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# Effect of high pressure processing on the water holding capacity of sodium-reduced chicken breast myofibrillar protein gel containing $CaCl_2$ (#207)

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## Introduction

The development of sodium-reduced meat products is receiving considerable attention in meat industry. Gelation of myofibrillar protein (MP) is important for producing meat products with desirable water holding capacity (WHC). Calcium chloride ($CaCl_2$) has been used to substitute sodium chloride (NaCl) in the products. High pressure processing (HPP) could compensate for salt reduction in the products. However, the effect of HPP on WHC of MP gel with $CaCl_2$ needs to be elucidated to better use the combination (HPP and $CaCl_2$) for developing sodium-reduced meat products. The objective of this study was to investigate the effect of HPP (100-300 MPa) on the WHC of chicken breast MP with $CaCl_2$ (20 mM).

## Methods

MP was extracted from chicken breast meat, and the MP pellet was adjusted to a protein concentration of 50 mg/mL with 50 mM piperazine-N,N′-bis (2-ethanesulfonic acid) (PIPES) buffer (pH 6.25) containing 0.3 M NaCl and 20 mM $CaCl_2$ to generate MP-C suspensions. These suspensions were subjected to HPP and pressure levels were set at 100, 150, 200, 250, and 300 MPa. The suspensions were heated in a water bath (80°C) for 30 min to form gels.

The WHC was calculated as the percentage of the MP-C gel weight retained after centrifugation (10,000 ×g for 10 min at 4°C) relative to its original weight. The solubility was expressed as percent of protein concentration in the supernatant after centrifugation (10,000 ×g for 30 min at 4°C) with respect to that of MP-C suspensions before centrifugation. The soluble protein profiles of the supernatant after centrifugation were determined by SDS-PAGE using a precast 4–15% gel.

Comparison of multiple samples was conducted by ANOVA using SPSS 19 software (IBM). Values of $P< 0.05$ were considered to be statistically significant.

## Results

WHC

As shown in **Fig. 1**, the WHC of MP-C gels increased with elevated pressure from 0.1 to 200 MPa, whereas a significant ($P< 0.05$) decrease was observed when pressure levels were further increased. These results indicated that moderate HPP (≤200 MPa) could improve the WHC, but stronger HPP (>200 MPa) had a negative effect on the WHC.

Solubility

As presented in **Fig. 2**, the solubility of MP-C solutions increased with increasing pressure from 0.1 to 200 MPa, however, further increasing the pressure significantly ($P< 0.05$) decreased solubility. These were highly in accordance with the result of WHC (**Fig. 1**).

Soluble protein pattern

As shown in **Fig.3**, the major muscle protein profiles containing myosin heavy chain (MHC, 200 kDa) and actin (45 kDa) were presented in non-pressurized MP-C group. The intensities of MHC and actin became denser as pressure increased from 0.1 MPa to 200 MPa, followed by a decrease in intensities of both two bands when pressure levels were above 200 MPa. It was believed that the enhanced solubilized fractions of MHC and actin under 200 MPa were conducive to form a gel with improved WHC.

## Conclusion

Moderate HPP (approximately 200 MPa) increased the WHC of MP-C gels by promoting the solubilization of MHC and actin in MP. However, stronger HPP (>200 MPa) decreased the solubility of both proteins, thus significantly reducing the WHC values of MP-C gels. It is of interest to select low concentrations of $CaCl_2$ and moderate pressure to improve the functional properties of sodium-reduced meat products

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Notes

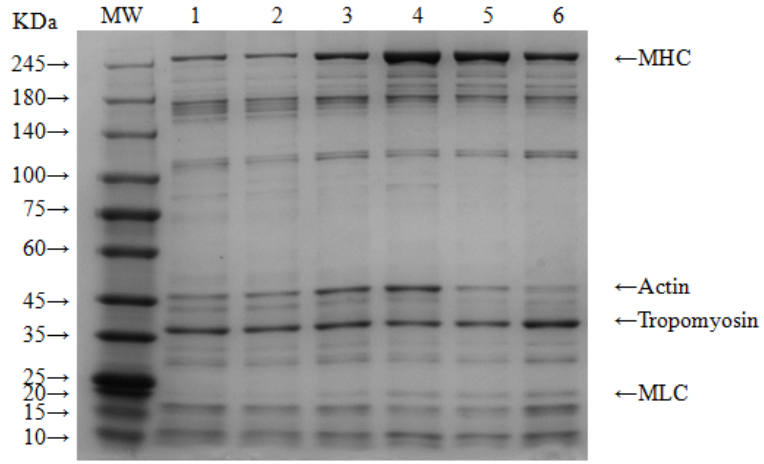


**Fig. 3. Effect of HPP on soluble protein profiles of MP-C.** MW: Molecular weight of markers; 1-6: Represents HPP of 0.1, 100, 150, 200, 250 and 300 MPa, respectivly; MHC: myosin heavy chain; MLC: myosin light chain.

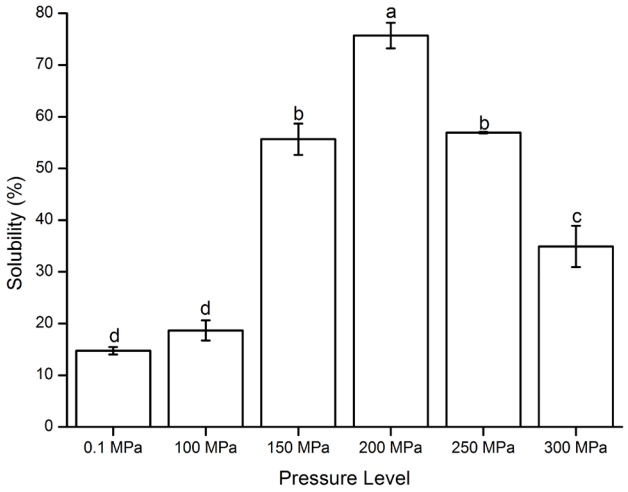


**Fig. 2. Effect of HPP on the solubility of MP-C.** Values with different letters are significantly different ($P<0.05$).

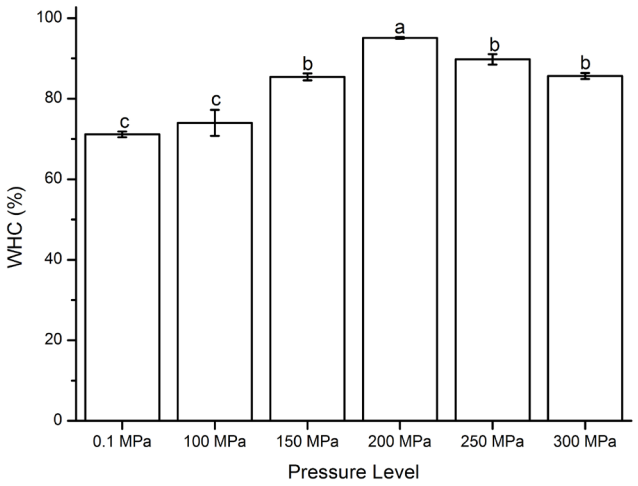


**Fig. 1. Effect of HPP on the WHC of MP-C gels.** Values with different letters are significantly different ($P<0.05$).

Notes