The probiotic properties of yeast: from the bakery to the pharmacy

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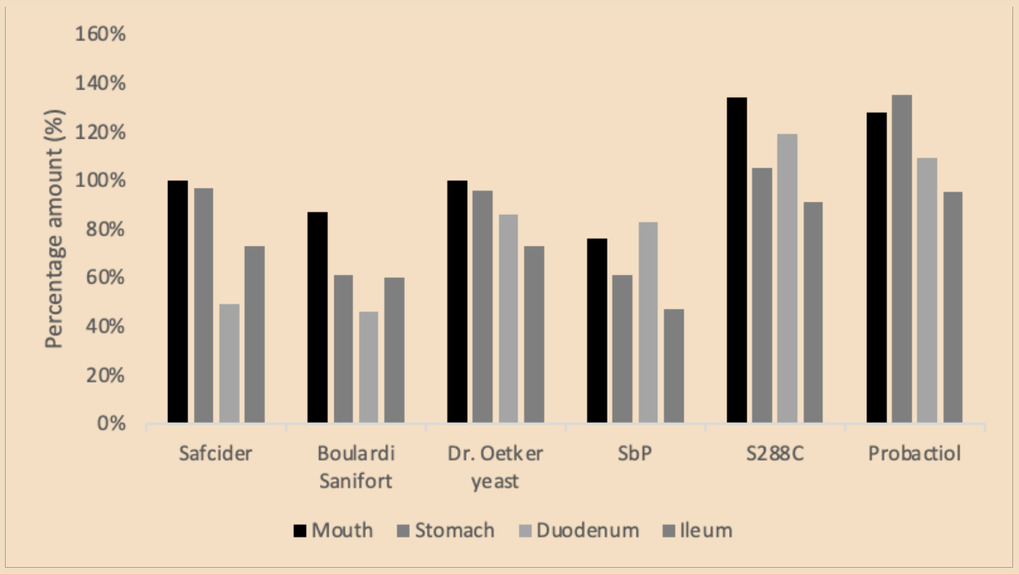
Introduction

Probiotics are defined as live micro-organisms that, when administered in correct dosage, provide a benefit to the health of the host. It is essential that these micro-organisms can attach to the epithelial cells of the gut and survive passage through the host's gastro-intestinal tract. It is also important that the microorganisms are not toxic to the host.
These properties were tested using an adhesion assay, a toxicity assay and by simulating the gastrointestinal tract.

Gastrointestinal assay

Simulating gastrointestinal tract:
•Mouth: amylase, ± pH 7
•Stomach: pepsin, pH 2 (HCl)
•Duodenum: pancreatin and bile, pH 5 ($NaHCO_3$)
•Ileum: pH 6,5 ($NaHCO_3$)

All the yeast strains tested in this study show a **decreasing rate of survival**. Safcider and Boulardi Sanifort show divergent results in the ileum. SbP and S288C strains also show abnormal results in the duodenum. At last the Probactiol displays unusual numbers for the stomach.
Dr. Oetker yeast is the perfect example of the expected values for the passage through gastrointestinal tract.
In general, there is a slight decrease in survival of the yeast cells while passing through the gastrointestinal tract. Outliers can be caused by technical inaccuracies and could be eliminated by optimizing the procedure.



Conclusion

In the adhesion assay there is a part of the strains that show too little growth on the control plates, in order to make a conclusion. Most yeast strains possess an adhesion rate between **30% and 60%**. Additional research is needed to determine which adhesion percentages and duration are beneficial to the host.

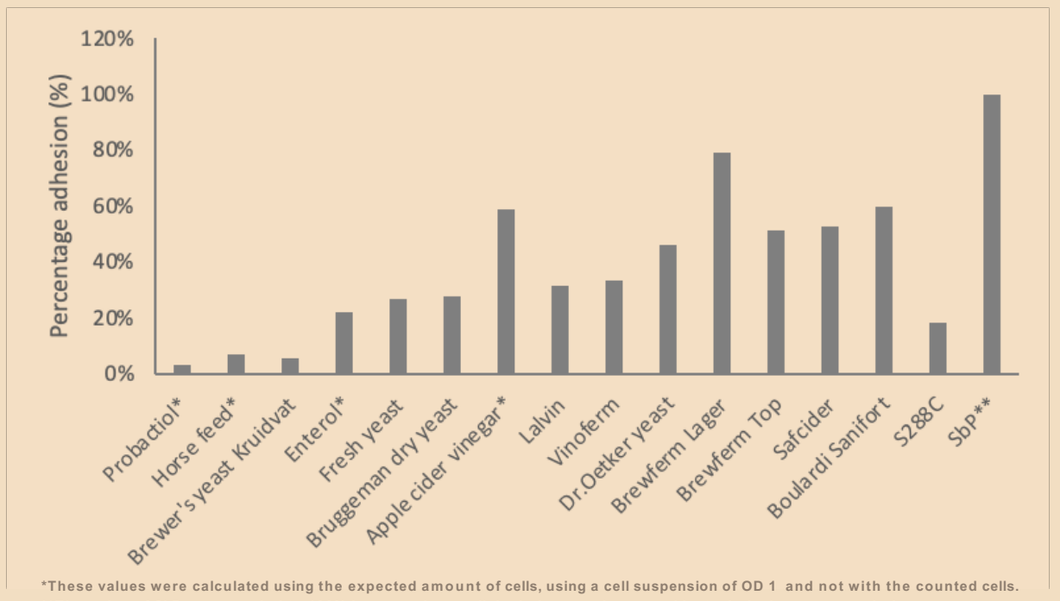
The yeast strains examined during this experiment with the exclusion of the S288c strain exhibit a toxicity **below 20% .** Based on toxicity, these yeast strains are good probiotics.

All yeast strains survive the simulated passage through the gastrointestinal tract. For brewer's yeast "Kruidvat", no conclusion is made because of the absence of growth.

In general this study indicates that *S.cerevisiae* strains may be better probiotics than *S.Boulardii*.

Adhesion Assay

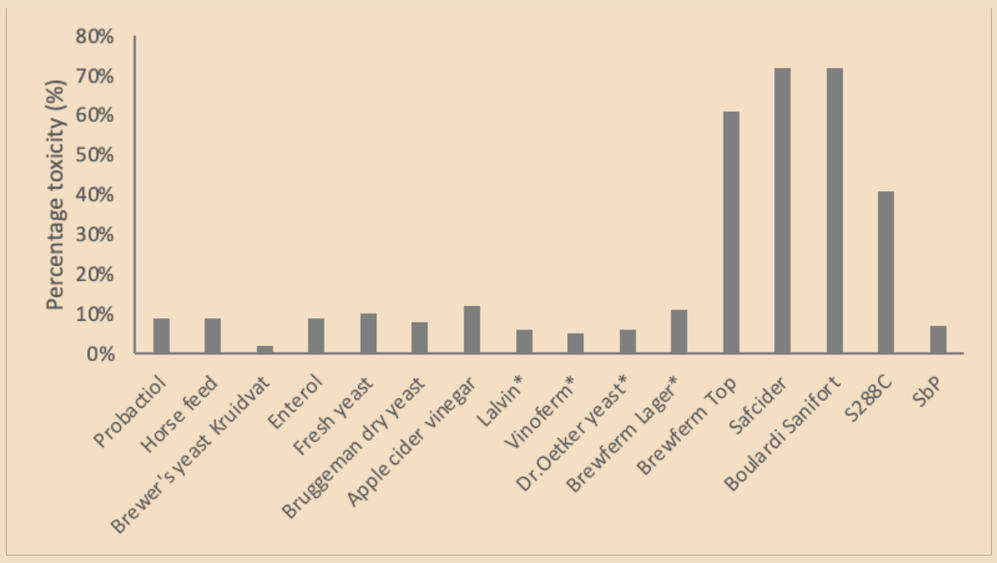
To perform the adhesion assay, a concentration of 10^7 yeast cells/ml were used, this corresponds to an optical density of 1. To prepare the adhesion assay, a Nunc 96-Well Flat Bottom was coated with HeLa cells and 100 µl of a cell suspension with 10^7 yeast cells per milliliter were added. The colonies on the control plates represent the concentration of cells in a cell suspension with an optical density of 1. This is the reference to compare the number of adhered cells with.
An insufficient amount of control cells was recovered from the control plate of Probactiol, horse feed, fresh yeast, Enterol, and apple cider vinegar. These results are not representative.(*)
For the SbP strain, the adhesion percentage is rounded to 100% (**). For the other strains, adhesion percentages are found between **3% and 79%**.



*These values were calculated using the expected amount of cells, using a cell suspension of OD 1 and not with the counted cells.
**The value of SbP was rounded to 100% because the small deviation may be caused by technical errors or variation.

Toxicity Assay

The toxic effect of yeast cells on HeLa cells was measured using Promega CytoTox 96 Non-Radioactive Cytotoxicity Assay. It is based on the LDH release following the breakdown of the cells.
Safcider, Brewferm top and Boulardi Sanifort are tree outliers. This may be the result of contamination or damaged HeLa cells.
In general, yeasts are not that toxic for human epithelial cells. All yeasts, excluding S288C, show a good value **below 20%** and are thus suitable as possible probiotics within this criterion.



*The values shown with a star are the values calculated with the absorbance at 680 nm instead of 490 nm.

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