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Impact of semolina food structure on mastication and bolus properties – prospects to postprandial glycaemia

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Food structure and structure disintegration are relevant factors for digestion and postprandial metabolism. The current study aimed to investigate the mastication process and disintegration of semolina foods of different structures (spaghetti, penne, fresh penne, bread, couscous) after mastication and after in vitro gastric digestion.

The mastication process of 26 participants was monitored using electromyography. Bolus samples obtained from the mastication experiment were pooled and analysed regarding their saliva impregnation, structure disintegration, microstructure and salivary alpha-amylase induced starch hydrolysis. Further, the bolus samples were treated in in vitro gastric conditions and further structure disintegration and changes in microstructure were studied.

Pasta products required more chewing than bread or couscous but resulted in larger particles. Starch hydrolysis, induced by salivary alpha-amylase, was the fastest in bread and couscous boluses, which can partly be explained by the small particle size and thus large surface area for the enzymatic action. Regarding bread, also the high amount of saliva and thus salivary alpha-amylase might in part explain the faster starch hydrolysis compared to pasta. Consistently, bread microstructure seemed to be more easily accessible to the salivary enzymes, as indicated by higher degree of starch granule disintegration in comparison with pasta and couscous. In pasta and couscous, less modified starch granules were detected in the inner parts of the bolus particles. After in vitro gastric treatment, the particle size of pasta products remained reasonably large, whereas the size of couscous and bread particles was clearly reduced.

In conclusion, the semolina products differed after mastication with respect to particle size and starch hydrolysis. These factors are relevant for glucose uptake rate and postprandial glycaemic responses, which has previously been shown to be lower for pasta than for bread. The results highlight the importance of considering structural food features in addition to food ingredients as determinants of digestibility.