Title Changes in antioxidant compounds in white cabbage during winter storage

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Abstract

Cabbage is an important source of dietary antioxidants, available throughout the year. Using electrospray ionisation Fourier transform ion cyclotron resonance mass spectrometry we studied changes in antioxidant compounds in white cabbage during 6 months of commercial storage. Cabbages were harvested at the end of November and stored until the end of May in pallet bins in a refrigerated shed under natural-air conditions. Samples were collected four times during storage in November, February, April and May. Antioxidant compounds identified in cabbage included: ascorbic and dehydroascorbic acid (vitamin C), pyridoxine and pyridoxamine (vitamin B6), nicotinamide and nicotinic acid (vitamin B3), pantothenic acid (vitamin B5); flavonoids (artemetin, betanidin, butein/naringenin chalcone, chalcone, cyanidin, equol, flavone, hydroxyflavone, kaempferol/luteolin, malvidin, naringenin/tetrahydrochalcone, nobiletin, pelargonidin, purpurogallin and quercitol); phenolic acids (benzoic, caffeic, cinnamic, coumaric/hydroxycinnamic, dimethoxybenzoic, gallic/trihydroxybezoic, phenylacetic, rosmarinic, syringic, vanillic and veratric). Fresh-harvested cabbages contained the highest levels of ascorbic acid and pyridoxine. Vitamins B3 and B5 and D2 were below the detection limit. During the first 3 months of storage cabbage lost all pyridoxamine and ~80% of ascorbic acid. At the end of storage, however, the content of ascorbic acid and vitamins B3 and B5 increased, which may reflect preparation of cabbage for a new growth. A large variety of flavonoids were present in fresh-harvested cabbages. More than half of these compounds were lost during the first 5 months of storage. However, at the end of storage an increase in the levels of some flavonoids was detected. Among 11 phenolic acids found in this study, 7 compounds were present during all the storage period, 2 compounds were lost and 3 other compounds appeared during storage. Starting from April, the appearance of dark lesions on the outer cabbage leaves and detection of ergosterol in cabbage samples indicated the progression of fungal infection. This could trigger synthesis of flavonoids and phenolic acids associated with pathogen resistance in the last months of storage. The study demonstrates that changes in antioxidant compounds in cabbage during long-term storage reflect several ongoing processes, such as postharvest senescence, biennial cycle and response to fungal infection.