Polyphenols, Probiotics, and the Functional Nutrition Potential of Kombucha

Kombucha is a sweetened tea fermented by a symbiotic culture of bacteria and yeast (SCOBY). As the wellness and functional nutrition markets expand, particularly in the United States, the consumption of kombucha has also risen due to its perceived probiotic and intestinal health benefits.

Microbial Composition and Fermentation Process

The SCOBY for kombucha typically comprises osmophilic yeasts like Brettanomyces, Candida, Lachancea, Pichia, Saccharomyces, Schizosaccharomyces, and Zygosaccharomyces. Acetic acid bacteria, such as Acetobacter, Gluconobacter, and Komagataeibacter, as well as occasionally Lactobacillus species, will also be present.

Within the SCOBY, yeasts secrete invertase that cleaves sucrose into glucose and fructose, which leads to the release of carbon dioxide and ethanol. Acetic-acid bacteria oxidize these substrates to produce acetic, gluconic, and glucuronic acids, which simultaneously reduce pH and form the cellulose pellicle that becomes the daughter SCOBY.

Fermentation yields a final product that comprises these organic acids, trace amounts of alcohol, water-soluble B vitamins (B1, B2, and B6, occasionally B12, although its presence is inconsistent and not reliably bioavailable), as well as other antimicrobial compounds for stabilization.

Black, green, oolong, or white tea can be used to prepare kombucha, each with a distinct polyphenol and mineral profile. The duration of fermentation, which ranges between five and 14 days, also determines the concentrations of acid, ethanol, and vitamins, which subsequently dictate whether the drink will taste tart or have stronger vinegar undertones. Understanding these variables enables brewers to adjust the flavor, carbonation, and functional properties of their kombucha products.

Nutritional Profile and Bioactive Components

Green tea provides abundant catechins, including epigallocatechin gallate, a potent radical scavenger. Black tea contributes oxidized polyphenols like theaflavins and thearubigins, which affect the color and antioxidant capacity of kombucha.

During fermentation, microbial enzymes can hydrolyze larger polyphenols, releasing smaller and more bioavailable molecules in the process. These enzymes can also increase total phenolic levels and antioxidant activity as compared to unfermented tea products.

The living SCOBY consists of acetic acid bacteria, lactic acid bacteria, and yeasts that regulate nutrient release and may act as a probiotic source, though human evidence is lacking. The potential probiotic properties of kombucha underscore the importance of proper product handling, as certain storage conditions or pasteurization can reduce the live counts. Nevertheless, inactivated cells and their metabolites may act as postbiotics and, as a result, provide additional health effects.

Kombucha is rich in various organic acids that exhibit distinct detoxification properties. Glucuronic acid, produced by Komagataeibacter species, for example, has been shown in preclinical studies to bind hepatic toxins, support glucuronidation, enhance the bioavailability of phenolic compounds, and modulate steroid hormone balance. However, such detoxification effects in humans remain unproven.

Evidence from Preclinical and Clinical Studies

The tea polyphenols and fermentation metabolites present in kombucha exhibit distinct antimicrobial, antioxidant, detoxifying, immune-stimulating, and disease-modifying properties, as reported in rodent, rabbit, poultry, livestock, and cell models. For example, diabetic animal studies have reported lower glucose levels, beta-cell regeneration, improved metabolism and liver outcomes, as well as improved survival outcomes in rodent models of sepsis.

Translation of these observations into human trials is limited by variable SCOBY composition, complex metabolites, unverified historical claims, as well as small, self-reported, and single-product trials. Thus, standardized brewing protocols and larger studies are needed to define clinically meaningful outcomes in diverse populations and endpoints over time.

Future Directions

Consistent starter cultures, substrates, fermentation times, temperature, pH, and packaging control are essential to generate reproducible chemistry, ensure safety, and allow data from different labs to be compared. Regulatory bodies, industry, and researchers are encouraged to collaborate on quality standards that protect consumers and reduce variability across products.

Additional studies are needed to optimize fermentation strategies, strain selection, and process optimization to enrich for polyphenols, vitamins, organic acids, and other targeted compounds while retaining product acceptability. Standardized outcome sets and reporting templates will enhance comparability and facilitate future meta-analyses across studies.

Conclusion

Kombucha is a fermented tea rich in polyphenols, organic acids, and microbial components that may contribute to prebiotic-like effects, supporting gut function, metabolic regulation, and detoxification. Despite its reported health benefits, there remains a lack of evidence supporting these claims from human trials, with existing data largely heterogeneous and of low quality. Consumers should choose properly acidified, well-handled products and drink in moderation, especially if immunocompromised, pregnant, or managing chronic disease.

Source:

https://www.news-medical.net/health/Kombucha-Polyphenols-Probiotics-and-the-Functional-Nutrition-Potential.aspx