EFFECTS OF NaCl CONTENT ON FUNCTIONAL PROPERTIES OF WOODEN BREAST BROILER CHICKEN MEAT

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I. INTRODUCTION

With the increasing demand for poultry meat, broilers have been extensively selected for rapid growth and breast muscle yield [1]. However, this has been accompanied by an increasing incidence of wooden breast (WB) myopathy [2]. The WB condition is macroscopically characterized by diffused and hardened areas in the muscle, the caudal end of which exhibits pale ridge-like bulges [3]. WB has undesirable appearance and tough texture which reduces consumers' acceptability, causing huge economic losses to modern meat industry [1]. To determine the functional and technological properties of WB meat, the current study aimed to evaluate functional properties of WB chicken meat batters with different NaCl additions.

II. MATERIALS AND METHODS

Breast muscle samples were initially collected and assessed as normal or WB fillets with diffuse hardened areas and pale ridge-like bulges at the caudal end) based on the criteria described before [3]. After selection, samples were tagged, transported to the laboratory and held at 4°C. NOR and WB meat batters were prepared with 0, 1, 2, 3 or 4% NaCl (w/w). The procedure used for batter production was described below. Chicken breast meat was chopped in a chilled cutter (Grindomix GM 200, Retsch, Germany), at a speed of 3,000 rpm for 10 s, followed by the addition of iced water and salt and then chopped again at the same speed for 10 s, until the final protein content reached 150 mg/g. Salt-soluble protein (SSP), textural profile analysis (TPA) and water holding capacity (WHC) [4] measurements are performed for meat batters as previously described. Data analysis was performed by Student's t-test or Duncan's multiple range tests using SAS 9.12 (SAS Institute Inc., Cary, NC, USA, 2003).

III. RESULTS AND DISCUSSION

The content of SSPs for WB and NOR meat batters is shown in Fig. 1A. At 0% NaCl content, there was no significant difference between NOR and WB meat batters. The SSP contents of WB meat batters were significantly lower compared with NOR meat batters ($P < 0.05$) with 1% or 2% NaCl addition, which might result from insufficient swelling of the MPs in WB samples during chopping due to its different microstructure. However, when adding NaCl to 3% or 4%, the SSP contents of WB meat batters were higher than that of NOR meat ($P < 0.05$).

Regarding the protein profiles, NaCl content had a pronounced effect on the overall SDS-PAGE pattern of both sample groups (Fig. 1B). The myosin heavy chain (MHC) and actin, the most abundant MPs, appeared when NaCl content was higher than 3%. The proteins profiles of the extracted SSP were very similar between WB and NOR meat batters, except for the band intensity of MHC, with more MHC extracted at 3% NaCl content, and its partial degradation at 4% NaCl in the WB group compared to NOR group.

The WHC of meat batters prepared with various NaCl addition is shown in Fig. 1C. NaCl significantly affected WHC of both NOR and WB meat batters ($P < 0.05$). With the increasing addition of NaCl, the WHC significantly increased. In meat batters, the NOR groups had higher WHC than the WB groups before NaCl content reached 3% ($P < 0.05$). However, when the NaCl content reached 3% or more, no significant difference was observed between the two meat batters ($P < 0.05$).

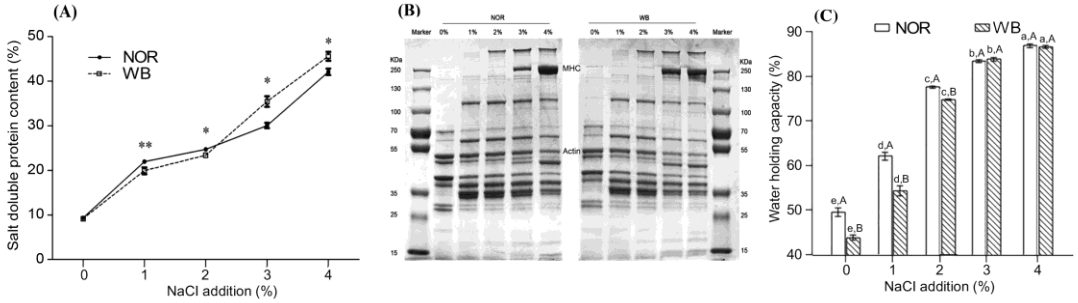

Figure 1. Effects of salt content on SSP content (A), SDS-Page profile (B) and WHC (C) of NOR and WB meat batters

The effects of NaCl on textural properties of the WB and NOR protein gels are shown in Table 1. The textural characteristics of the gels at different NaCl contents varied. The improved gel hardness was accompanied with increased NaCl addition from 0% to 4% (w/w) for both the NOR and WB batters. Hardness of gels prepared from WB meat batters was significantly lower compared with NORs at all NaCl additions.

Table 1 Texture profile analysis (TPA) of thermal-induced gels prepared from normal and wooden breast meat with various salt contents.

Treatment	NOR					WB				
Salt content (%)	0	1	2	3	4	0	1	2	3	4
Hardness (N)	783.0±2 2.6^{a,A}	998.7±3 7.0^{d,A}	2333.1±1 84.2^{c,A}	3316.4±1 36.7^{b,A}	3930.5± 66.3^{a,A}	590.7±1 9.5^{e,B}	679.5±2 2.5^{d,B}	1757.2± 51.9^{c,B}	2885.3± 63.4^{b,B}	3248.7± 81.7^{a,B}
Gummine ss	332.1±1 15.1^{d,A}	376.9±1 3.3^{d,A}	1258.8±1 56.8^{c,A}	2158.4±1 10.2^{b,A}	2680.0± 73.8^{a,A}	208.0±5 5.4^{d,B}	230.9±9 .9^{d,B}	861.8±4 2.7^{c,B}	1795.7± 57.0^{b,B}	2174.2± 54.3^{a,B}

IV. CONCLUSION

Increasing the NaCl content to 3% or higher enhances the swelling of MPs and increases SSP extraction, especially of MHC, thereby improving cooking yield. At 0%–2% NaCl addition, the cooking loss of WB meat batters was inferior to that of NOR. However, no significant changes were observed at 3% and 4% NaCl additions. The TPA results showed that the gels prepared from the WB were weaker compared with those prepared from the NOR at all NaCl contents. High NaCl content might be necessary for the solution of SSP and the formation of three-dimensional gel network of WB meat, which can trap water and increase the elasticity. In other words, WB may not be suitable to produce low-salt and gel-type meat products.

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