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Developing gelling ingredients to produce 3D-printed milk gels with tailored properties

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3D printing technology is an interesting approach to producing gels with customized textures. This strategy can produce food products for special needs, such as with a specific texture for dysphagia – but new ingredients are needed to ensure it. This study developed 3D-printed milk gels for dysphagic diets combining two biopolymers as structuring agents: native or Dry Heating Treatment (DHT)-modified cassava starch and kappa-carrageenan (κC). Starch was DHT-modified (130 °C for 2 and 4 h) and the gels were prepared with reconstituted skim milk with 5% of gelling agents: starch (100, 99.7, 99.4, 99.1, 98.8 and 98.5%) and κC (0, 0.3, 0.6, 0.9, 1.2 and 1.5%), by gelatinization and gelification. The milk gels were then 3D-printed in different geometries and evaluated in relation to shape and texture. The results showed that κC had a dominant effect compared to the DHT-modified starch on gel texture and 3D printing performance, while the DHT-modification had no significant difference to native starch. In addition, a small κC concentration is enough to improve the milk gel properties, whereas, as the κC concentration is increased, the printing quality decreases. The gels obtained by molding or 3D printing resulted in different texture behaviors, which was associated with the gel extrusion process that breaks down their initial structure. Some conditions were able to suit the dysphagic diet needs. In conclusion, this study demonstrated an approach to modify the milk gel texture by adding two different gelling agents, and that these agents act in different ways on the formation of gels and final textural properties, just like 3D printing technology.

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