Effect of high hydrostatic pressure with reduced content of sodium chloride and sodium phosphate on the physicochemical properties of chicken meat gels

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Introduction: Excess sodium (Na+) consumption is a worldwide public health problem, with an increasing amount of high-quality research showing the relationship between high sodium diet and hypertension, cardiovascular and renal diseases (Santos et al., 2019, Ritz et al., 2012). Processed foods are considered one of the main sources of dietary sodium and about 75% of the daily sodium intake comes from salt (sodium chloride). High pressure processing (HPP) has been the most adopted non-thermal processing technology in the food industry (high hydrostatic pressure, hydrodynamic pressure, high pressure homogenization). HPP is mostly applied as a cold pasteurization method to inactive vegetative spoilage and pathogenic microorganisms and to extend shelf-life, allowing the reduction of food waste (Bolumar et al., 2020). In this study, we applied the high hydrostatic pressure (HHP) technology for the improving functional properties of myofibrillar proteins that are mainly responsible for the texture, yield, and organoleptic characteristics of final meat products. The objective of this study was to investigate the effect of HHP treatment (0.1-200 MPa, 10 min, 20 °C) in combination with sodium addition on the physicochemical properties of chicken meat gels for the development of low sodium gel-based meat products.

Materials and methods: The chicken breast meat was used for meat gel preparation, according to the method of Maksimenko et al. (2019). Briefly, the minced chicken meat was mixed with various concentrations of sodium chloride (0-2%) and sodium pyrophosphate (0-0.3%) and subjected to HHP treatment at 0.1-200 MPa for 10 min using a high pressure food processor (Dr. CHEF, Kobe Steel, Japan). The water content (HG-63, Mettler Toledo, Switzerland), cooking losses, meat color (CR-400, Konica Minolta, Japan), protein composition by SDS-PAGE analysis, and texture parameters (Creep Meter RE2-33005B, Yamaden, Japan) of chicken meat gels were determined.

Results and discussion: The HHP treatment at 200 MPa in combination with sodium addition increased the water content ($p < 0.01$) and decreased the cooking losses ($p < 0.01$) of meat gels compared to unpressurized gels. HHP treatment at 150-200 MPa affected the color (L*, a*, and b* values) of meat gels ($p < 0.01$). In the SDS-PAGE analysis, the staining intensity of the α-actinin protein band was decreased in pressurized gels. Irrespective of the sodium content, HHP treatment at 150-200 MPa caused a significant change in the texture of meat gels compared to unpressurized gels. Texture attributes such as gel strength, modulus of elasticity, cohesiveness, and adhesiveness of low sodium meat gels were significantly improved by HHP treatment at 200 MPa ($p < 0.01$).

Conclusions: The present study confirmed that HHP treatment at 200 MPa was effective in producing low sodium chicken meat gels while providing high-quality textural properties.

Literature:

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