World Academy of Science, Engineering and Technology
International Journal of Nutrition and Food Engineering
Vol:15, No:01, 2021

Chemical, Physical and Microbiological Characteristics of a Texture-Modified Beef- Based 3D Printed Functional Product

Authors : Elvan G. Bulut, Betul Goksun, Tugba G. Gun, Ozge Sakiyan Demirkol, Kamuran Ayhan, Kezban Candogan

Abstract : Dysphagia, difficulty in swallowing solid foods and thin liquids, is one of the common health threats among the elderly who require foods with modified texture in their diet. Although there are some commercial food formulations or hydrocolloids to thicken the liquid foods for dysphagic individuals, there is still a need for developing and offering new food products with enriched nutritional, textural and sensory characteristics to safely nourish these patients. 3D food printing is an appealing alternative in creating personalized foods for this purpose with attractive shape, soft and homogenous texture. In order to modify texture and prevent phase separation, hydrocolloids are generally used. In our laboratory, an optimized 3D printed beef-based formulation specifically for people with swallowing difficulties was developed based on the research project supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK Project # 218O017). The optimized formulation obtained from response surface methodology was 60% beef powder, 5.88% gelatin, and 0.74% kappa-carrageenan (all in a dry basis). This product was enriched with powders of freeze-dried beet, celery, and red capia pepper, butter, and whole milk. Proximate composition (moisture, fat, protein, and ash contents), pH value, CIE lightness (L*), redness (a*) and yellowness (b*), and color difference (ΔE*) values were determined. Counts of total mesophilic aerobic bacteria (TMAB), lactic acid bacteria (LAB), mold and yeast, total coliforms were conducted, and detection of coagulase positive S. aureus, E. coli, and Salmonella spp. were performed. The 3D printed products had 60.11% moisture, 16.51% fat, 13.68% protein, and 1.65% ash, and the pH value was 6.19, whereas the ΔE* value was 3.04. Counts of TMAB, LAB, mold and yeast and total coliforms before and after 3D printing were 5.23-5.41 log cfu/g, < 1 log cfu/g, < 1 log cfu/g, 2.39-2.15 log EMS/g, respectively. Coagulase positive S. aureus, E. coli, and Salmonella spp. were not detected in the products. The data obtained from this study based on determining some important product characteristics of functional beef-based formulation provides an encouraging basis for future research on the subject and should be useful in designing mass production of 3D printed products of similar composition.

Keywords : beef, dysphagia, product characteristics, texture-modified foods, 3D food printing
Conference Title : ICFTNS 2021 : International Conference on Food Technology and Nutrition Sciences
Conference Location : Paris, France
Conference Dates : January 25-26, 2021