Kombucha Fermentation Using Probiotics and Red Dragon Fruit (*Hylocereus polyrhizus*): Effects on Microbial Dynamics, Metabolisms, and Aroma Profiles

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Abstract:
This study aimed to develop probiotic Kombucha fortified with red dragon fruit (RDF) (Hylocereus polyrhizus). A starter co-culture of acetic acid bacteria (AAB) with probiotic lactic acid bacteria (LAB) and probiotic yeast was used as a synthetic symbiotic culture of bacteria and yeast (syn-SCOBY). The impact of adding RDF either at the primary or secondary fermentation stages was studied. Primary fermentation was carried out aerobically at 30°C for 3 days, followed by anaerobic secondary fermentation at 30°C for 2 days, 2 weeks, and 4 weeks. The addition of RDF increased the viability of LAB, especially at secondary stages, while there was no viable LAB detected in the control group without adding RDF. However, all types of microbial cells decreased extensively and also concurrently with the depletion of sugar content after 4 weeks of fermentation. The pH values decreased to 2.7-3.8, corresponding to the increase in acidic concentration, especially in the RDF-based media. More than 40 volatile compounds, especially esters and alcohols such as ethyl acetate, octanoic acid ethyl ester, phenylethyl alcohol, and linalool, are responsible for fruity and floral flavours. The RDF addition in the secondary phase recorded a higher level of ethyl acetate than the addition in the first phase. The ethyl acetate level became much lower when the fermentation was continued in the second phase. This study has shown that the timing of fruit addition significantly influenced microbial dynamics, LAB viability, metabolic activity, and aroma complexity.

Keywords:
Kombucha, red dragon fruit, probiotic, lactic acid bacteria, volatile compounds.