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Evaluation and correlation of sensory attributes and chemical compositions of emerging fresh produce: Microgreens

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ABSTRACT

Microgreens are an emerging food product with scarce information pertaining to their sensory and nutritional properties. In this study, six species of microgreens, including Dijon mustard (*Brassica juncea* L. Czern.), opal basil (*Ocimum basilicum* L.), bull's blood beet (*Beta vulgaris* L.), red amaranth (*Amaranthus tricolor* L.), peppercress (*Lepidium bonariense* L.) and China rose radish (*Raphanus sativus* L.), were evaluated for their sensory attributes and chemical compositions. Results showed that bull's blood beet had the highest rating on acceptability of flavor and overall eating quality while peppercress the lowest. Chemical compositions also differed significantly among the six species. China rose radish had the highest titratable acidity and total sugars, while red amaranth had the highest pH value and lowest total sugars. Regarding the phytonutrient concentrations, the highest concentrations of total ascorbic acid, phylloquinone, carotenoids, tocopherols, and total phenolics were found in China rose radish, opal basil, red amaranth, China rose radish, and opal basil, respectively. The relationships between sensory–sensory attributes and sensory–chemical compositions were further studied. It was found that overall eating quality of microgreens was best correlated with flavor score and microgreen's pH value and total phenolic content were strongly correlated with flavor attributes, e.g., sourness, astringency, and bitterness. In general, despite the differences among individual microgreens, all of the microgreens evaluated in this study demonstrated "good" to "excellent" consumer acceptance and nutritional quality.

1. Introduction

Microgreens are emergeing specialty food products, which recently have garnered increased attention in the United States. They are tiny versions of regular plants produced from the seeds of vegetables, herbs or grains, having two fully developed cotyledons with the first pair of true leaves emerging or partially expanded. Microgreens are usually harvested in 7–14 days after germination. Although small in size, microgreens can provide intense flavors, vivid colors, and crisp textures and can be served as an edible garnish or as a new salad ingredient (Brentlinger, 2005). A previous study has found that microgreens are generally packed with more phytonutrients (such as ascorbic acid, α-tocopherol, and β-carotene) than their mature plants, and are excellent sources of vitamins and carotenoids (Xiao et al., 2012).

In addition to nutritional values, sensory attributes are often important factors governing the consumer acceptance of a food product and their purchase intent. In general, the overall quality of fresh produce is related to several sensory attributes, such as appearance, texture and flavor (Barrett et al., 2010; Nandane and Jain, 2011). Among all the quality attributes, appearance is the initial quality attribute that attracts consumers, and affects their choice for the first-time purchase; however, other organoleptic characteristics (e.g., flavor and texture) play a crucial role in consumer satisfaction and repeat purchases (Barrett et al., 2010; Francis et al., 2012). As consumers' health awareness increases, nutritional values of food are often intertwined in the consumers' purchasing decision. Therefore, both sensory and nutritional attributes are very important for food products.

While the sensory attributes of many conventional fruits and vegetables are well documented, no scientific studies have been published in the open literature to evaluate the sensory qualities of microgreens, as well as their associations with chemical

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compositions. Therefore, the main objectives of this study were to (1) assess sensory quality and consumer acceptance of selected microgreens; (2) correlate chemical compositions with sensory attributes of those microgreens; and (3) evaluate the nutritional values of these microgreens.

2. Materials and methods

2.1. Sample preparation

Six microgreen species were evaluated in this study, including Dijon mustard (*Brassica juncea* L. Czern.); opal basil (*Ocimum basilicum* L.); bull's blood beet (*Beta vulgaris* L.); red amaranth (*Amaranthus tricolor* L.), peppercress (*Lepidium bonariense* L.) and China rose radish (*Raphanus sativus* L.). The optical images were as shown in Fig. 1. These microgreen species were selected based on their representation of the unique flavor categories of mustard, herbal, vegetable, mild, peppery, and radish, respectively. The microgreens were obtained from Fresh Origins Farm (San Marcos, CA, USA). The products were grown in peat moss in unheated greenhouses under ambient light and harvested without roots using a commercial harvester. Samples were immediately packed in unvented clamshell containers (113 g × 3 containers for each species) and shipped overnight in a cardboard box filled with insulating foam and ice packs to main low temperature. Upon receipt at USDA-ARS Beltsville Agricultural Research Center (Beltsville, MD, USA), the samples were inspected and any defective microgreens were discarded. Sub-samples (50 g × 3 containers, as one replicate) were immediately freeze-dried for phytonutrient analyses or juiced and centrifuged for titratable acidity and pH analyses. The remainder of the samples was stored in 1 °C for one day prior to sensory evaluation. In the

Fig. 1. Optical images of microgreen species evaluated in consumer test, where A, B, C, D, E and F represent bull's blood beet, red amaranth, Dijon mustard, China rose radish, peppercress and opal basil microgreens, respectively.