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Characterization of a Partially Purified Carom (*Trachyspermum ammi*) Extract and Its Influence on Starch Functionality and Digestibility

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ABSTRACT

The interactions between starches and the components in spices and herbs have been poorly studied so far. This study investigated the preliminary effects of thirty-six different spices and herbs on pasting properties of rice starch. It largely concentrated on the characterization of a partially purified carom extract (from the dried fruit of the *Trachyspermum ammi* plant) and its influence on the structural, thermal, pasting properties and digestibility of native rice starch. Rheology, differential scanning calorimetry, size exclusion chromatography coupled with a multi-angle laser light scattering, zeta potential, hot-stage optical microscopy, scanning electron microscopy (SEM), and in-vitro starch digestion analysis were carried out to characterise the carom extract and starch-carom system. The results showed that carom, cumin, fennel, mulberry leaf, perilla leaf, neem and coriander seed extracts showed peak and final viscosity-suppressing effect, while mesona, rosemary, green tea, thyme, and clove extracts showed peak viscosity-enhancing effect on rice starch during starch pasting. The water-soluble fraction of carom had the highest degree of viscosity-suppressing effect as compared to other spices and herbs. With increasing concentration of carom, the peak and final viscosities of rice starch decreased; the onset, peak, and end temperatures of rice starch increased; and granular swelling of potato starch was restricted and delayed. The viscosity-suppressing effect was not caused by pH or small molecular carom compounds such as mineral salts and phytochemicals. A protein polymer in carom extract with an M_w of $\sim 2.08 \pm 0.10 \times 10^5$ Da and isoelectric point of ~ 3.5 was found responsible for the suppression effect. The protein fraction completely denatured at $\sim 83^\circ\text{C}$. Micrographs of SEM showed that carom protein appeared as raisin-like clusters. The ability of carom protein to suppress the peak viscosity of starch was also observed in potato, tapioca, glutinous rice, waxy maize, waxy rice, rice, sweet potato, maize, wheat, and pea starches, suggesting that the effect was independent of the source and ratio of amylose to amylopectin. It was proposed that the protein molecules could be interacting with the starch granular surface and/or starch molecules. *In-vitro* starch digestion study showed that dialysed carom extract with rice starch caused an unusual increment in glucose release. The lower viscosity of the starch-carom gels and/or a carom enzyme stimulatory effect were proposed to be responsible for increasing the rapid breakdown of starch.

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