beverages

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Editorial

Traditional, Functional, and Novel Fruit Beverages: Cultivation, Processing, and Consumption

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The botanical kingdom offers opportunities to find new beverage ingredients using various techniques. The beverage market comprises various segments, such as juices, bottled waters, teas, dairy drinks, and functional beverages. These groups, in turn, present challenges for incorporating ingredients [1].

Driven by consumer interest and the promise of innovation and health advantages, new functional beverages are set to hit the market soon. Their success will hinge on clear and compelling evidence of their effectiveness in supporting health.

Therefore, essential aspects in developing a new generation of beverages could include identifying and quantifying bioactive compounds, examining the bioavailability and metabolism of functional ingredients, evaluating safety considerations, and ensuring product stability [2].

This Special Issue aims to provide an overview of fruits and by-products as sources of bioactive compounds to produce functional beverages, with particular attention being paid to extraction techniques, cultivation, processing, and consumption.

Zheng et al. studied bioactive polyphenols from white willow (*Salix alba*) under different temperature and pH conditions, analyzing their interactions with Alzheimer's-related enzymes (AChE and BuChE) via molecular docking. Epicatechin, chlorogenic acid, and salicin showed strong binding affinities and inhibitory potential through hydrogen bonds and hydrophobic interactions at enzyme-active sites.

Watrelot and Hollis studied the development of a low-alcohol sparkling beverage called "Piquette". The beverage is produced after adding water to red grape pomace, followed by pressing and fermenting residual sugars. The subsequent bottling before fermentation produces the development of CO_2, obtaining a low-alcohol and sparkling product. The study produced piquette from various red grape cultivars, using different pomace-to-water ratios and yeast strains, followed by sensory evaluations. Consumers highly appreciated the piquette, highlighting its potential to add value to grape pomace, enhance wine industry sustainability, and boost profitability.

In the third article of this Special Issue, Regalado-Rentería et al. examine the anti-inflammatory and hypoglycemic potential of the residue from roselle beverage production. This residue could offer an accessible and cost-effective nutraceutical intervention for individuals at risk or who have been diagnosed with Type 2 diabetes mellitus (T2DM), particularly in regions where roselle-based beverages are commonly consumed. This study evaluates the effect of Roselle beverage residue on gene expression related to insulin resistance in T2DM-induced rats. The findings show that Roselle residue benefits

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advanced T2DM prevention and management, with greater efficacy in healthy and insulin-resistant subjects, improving insulin sensitivity, lowering serum glucose, and enhancing pancreatic function.

Anthocyanins in strawberries act as antioxidants and contribute to beverage color and stability. Increasing their levels in strawberry nectars can enhance functionality. Murray et al. found that nectars from overripe strawberries had the highest anthocyanin content, improving color retention and extending shelf life.

In the study by Vasić et al., the phytochemical composition of herbal teas prepared from pseudofruits of rosehip (*Rosa canina* L.), as well as herbal mixtures containing rosehip, hibiscus flowers (*Hibiscus sabdariffa* L.), and saffron (*Crocus sativus* L.), were tested.

The antioxidant activity and in vitro inhibitory potential towards α-amylase were evaluated on the same herbal mixtures. The drying temperature of rosehip was shown to be of great importance for the phytochemical composition and antioxidant properties.

An increase in the total amount of flavonoids, flavonols, and anthocyanins was observed, especially in tisanes prepared from herbal mixtures (rosehip/hibiscus and rosehip/hibiscus/saffron). All herbal preparations showed good inhibitory activity towards α-amylase, although those prepared with dog rose and hibiscus were the most effective. The authors emphasize the need for a detailed quantification of phenolic compounds in the herbal tea samples examined.

In the context of functional foods and beverages, probiotic fruit juices offer a unique opportunity to combine the health benefits of probiotics with the nutritional properties of fruit juices.

Most probiotic food products are dairy products, and, for this reason, fruit juices could be a valid alternative.

Although the market for probiotic-containing fruit juices may seem promising, some technological issues prevent its diffusion. D'Amico and colleagues focused their review, titled 'Fruit Juices as Alternative to Dairy Products for Probiotics' Intake', on the stability and sensory properties of fruit juices which can be altered by probiotics or their metabolites.

The literature highlights strategies to enhance beverage quality, including using pH-tolerant probiotic strains, microencapsulation, adding prebiotics and antioxidants, and adopting innovative technologies [3]. These approaches improve probiotic survival and efficacy, maximizing health benefits. Fruit selection also plays a crucial role in developing probiotic fruit juices.

Probiotic survival in beverages largely depends on pH, making fruit selection crucial. Orange, pineapple, apple, and pomegranate juices have been identified as excellent substrates for functional probiotic drinks [4]. Mango is a good matrix as a substrate for the survival of *Lactobacillus rhamnosus* and *L. plantarum*. The studies referenced in the review show that oranges, pineapple, and mango are the best fruits for producing probiotic fruit juices. Their natural pH between 3.0 and 4.5 creates an optimal environment for the growth and stability of probiotic bacteria.

Probiotic fruit juices represent a market area that can be fully exploited by providing consumers with safe, effective, healthy, high-quality food products.

The review 'Pigmented Native Maize: Unlocking the Potential of Anthocyanins and Bioactive Compounds from Traditional to Functional Beverages' shows that corn is an important crop for producing a wide variety of foods, including beverages that are significant in the culinary and cultural heritage of Mexico.

Pigmented corn contains bioactive anthocyanins, such as cyanidin-3-O-glucoside, known for their anti-inflammatory, antioxidant, and anti-carcinogenic properties. Ensuring anthocyanin stability is crucial for developing functional corn-based beverages. Techniques like co-pigmentation, modified atmosphere processing, and biopolymer encapsulation can

enhance stability. These anthocyanins also have potential as natural food colorants and functional beverage ingredients.

As the guest editors of this Special Issue, which belongs to the section 'Quality, Nutrition, and Chemistry of Beverages', we are pleased to present these seven papers concerning potentially novel beverages and/or novel technologies. We hope that our readers will find them interesting and important.

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