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### Health Benefits of *Saccharomyces boulardii* as a Probiotic

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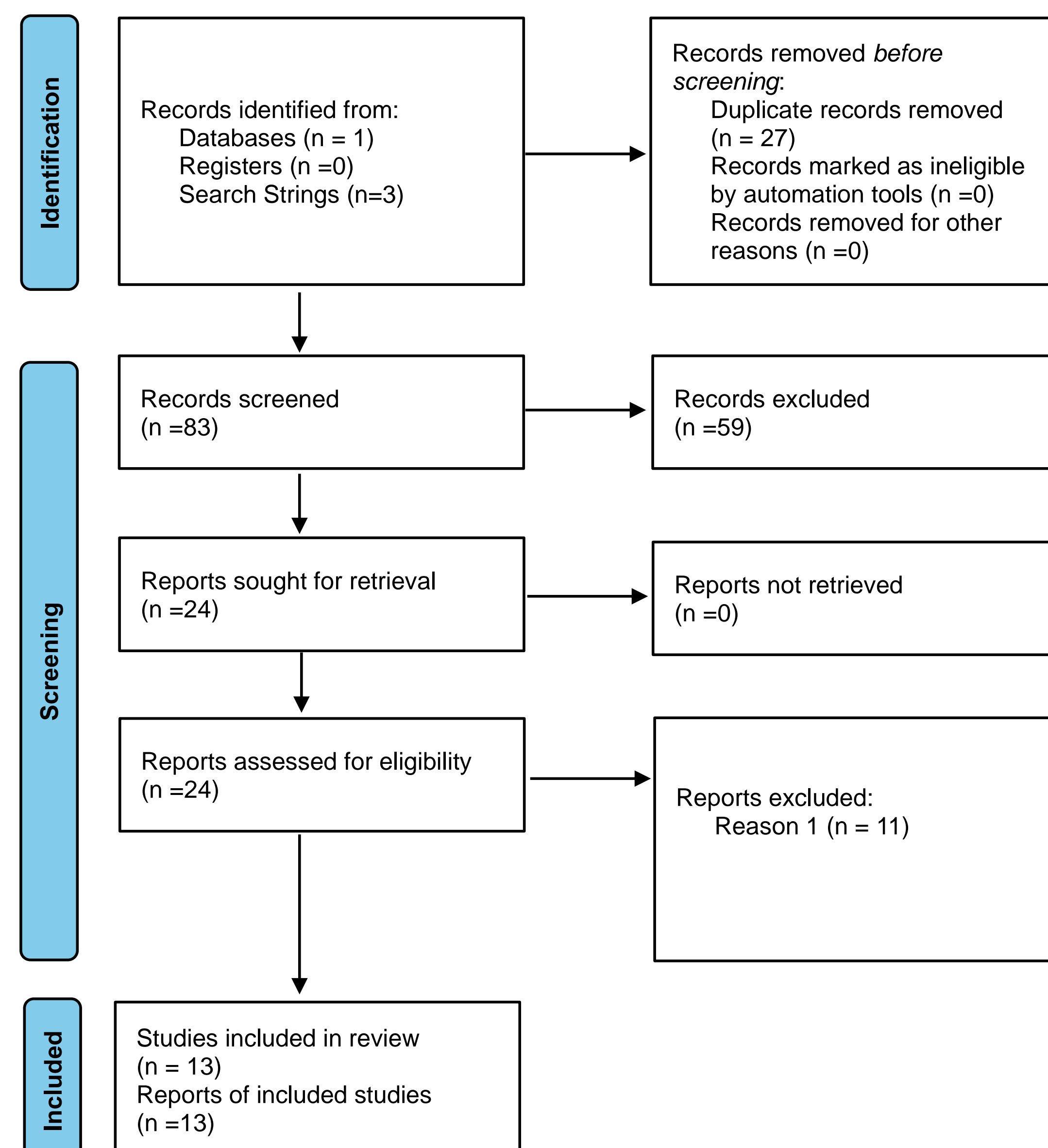
# Health Benefits of *Saccharomyces boulardii* as a probiotic

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## Background

*Saccharomyces boulardii* (SB), a budding yeast, within the *Saccharomyces* genus. It commonly used as a probiotic that has been isolated from lychee and mangosteen fruit. *S. boulardii* is not known to acquire resistant genes and does not last in the intestine after 3-5 days of discontinuing the ingestion. The clinical efficacy of this probiotic yeast is known to improve various diarrhea such as pediatric diarrhea, antibiotic-associated diarrhea, acute diarrhea, and traveler's diarrhea. Additionally, when used as an adjuvant to treatment for *Helicobacter pylori* and *Clostridium difficile* infections, it improves bacterial eradication, prevents relapse, reduces adverse reactions and treatment-associated diarrhea. Several animal studies have shown that *Saccharomyces boulardii* can alleviate certain psychological and behavioral conditions through the brain-gut axis and modulate gut microbiome composition. There is bidirectional communication between the brain and gut which is carried out by various pathways like neuronal, endocrine, metabolic and immune. Alterations to composition and function of the microbiota are related to many stress related psychiatric disorders. This is evident in Irritable bowel syndrome (IBS), a gut-brain axis disorder that shares high levels of psychiatric comorbidities including anxiety and depression. The mechanism of how this happens is still unclear; however many studies support the view that the gut brain axis is key link between certain gastrointestinal and psychiatric disorders. Individually these disorders also share similar pathophysiology for example changes in monoamine levels and inflammatory states.

## Methods



**Figure 1:** Methodology for inclusion of articles. Articles were found using PubMed and were analyzed for relevance towards behavioral health. **Reason 1 exclusion criteria**= Article not directly relevant to behavioral health

## Results

### Memory

- Significant reduction in fear conditioning and improvement of spatial memory and recognition memory in mice experiencing Ampicillin induced gut dysbiosis following the administration of *Saccharomyces boulardii*
- Amelioration of LPS-induced memory dysfunction. Significant reduction in serum interleukin(IL) - 1 $\beta$ , IL-6 and TNF- $\alpha$ , as well as hippocampal levels of NLRP3 and caspase-1

### Cognitive Function

- Reduces acetylcholine esterase, oxidative stress and inflammatory cytokines and chemokines. Protects hippocampal neuronal damage which eventually reverses gut dysbiosis associated cognitive decline
- Significant impact on inhibiting microglia activation by IL-6, IL-1 $\beta$ , and cluster of differentiation 11b (CD11b) and regulating the Toll-like receptor pathway, alleviating neuroinflammation and synaptic damage via gut-brain axis, and improving cognitive impairment in mice with Alzheimer's disease

### Antidepressant effects

- *Saccharomyces Boulardii* treatment significantly improved the depression-like behavior experienced by rats with hemiplegic spastic cerebral palsy

### Obsessive Compulsive Disorder

- Successful reduction of OCD and self-injurious behavior

### Stress adaptation

- Less robust stress response, more simulated immune function, return to non stress state faster, which can indeed lessen the impact of animal health issues and unavoidable stressors
- Increased pulse rate under stress reflects enhance sympathetic activity

### Anxiety alleviation

- *S. Boulardii* treatment in rats alleviates lipopolysaccharide (LPS) induced anxiety-like behaviors by reducing cortisol and corticosterone levels and mitigating the adverse effects of LPS on serum serotonin and brain-derived neurotrophic factor (BDNF). (10)
- Daily administration of *S. boulardii* strain CNCM I-745 for two weeks improved anxiety-like behaviors and gastrointestinal transit in mice with IBS and comorbid anxiety. (7)
- Quadruple therapy for *H. pylori* infection in conjunction with *S. boulardii* supplement resulted in significant reduction in anxiety, headache and abdominal pain in contrast to the control group.

### Sleep

- Rugby players competing internationally had increased perceived sleep quality, and decreased acute muscle soreness when compared to placebo

### Immune effects

- Regulates gut microbiota structure, accelerates the maturation of gut microbiota and reduces the risk of gut microbiota dysbiosis
- Promote the development of the immune system and increase vaccine efficacy during early-life period, which can alleviate the damage of weaning stress

### Antioxidant Effects

- *S. boulardii* grown in media mimicking gut environment contained more phenolic compounds when compared to other yeast species
- The phenolic compounds may have antioxidant effects and may be a beneficial adjunct to treatment of inflammatory conditions

## Discussion

Benefits of *Saccharomyces boulardii*:

- Helps with memory dysfunction
- Protects hippocampal damage in dysbiosis
- Inhibits microglial
- Improves depression like behaviors in rats
- Reduces OCD self-injurious behaviors
- Quicker return to baseline stress levels
- Improvement in anxiety
- Increased sleep quality
- Helps regulate the gut microbiome
- Produces compounds with potential antioxidant properties

*Saccharomyces boulardii* has potential positive effects on many different behavioral issues and different organ systems. These effects show that SB can be beneficial as an adjunct or even a treatment for many symptoms seen in a myriad of different disease processes.

## Conclusion

*Saccharomyces boulardii* has been shown to have many potential benefits as a probiotic organism. This fungal species can survive and make it to the lower GI tract of humans when compared to other yeasts allowing it to be a suitable member of the human microbiome. Studies shown and represented here have shown that *S. boulardii* may play a role in neuromodulation, especially in those that have gut dysbiosis. This yeast may also play a role in modulating behaviors in those with OCD, and in modulating the stress response as well as anxiety alleviation and even in sleep and recovery in athletes. The results of these studies show that there is still much to learn about *S. boulardii*'s roll in the human microbiome and its effects on overall human health. The outcomes of these studies show that the human microbiome and the fungi, bacteria, and other organisms that make it up may be something that should be considered when examining the overall health of patients. If more can be understood about the impact that members of the human microbiome have on the overall health of their patients, using probiotics such *S. boulardii* may one day be utilized as potential treatments or addition to treatments for a myriad of illnesses with a low potential for adverse outcomes.

## Limitations/Future Directions

The limitation of this study is that the subjects of most of the studies are animal based, therefore it is vital to research the potentiality of the *S. boulardii* treatment on human subjects.

Future studies would be directed towards testing proposed potential benefits of *Saccharomyces Boulardii* in human subjects.

## Reference

