



Editorial

Functional Beverages, from Idea to Functionality

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The search for, and development of beverages that could be a panacea is one which is several millennia old. Recently, the emergence of technological advances has certainly set the stage for the development of a number of novel products. Although the concept of an “elixir of youth” remains beyond science, the development, storage and potential beneficial health outcomes of the carefully developed functional beverages is providing the backbone for considerable growth in the current scientific research and advancements in the beverages industry [1].

There has been a significant increase in demand for the development of functional food products, including beverages, as well as for the use of isolated ingredients and supplements. In Western society, functional beverages are a relatively new concept, with the main orientation being towards the addition of ingredients aimed at inducing beneficial health effects [2,3]. Many of the studies that have employed this supplement approach have tended to rely on the antioxidant values determined using the in vitro experiments, posing a question with respect to their true physiological activity [4]. In addition, the beneficial health effects seen following the consumption of beverages have also been related to the other functional ingredients [5] and can exhibit any potentially beneficial effect after the prolonged periods of regular consumption, when included as part of the everyday diet. Therefore, these products may provide a bi-directional relationship between the overall health and gut microbiota [6–8].

Needless to say, the development of functional beverages is a complex process and the selection of the initial ingredients and raw materials, methods of processing, storage, palatability and methods of delivery all play equal parts in the functionality of the final beverage product itself. Hence, the aim of this Special Issue, “*Functional Beverages, from Idea to Functionality*”, is to compile a number of recent high-quality manuscripts describing the potential of functional beverages covering the topics from generation of ideas, stability studies (human and animal trials) as well as other applications of these beverages. In addition, this Special Issue also considers the new and innovative ideas implementing the use of liquids not traditionally considered as the beverage itself, but in the form of mouth swills, an area that has received increased interest from the fields of sport and fitness.

This Special Issue is composed of five different works by international research teams, providing up-to-date original research on a range of different aspects related to the development of functional beverages and their in vitro [9,10] and in vivo [11] properties, in addition to findings from observations of human trials [12,13]. Additionally, the potential for waste valorization of the production by-products was also determined [10].

The findings of the study by Bender et al. [9] demonstrate the potential use of *Stevia rebaudiana* as a sweetener in red raspberry juices in order to reduce the use of simple sugars. It is well established that Stevia can reduce overall calorie intake; in addition, this work found that the addition of Stevia

resulted in the significantly increased in vitro antioxidant activity of the new beverages via the oxygen radical absorbance capacity and the cellular antioxidant assays in the HepG2 cells.

The study by Gouws et al. [10] investigated the effects of different juicing techniques (stick blender; jug blender; commercially available juicer; cold-press juicer) on phytochemical and antioxidant characteristics of commercially grown purple Prickly pear (*Opuntia ficus indica*) as whole fruit and fruit flesh. In addition, this study also examined the pomace produced which has traditionally been seen as the food waste. These findings indicate that the choice of processing technique selected influences the yield of juice as well as the observed characteristics. This places the emphasis and importance on the selection of the appropriate processing techniques for the maximal extraction of phytochemicals and reduction in pomace waste. Additionally, the pomace of the prickly pear can also be seen as the valuable source of different phytochemicals.

Lacerda et al. [11] assessed the biochemical and physiological effects in an animal model (rats) was observed when they were fed with high-fat diets supplemented with purple grape juice. Although, the consumption of high fat diet still remains a debatable issue with respect to human health, it is still considered to contribute to the onset and development of obesity and cardiovascular disease. The findings of this study suggest that the consumption of organic and conventional grape juice influenced the pattern of food intake in the animals. This was accompanied by a reduction in body weight of the animals consuming grape juice, with an increase in the high fat only diet group. Animals fed a high fat diet also had increases in abdominal fat, abdominal fat/weight ration and hepatic enzymes (aminotransferase and gamma-glutamyl transpeptidase), while these changes were not observed in the groups consuming the purple grape juice. This study found that the consumption of grape juice potentially reduces the negative effects on physiological and biochemical parameters induced by high fat diets in this animal model.

The commercial processing of tropical fruits still remains limited, although there is an increasing demand for these processed fruit products in the global market. The study by Hemaltha et al. [13] aimed to develop a process for ready to serve beverages from enzyme liquefied (pectinase) Cape gooseberry juice, including the use of additives and preservatives. The study also investigated the effect of storing at different temperatures storage on microbial, sensory and physicochemical quality parameters. The findings have indicated that beverages stored at different temperatures (refrigerated and at room temperature) had microbial counts within the permissible limits in addition to receiving higher sensory and overall acceptability scores. This can be considered from the functional beverage perspective as the method for development of ready to serve beverage produced from the Cape gooseberry as an alternative to the similar soft drink products available on the market.

Functional beverages are considered as fluids (and associated products) that can deliver functional benefits when consumed. The boundaries of this traditional definition seems to be challenged by the products which are liquids, but are not typically drunk in order to exhibit their functional effects, are swilled in the mouth instead. This study developed a menthol solution for use during sport and exercise, which was evaluated in a study by Best et al. [12]. Menthol containing mouth swills have exhibited potential benefits in athletes across different sports. Interestingly, the color of the liquid was also assessed to measure any psychophysiological effect on outcomes linked to the perception of the mouth swill product. In this study, participants evaluated the preferred menthol concentration range and the smell, taste, freshness mouthfeel and irritation (using the 15 cm Visual Analogue Scale) after consuming the 25 mL of different colored (light blue, dark blue, light green, dark green and red) mouth swills containing a standardized menthol dose. These findings indicated that there were no differences between the doses or colors provided; however, higher concentrations had some smaller statistical effects.

In summary, the field of functional beverages is a diverse and rapidly growing area and the new techniques and applications are continuously being developed and investigated. These are being applied to a range of applications, from the reduction of food waste through to pushing the boundaries

with the development of ergogenic mouth swills. We (the co-editors of this Special Issue) are thankful to the authors and reviewers who have contributed to this issue, sharing their knowledge and findings.

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