ABSTRACT

Long- and Short-Range Structural Changes of Recrystallised Cassava Starch Subjected To In Vitro Digestion

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The conformational and structural order of resistant starch type III made from cassava starch was studied. The gelatinized starch was debranched using pullulanase and then recrystallised by annealing, temperature-cycling or heat-moisture treatment. Subsequently, the recrystallised products were subjected to *in vitro* digestion using porcine pancreatic α-amylase and amyloglucosidase. The undigested and digested products were analyzed for polymer chain distribution, crystallinity, molecular order, structural conformations and thermal stability using high performance anion exchange chromatography, wide angle X-ray diffraction, Fourier transform infrared spectroscopy, ^{13}C CP/MAS nuclear magnetic resonance and differential scanning calorimetry, respectively. Average degree of polymerisation increased from 20 to 22 glucose units upon digestion. Both the undigested and digested starches comprised mixtures of A, B and V crystalline types. Percentage of crystallinities by X-ray diffraction were 40.9%, 50.7% and 56.2% in annealed, temperature-cycled and heat-moisture treated starches, respectively. These values increased to 47.9%, 54.4% and 58.2%, respectively, in the digested products. The ordered fractions in the undigested annealed, temperature-cycled and heat-moisture treated starches were 69.3%, 71.4% and 79.2%, respectively, as determined by ^{13}C CP/MAS nuclear magnetic resonance. However, the disordered phase was indistinct in the digested products although the contents of non-crystalline conformations were significantly ($p < 0.01$) higher. The melting enthalpies of the digested residues increased by factors of 2.50 in annealed, 2.53 in temperature-cycled and 2.06 in heat-moisture treated starches, suggesting molecular rearrangement in a manner related to the enzyme susceptibility of the initial materials.

Key words: Cassava starch, In vitro digestion, Crystallinity