Summer research experience analyzing the effects of dietary fiber on primary and secondary kombucha processes

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Introduction:

This summer I had the opportunity to have my summer internship program experience at the University of Nebraska Lincoln on the Croop to Food Innovation REEU program. I work with Dr. Auchtung and Dr. Deehan on the effects of dietary fiber on primary and secondary processes of kombucha.

Kombucha is a fermented sparkling sugared tea drink that is obtained following the fermentation of green or black tea by the symbiotic culture of bacteria and yeast (SCOBY). The scoby primarily consists of a community of acetic acid bacteria (AAB) and yeasts (Coelho et al., 2020). These organisms are potential probiotics that contribute to the health benefits of Kombucha. The beneficial effects of the beverages result from, among others, the antioxidant activities that restore the balance between the production of free radicals and the body's defense mechanism. As a result, Kombucha may contribute to the reduction of multiple health disorders (Wang et al., 2022).

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 30g-35g per day for men and 25g-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 level of fiber, fiber supplementation could help fill this gap (Barber et al., 2020).

Purpose and Objectives:

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. 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 and Procedures:

For our methods we started with making kombucha from scratch using black tea. After making the tea we added about 500mL of tea per 1,500mL mason jar, 38.55g grams of sugar and 17.25g of dietary fiber. After pouring the tea we filled the jar with water until the 1,500mL mark and then added 100mL of previous kombucha liquid and a scoby. We use 5 jars, the control jar with only sugar and 4 jars with different types of dietary fiber in each one. The dietary fibers were resistant maltodextrin, fructooligosaccharide, Inulin and 50/50 of Inulin and fructooligosaccharide. We also had 5 mason jars with 38.55g of sugar that was used for the secondary fermentation process (Isakov et al., 2023).

In the secondary fermentation process we moved the kombucha into a 8 oz sealed bottle and added 1/4 tsp of sugar and 1 tsp of flavor to the kombucha, for the kombucha with only sugar, we added the 4 types of fiber in this secondary fermentation process.

When the Kombuchas finished their secondary fermentation process, we made a sensory panel in which people could give us an evaluation of flavor and texture of the drink using a hedonic scale.

Results:

The participants showed an overall liking to the flavors being the ginger the best one and the best match for the ginger flavored kombucha being the resistant maltodextrin.

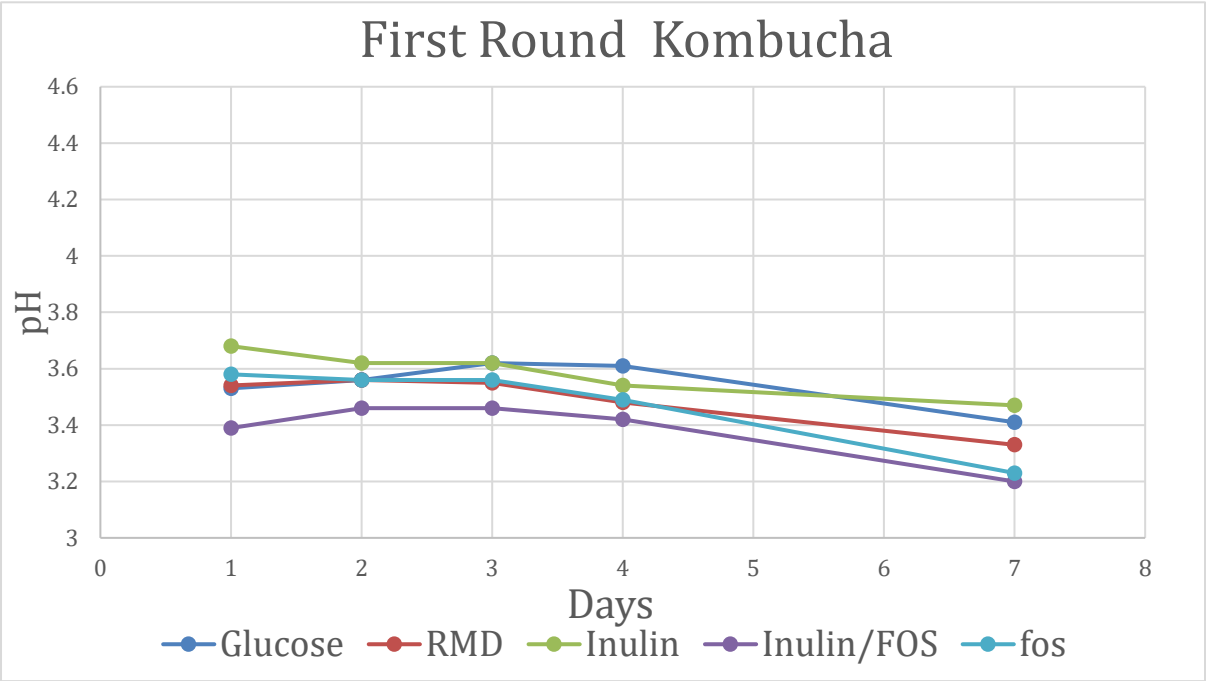

Figure 1: pH of the First Round Kombucha during the Primary Fermentation Process.

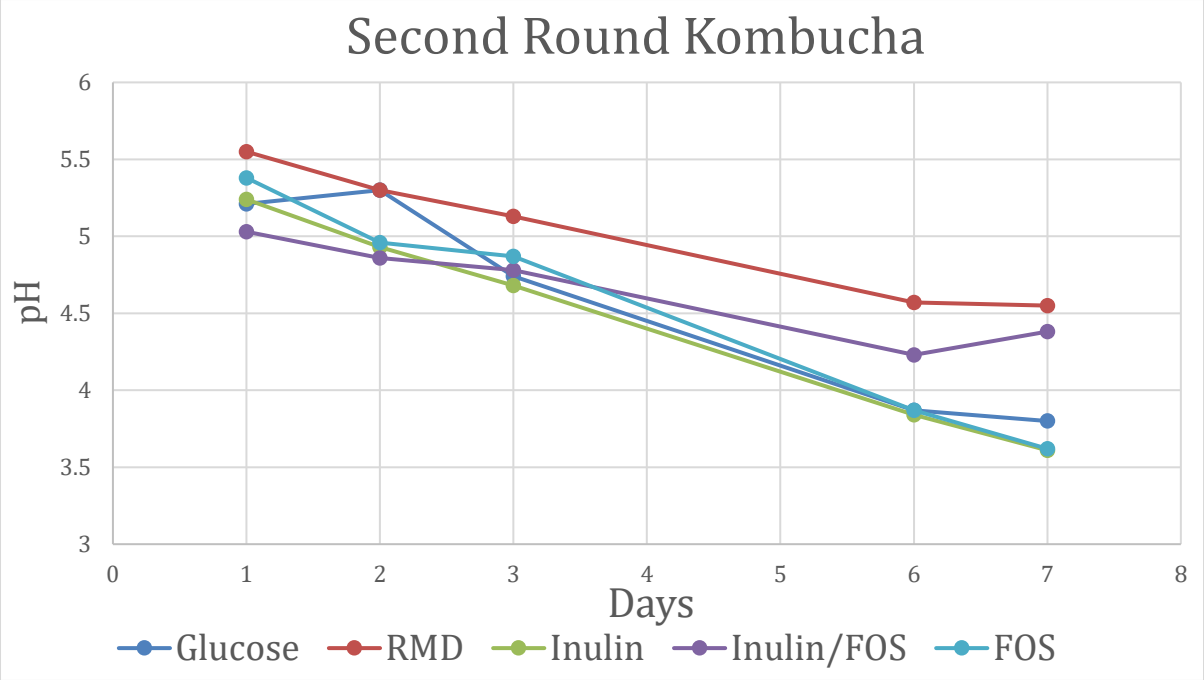

Figure 2: pH of the Second Round Kombucha during the Primary Fermentation Process.

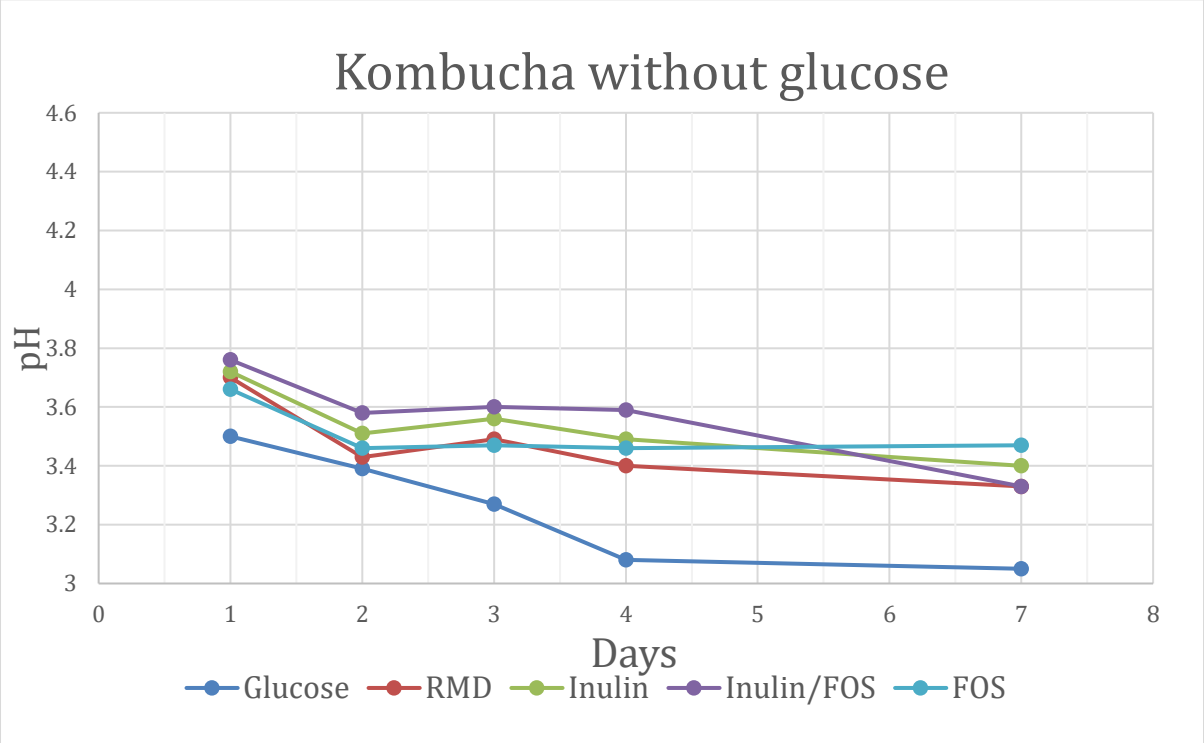

Figure 3: pH of the Kombucha without glucose during the Primary Fermentation Process.

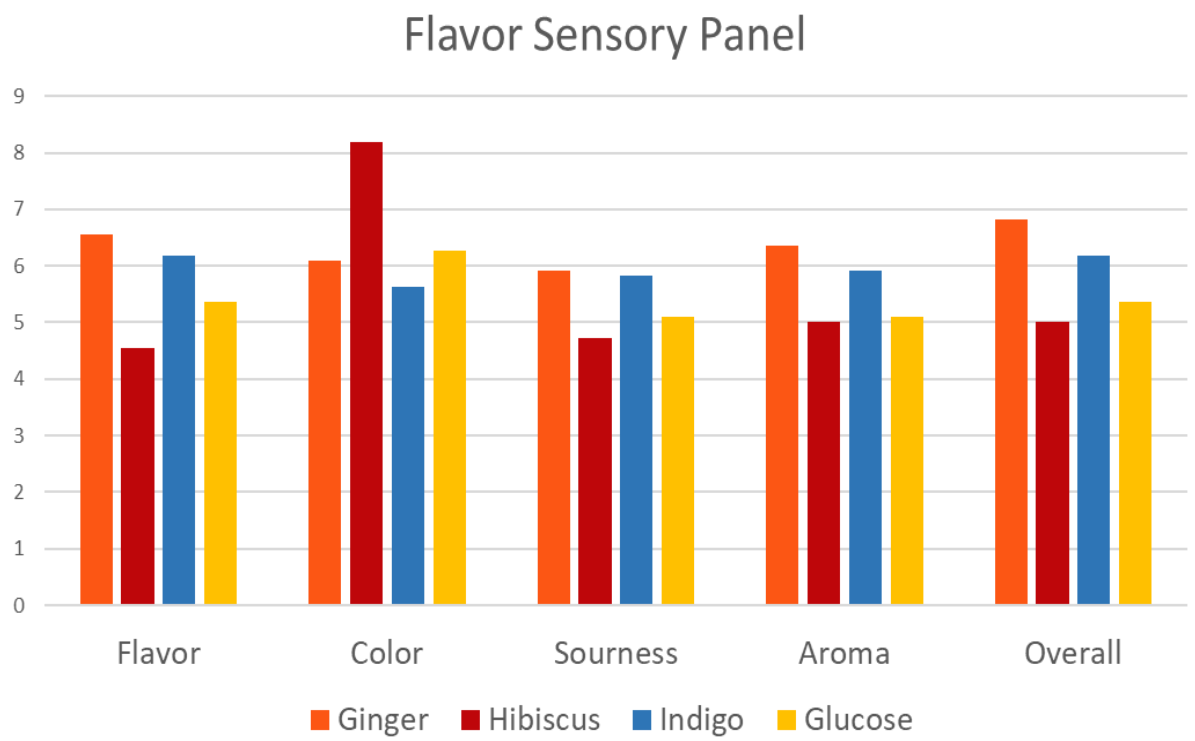

Figure 4: Averages from the Flavor Sensory Panel Results

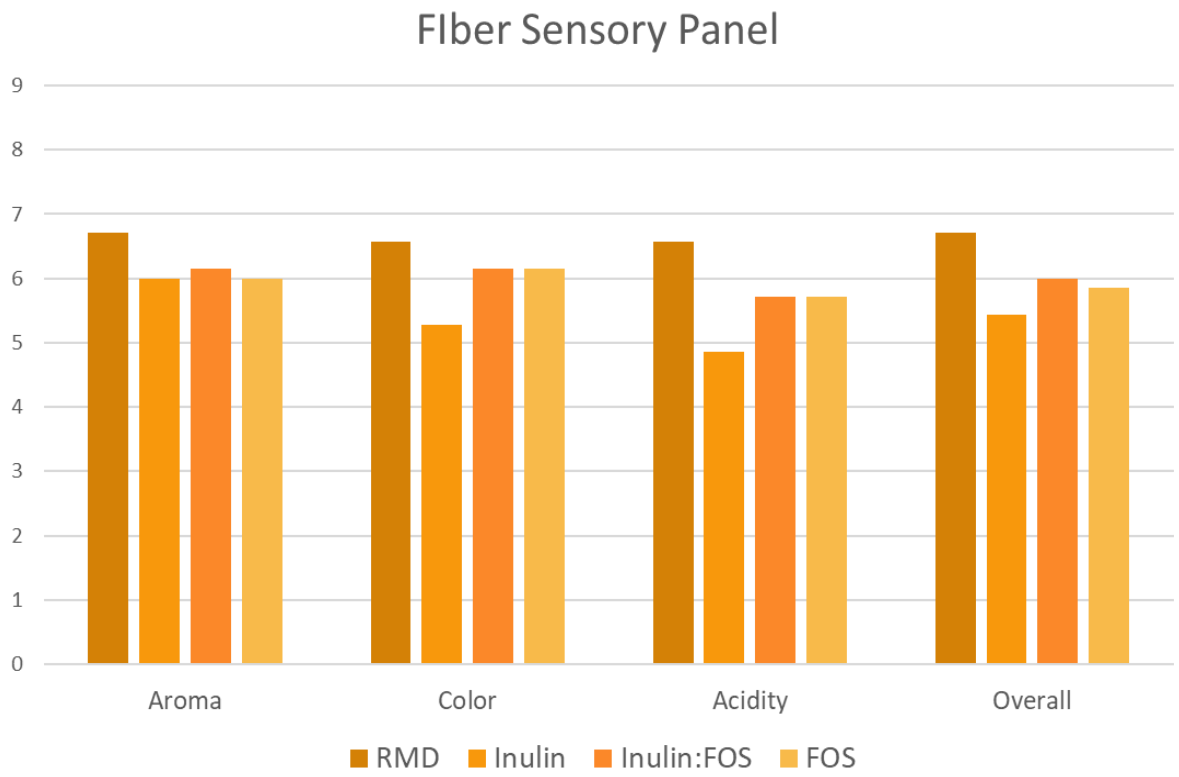

Figure 5: Averages from the Fiber Sensory Panel Results

Conclusion and future directions:

We conclude that 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 (Mendelson et al., 2023).

For future directions we want to test whether microbial activity alters the fiber levels during refrigeration (shelf-life studies). Also, we want to determine whether addition of fibers to primary fermentation altered the microbial composition or the organic acid profile of the kombucha.

This research was supported by USDA-NIFA REEU grant 2022-67037-36616.

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