulardii* could increase the secretion of IgA and other immune secretory components in the small intestine [3]. Thus, stimulation of the host's mucosal immunity is a mechanism by which *S. boulardii* acts against intestinal pathogens [4-6].

Probiotics like *S. boulardii* will increase the nutritional value of food and protect food from degradation; however, to do this, they need to survive in food processing techniques and gastrointestinal tract [7]. Microencapsulation is a technique that protects the microorganisms from external influences [8]. Among products used for microencapsulation, sodium alginate is widely used in microencapsulation of probiotic bacteria in concentrations of (0.5-5%) [9]. This study was designed to evaluate the effect of *S. boulardii* microencapsulation on IgA secretion in a rat model.

## Materials and Methods

### Animal model

Male Wistar rats weighing 100-110g were obtained from the Department of Laboratory Animals, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran. They were kept at 20°C under 12:12h light/dark cycle. Standard pellet food and water was provided for them ad libitum. The rats were divided into three groups, each containing 10 rats: MT group of rats receiving microencapsulated *S. boulardii*, the control (C) group receiving normal saline, and the T group receiving unencapsulated *S. boulardii*. Probiotics were gavaged to rats at the dosage of 2g/kg for 8 continuous weeks.

### Probiotic strain

*S. boulardii* (ATCC 74068) was obtained from the Mycology Research Center. It was cultured on sabouraud dextrose

broth (Merck, Germany) Supplemented with Chloramphenicol (0.05%) (SC) and incubated at 28°C, 180 rpm for 48h. The cells were centrifuged at 800g for 10 min and washed three times with sterile Phosphate-Buffered Saline (PBS) before use. The number of *S. boulardii* yeast cells were adjusted to 2.11010CFU/ml with a hemocytometer before microencapsulation.

### Microencapsulation

Extrusion technique was used for microencapsulation of *S. boulardii* as described previously [10]. In brief, the cells were suspended in (2%) sodium alginate solution. Then, this mixture was injected to 0.1M calcium chloride using a sterile insulin syringe. The formed droplets were isolated from suspension with centrifugation.

### IgA measurement

After 8 weeks, the rats were euthanized, and their gastrointestinal tracts were isolated. Their intestinal mucosa was isolated, according to Lim et al. (1981) method with brief modifications [11]. In brief, intestinal content was washed out with cold PBS containing penicillin/streptomycin (100µg/mL) and centrifuged at 500g for 10 minutes. IgA was measured in duodenal and jejunal washings using Enzyme Linked Immunosorbent Assay ELISA assay method according to manufacturer's instructions.

### Statistical analysis

The obtained data were analyzed in SPSS V. 21. Analysis of Variance (ANOVA) was applied to compare statistical changes in different groups. Tamhane's T2 post hoc test was used to compare data between groups. A P-value less than (0.05) was considered significant.

## Results

Table 1 shows the results of IgA production by duodenal and jejunal epithelial cells. Probiotic *S. boulardii* increased

**Table 1.** IgA release (µg/mL) from duodenum and jejunum of studied rats

Group	Intestinal Area	Mean±SD	
		Duodenum	Jejunum
Control		282±0.02a*	189±1.97a
MT		460±3.47b	540.3±2.14b
T		340.7±0.92c	242±0.57a

\*Different characters show significant differences

IMMUNOREGULATION

MT: Rats treated with Microencapsulates *S. boulardii*; T: Rats treated with unencapsulated *S. boulardii*

IgA secretion from duodenum and jejunum in comparison with the control group, and this increase was significant in the MT group and in the duodenum of T group ( $P < 0.05$ ). Interestingly, IgA secretion was significantly higher in the intestines of rats treated with microencapsulated *S. boulardii* ( $P < 0.05$ ).

## Discussion

*S. boulardii* is a probiotic yeast mainly used in the treatment of gastrointestinal disorders. Enhancing the host immune system could be an important defense against infectious diseases of intestines, causing diarrhea [12]. In our study, *S. boulardii* increased the secretion of IgA from intestinal mucosa, which agreed with other studies [12-15]. However, this increase was higher in the duodenum of the T group and jejunum of the MT group. Nevertheless, this difference was not significant ( $P > 0.05$ ). The higher secretion of IgA in the jejunum of microencapsulated *S. boulardii*-treated rats could be the results of microencapsulation, which protected the yeast cells in the first parts of the intestinal tract and provided enough yeasts in jejunum that could affect IgA release by jejunal mucosa. Since intestinal infections are mostly initiated from jejunum, microencapsulation of *S. boulardii* could protect against intestinal disease as well as treatment of infectious disorders. It can be concluded that microencapsulation enhances the release of IgA by intestinal cells, and this could be an essential mechanism in the protection and treatment of intestinal illnesses.

## Ethical Considerations

### Compliance with ethical guidelines

The ethical issue of the present study was approved by Research Council of AJA University of Medical Sciences (Code: 1395.121)

### Funding

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### Authors' contributions

Designing: Ali Reza Khosravi, Zohreh Farahnejad and Hassan Ghorbani Choboghlo; Laboratory experiments: Donya Nikaein, Hassan Ghorbani Choboghlo and Reza Rahmani; Manuscript writing, editing and revising: Donya Nikaein, Hassan Ghorbani Choboghlo and Reza Rahmani.

### Conflicts of interest

Authors declared no conflict of interest

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