Abstract

In recent years, the food industry has advanced with novel technologies, among which 3D Food Printing (3DFP) has gained considerable interest. This study investigates the effect of varying gelatin–iota-carrageenan concentrations on the textural and sensory properties of spinach gummies and their application in the 3DFP process. Results showed 8% formulation has no significant difference ($p>0.05$) in overall textural properties compared to commercial gummy. TPA results indicated a linear increase in hardness (11,715.66–22,945.33 g) and gumminess (9,996.37–19,235.00 g) with increasing hydrocolloid concentration, whereas springiness (0.96–0.97) and cohesiveness (0.84–0.85) showed no significant variation. The 8% formulation significantly achieved the highest ratings for taste (6.60) and overall liking (6.70), while the 12% formulation (F3) scored significantly lower in hardness, cohesiveness, gumminess, taste, and overall liking ($p<0.05$). The 8% formulation was also successfully 3D-printed using a 0.84 mm nozzle at 35°C, demonstrating good flowability and rapid gelation for structural stability. The layer-by-layer process of 3D food printing contributed to increased sensory perception of hardness and gumminess ($p<0.05$), although all textural attributes showed no significant differences ($p>0.05$) between 3D-printed and conventional gummy. Overall, 3DFP gummy received higher acceptance (7.47) compared to conventional gummy (6.4). While further experiments could greatly enhance the final quality of the 3DFP gummies, this study highlights promising opportunities for the practical application of gelatin and iota carrageenan in 3DFP gummy products.

Keywords: *3D Food Printing, gelatin, gummy, iota carrageenan, sensory evaluation, texture profile analysis*