



Impact of Dietary Fibers on Primary and Secondary Fermentation Processes in Kombucha

Francheska M. Caraballo Casiano¹, Armando Lerma Fuentes², Edward C. Deehan², Jennifer M. Auchtung²
University of Puerto Rico – Río Piedras¹
University of Nebraska – Lincoln, Department of Food Science and Technology²



Background

Kombucha is a fermented sparkling sugared tea drink that is obtained following the fermentation of green or black tea by symbiotic culture of bacteria and yeast (SCOBY). Consumption of Kombucha has been reported as early as 220 B.C in China. It was introduced in Russia and spread to Eastern Europe and North Africa due to his beneficial effects. The global market of Kombucha has increased significantly in recent years. Commercial Kombucha products are being flavored adding fruits or herbs.

The SCOBY primarily consists of a community of acetic acid bacteria (AAB) and yeasts. The characteristic feature of kombucha is that the SCOBY forms a cellulose-like layer on the tea's surface that results from the metabolic activity of selected stains of AAB. Yeasts metabolize the fructose and glucose added to the tea into ethanol. AAB are aerobic bacteria that use the oxygen for their growth to oxidize ethanol into acetic acid. The AAB metabolic processes causes the drink pH reduction, which usually ranges from 2.7 to 3.5. SCOBY will also sometimes contain lactic acid bacteria (LAB). These organisms are potential probiotics that contribute to the health benefits of Kombucha. The beneficial effects of the beverage results from, among others, the antioxidant activities that restore the balance between the production of free radicals and the body's defense mechanisms. As a result, Kombucha may contribute to the reduction of multiple health disorders.

Dietary fibers consist of carbohydrates that cannot be digested by humans and are often polysaccharides that originate from plant-based foods. One beneficial effect of dietary fiber is the effect on gut motility and prevention of constipation. An additional beneficial effect of dietary fiber consumption is through metabolism of fibers by the gut microbiota into short chain fatty acids that can improve health. Current recommendations for dietary fiber intake for adults are between 30-35g per day for men and 25-32g per day for women. Data from the National Health and Nutrition Examination Survey (NHANES) showed that on average, dietary fiber intake is around one third below the recommended level. Because of the low population that consumes the recommended lever of fiber, fiber supplementation could help fill this gap. The purpose of this project is to develop a Kombucha drink enriched with fiber so people can enjoy their drinks without the need to change the mind-set of the consumer.

Research Hypotheses

Our primary hypothesis is that the addition of fibers to the secondary fermentation will not alter the taste profile and allow the Kombucha drink to be classified as a high-fiber food.

Our secondary hypothesis was that the addition of fibers to the primary fermentation would alter the microbial composition of the SCOBY.

Methods

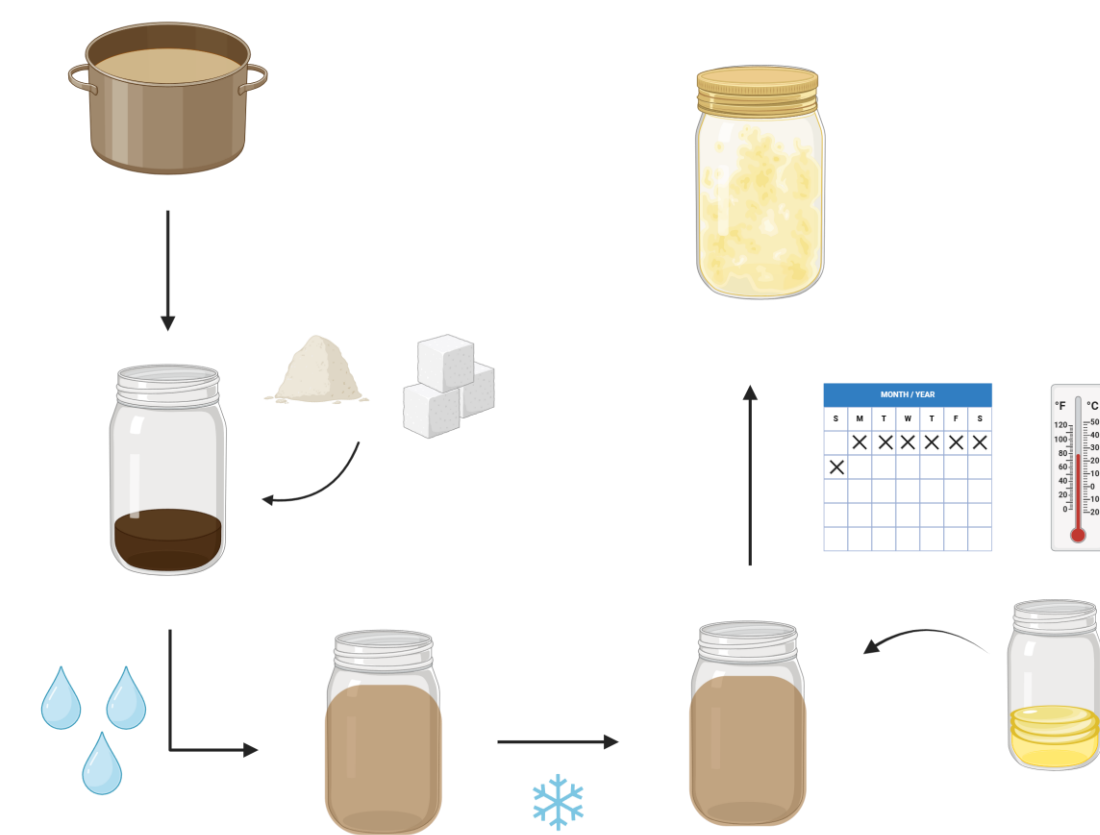


Figure 1: Primary Fermentation Process

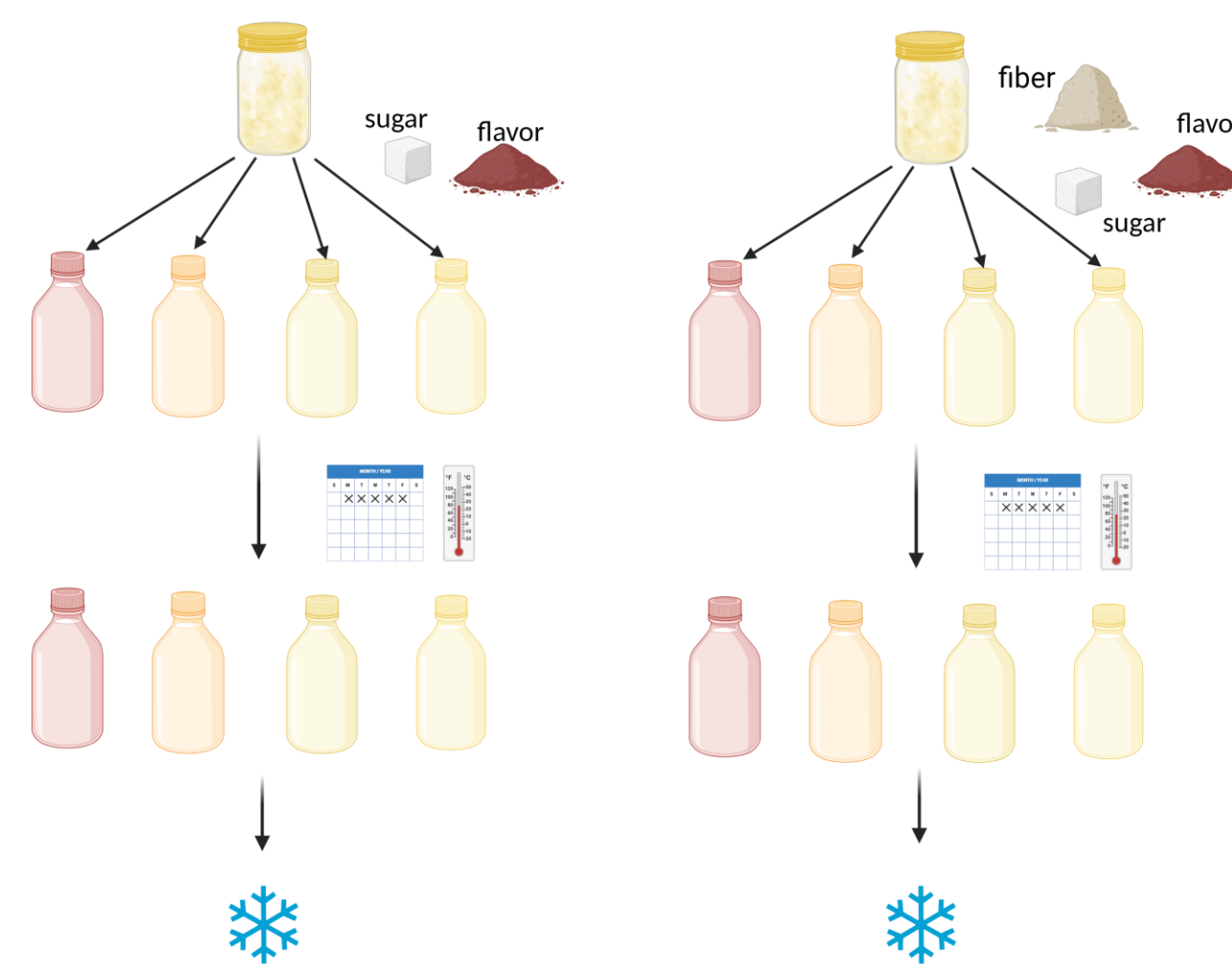


Figure 2: Secondary Fermentation Process

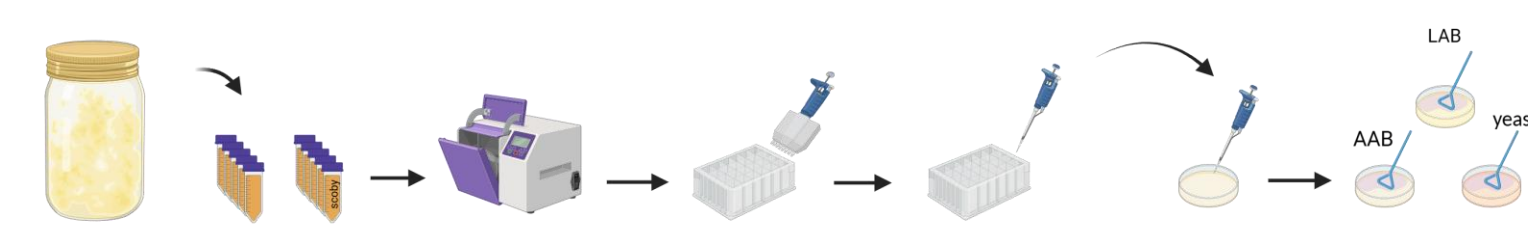


Figure 3: Serial Dilution and Plating Process

Results

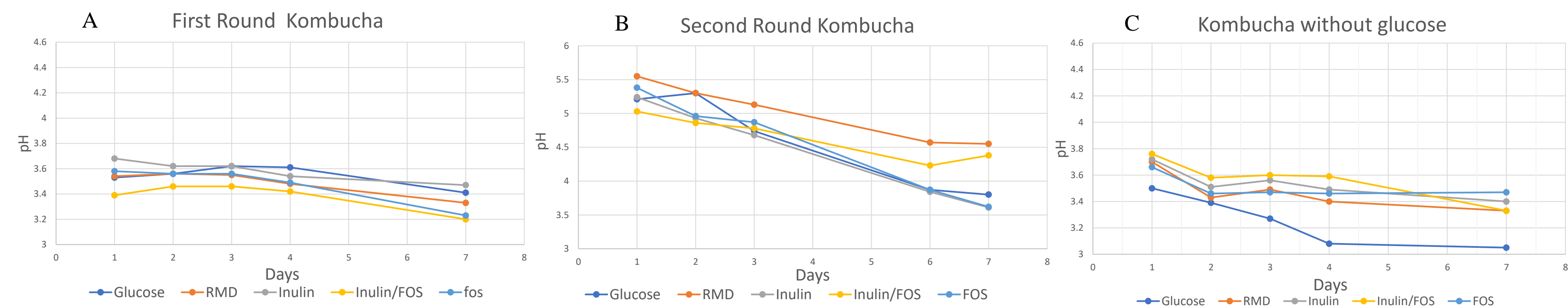


Figure 4: (A) pH of the First Round Kombucha during the Primary Fermentation Process. (B) pH of the Second Round Kombucha during the Primary Fermentation Process. (C) pH of the Kombucha without glucose during the Primary Fermentation Process.

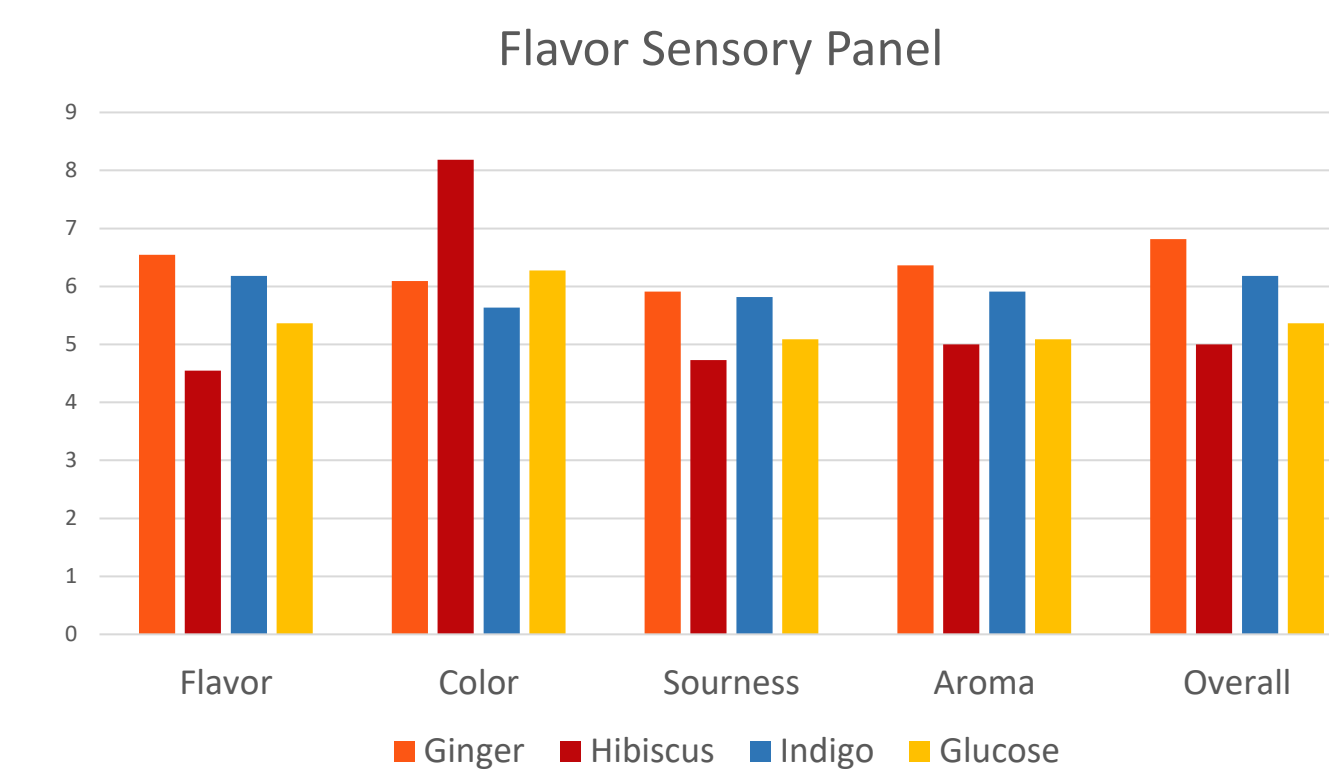


Figure 5: Averages from the Flavor Sensory Panel Results

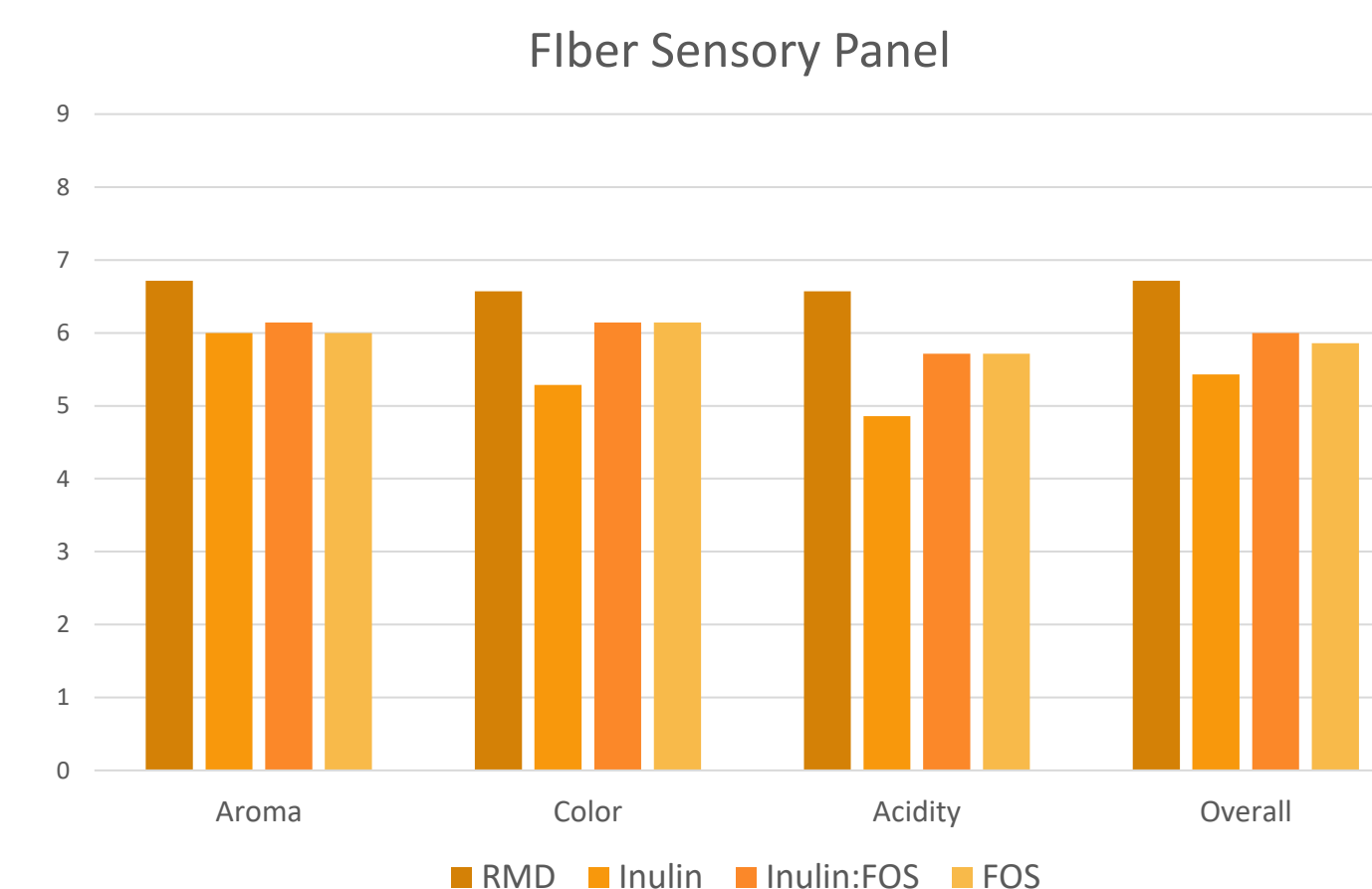


Figure 6: Averages from the Fiber Sensory Panel Results

Conclusions & Future Directions

- These results are significant for developing a high-fiber drink tailored for consumers seeking health benefits. The superior performance of ginger as a flavor and the preference for resistant maltodextrin as a fiber additive underscore the potential for creating a beverage that is both appealing and nutritionally beneficial. These findings enable manufacturers to create a Kombucha drink that satisfies consumer demand for tasty flavors while offering a beneficial source of dietary fiber for improved digestive health and well-being.
- Test whether microbial activity alters the fiber levels during refrigeration (shelf life studies).
- Determine whether addition of fibers to primary fermentation altered the microbial composition or the organic acid profile of the kombucha.

References

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