In Vitro Starch Digestibility and In Vivo Glycemic Response of Starch Inclusion Complexes Produced With Different Methods and Hydrothermal Treatments

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Objectives: Type 2 diabetes (T2D) has become a major health-threatening problem worldwide. Slowly digested or indigestible carbohydrates such as resistant starch (RS) are associated with a low glycemic index (GI) and decreased risk of developing T2D. Recently, starch inclusion complexes (ICs) have raised attention due to their thermally stable structure and high RS content. However, results are inconsistent and few research is present regarding their GI values. The aim of this study was to investigate the *in vitro* digestion kinetics and *in vivo* glycemic response of starch ICs produced with different methods and hydrothermal treatments, and to determine their potential as a novel type of RS, i.e., RS5.

Methods: Starch-ascorbyl palmitate (AP) ICs were produced by both DMSO and the "empty" V-type method. Combined hydrothermal treatments of annealing and acid hydrolysis (ANN-ACH) were applied to enhance the RS content of the IC samples. *In vitro* kinetic starch digestion was performed on the treated ICs to obtain their hydrolysis patterns and estimated GI (*e*GI) values with white bread as a reference food. *In vivo* glycemic response of the IC samples was examined in C57BL6/J mice, with high amylose maize starch (HAMS, a RS2) as a comparison and pure glucose as a reference.

Results: The V_{6h}-AP IC produced by the "empty" V-type method presented a slower and more gradual *in vitro* hydrolysis pattern as compared to the HAMS-AP IC produced by the DMSO method. Cooking significantly increased the *e*GI value of RS2, while the ANN-ACH treatment significantly decreased the *e*GI values of both IC samples ($p < 0.05$). Similarly, cooked RS2 resulted in higher postprandial glycemic response in mice as compared to raw RS2 and treated IC samples ($p < 0.05$). The *in vivo* GIs were also consistent with the *e*GI values obtained from the *in vitro* assay. Among all the tested samples, the treated V_{6h}-AP IC exhibited the lowest *e*GI and GI values, within range of low GI foods.

Conclusions: The low GI values of the ANN-ACH treated V_{6h}-AP IC indicated its pronounced effect in modulating the postprandial glycemic response, marking its great potential as a novel type of RS, i.e., RS5. In addition, good consistency was reached between the *in vitro* and *in vivo* methods of evaluating GI, indicating the reliability of the *in vitro* assay in predicting the glycemic response.

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