

Saccharomyces boulardii: Time for Change in the Age of Cost-Effective Medicine

Stacey J. Bell^{1*} and Dominique Clark²

¹Nutritional Consultant, Boston, Massachusetts, USA

²Exercise Physiologist, North Florida Sale Representative, Jarrow Formulas, Tampa, Florida 33644, USA

Healthcare costs are rising and treatments that deliver cost-effective care are welcome. Most antibiotics cause diarrhea [1]. The incidence ranges from 3.2 to 29 per 100 cases in hospitalized patients [2]. One way to reduce diarrhea caused by antibiotics is to use a low-cost, safe probiotic like *Saccharomyces boulardii*. This strain has been shown to reduce the development of Antibiotic-associated Diarrhea (AAD) and *Clostridium difficile*-associated Diarrhea (CDAD) [3]. Both conditions can result in increased length of stays (8-20 days), re-admissions, and increased morbidity [2,3]. All lead to increased hospital costs. Since 2002, there has been a two-fold increase in CDAD and one-in-ten patients who acquire *C. difficile* will die [3]. Over the past 25 years, published studies on *S. boulardii* showed it to be beneficial for these conditions, yet few physicians regularly prescribe them. Isn't it time for a change in the management of patients receiving antibiotics?

The probiotic *S. boulardii* is a unique, nonpathogenic yeast probiotic [3]. Probiotics are defined as live micro-organisms that when administered in the correct amount confers a benefit to the host [4]. Specifically, *S. boulardii* has been shown to survive transit in the gastrointestinal tract (i.e., resistant to degradation of enzymes, bile salts and organic acids) and inhibit the growth of a number of microbial pathogens including *C. difficile* [4,5]. Yeast-based probiotics, in contrast to bacterial-based probiotics, are good candidates for patients, because they cannot transfer antibiotic-resistant genes to resident bacteria. Thus, as *S. boulardii* is naturally resistant to antibiotics and can be safely prescribed to most patients receiving antibiotics.

Antibiotic-associated Diarrhea

Several prospective, randomized studies have shown that *S. boulardii* prevented AAD with no adverse side effects [2,6,7]. In these intervention studies, those in the *S. boulardii* groups had one-half to two-thirds fewer cases of AAD compared to the placebo groups. Admittedly, some investigators found no benefit of this probiotic strain for preventing AAD [1,8]. Nevertheless, most studies showed that *S. boulardii* was efficacious at preventing AAD.

Clostridium difficile-associated Diarrhea

The incidence of CDAD may range from 5% to 21% of hospitalized patients and cause up to a 7-day increase in length of hospital stay [9]. This form of diarrhea is usually nosocomially acquired, and 80% of patient are cured with either vancomycin or metronidazole therapy [10]. However, in 20% of these patients, the initial episode is followed by recurrences, which have been reported in 5% to 50% of patients after cessation of antibiotics [9,10].

Co-administration of either of the antibiotics typically prescribed and *S. boulardii* can decrease recurrences of CDAD by 50%, compared to just using the antibiotic regimen [9-11]. When *S. boulardii* is combined with high-dose vancomycin, the benefits are greatest [9-11]. Compared to another probiotic, *Lactobacillus GG*, *S. boulardii* is more effective at preventing CDAD [12]. Thus, prevention of CDAD can best be achieved by the co-administration of *S. boulardii* and the standard antibiotic regimen.

Systematic Reviews and Meta-Analyses

Several systematic reviews and meta-analyses have been conducted on probiotics, in general, and *S. boulardii*, specifically, for preventing AAD and CDAD [2-4,13,14]. In general, there is moderate-quality evidence suggesting that probiotic prophylaxis results in a large reduction in AAD and CDAD without an increase in clinically important adverse events [2,3]. In studies specifically focused on *S. boulardii*, prevention of AAD and recurrence of *C. difficile* intestinal infections was confirmed [4,14]. Hence, based on all these systematic reviews and meta-analyses, *S. boulardii* was effective at preventing AAD and CDAD and was well tolerated and should.

Summary

The totality of the evidence from intervention studies, systemic reviews, and meta-analyses, show that *S. boulardii* can play a vital role in preventing AAD and CDAD in hospitalized patients receiving concurrent antibiotics. The typical daily amount of *S. boulardii* needed is between 150 to 3,000 mg per day, and it costs less than \$1.00 [15]. Prophylaxis with this probiotic for all patients receiving antibiotics may be a cost effective measure given the associated cost of treatments for AAD or CDAD such as antibiotics, increased length of hospitalization, or readmission. *S. boulardii* is generally safe for all patients except those who are extremely immune-compromised, or those with central lines [15-17]. It is, indeed, time for a change in medical practice by co-administering the probiotic, *S. boulardii*, with antibiotics to prevent AAD and CDAD and reduce medical costs.

Conflict of Interest

Dr. Bell is a consultant to Jarrow Formulas, who sells *Saccharomyces boulardii* as a dietary supplement. Ms Clark is a sales representative of the same company.

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*Corresponding author: Stacey J. Bell, Nutritional Consultant, Boston, Massachusetts, USA, Tel: +617 999-6150; E-mail: staceyjbell@yahoo.com

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