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EFFECT OF COOKING SYSTEM ON WARNER-BRATZLER SHEAR FORCE MEASURE IN POULTRY MEAT

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Abstract - Numerous studies report poultry meat tenderness results but the cooking methods are different (e.g. water bath, grill, oven). Quality assessment results of cooked meat can be significantly affected by sample preparation with different cooking techniques. The aim of this study was to investigate the effect of boiling water bath or grill on Warner-Bratzler shear force determination in poultry meat. Cooking loss, Warner-Bratzler shear force, pH, moisture, lipids and protein content were determined. According to our results, poultry meat tenderness was higher in samples cooked in grill than boiling water bath. Cooking loss, moisture and lipid content did not change.

I. INTRODUCTION

Meat tenderness evaluation is important to consumer appraisal. Numerous studies report tenderness results but cooking methods were different (e.g. water bath, grill, oven). Quality assessment results of cooked meat can be significantly affected by sample preparation with different cooking techniques (1). During heat treatment, meat hardness occurs due to myofibrillar proteins denaturation (40-50ºC), collagen contraction (60-70ºC) and actomyosin contraction and dehydration (70-90ºC) (2).

To obtain accurate and repeatable Warner-Bratzler shear force data it is necessary to be care with regard to various factors such as cooking methodology or core removal (3). There are several cooking systems proposed for Warner-Bratzler shear force determination. The American Meat Science Association (4) recommends two cooking procedures: roasting (oven) and broiling (open air broiler) to an internal temperature of 71ºC. Honikel (5) suggests cooking in a water bath (55, 65, 80 or 95ºC) for tenderness measurement. Moreover, whole poultry carcasses are usually roasted and excised meat is grilled (6).

The aim of this study was to investigate the effect of cooking system (boiling water bath or grill) on Warner-Bratzler shear force determination in *pectoralis major* poultry muscle.

II. MATERIALS AND METHODS

Pectoralis major muscle from poultry was collected at 24 h post-mortem from a commercial abattoir. Each breast was divided in 2 fillets (average weight: 213.7 ± 34.9 g; n: 32) and randomly assigned to each cooking method. Cooking procedures used were boiling water bath (each sample inside a hermetic plastic bag) and grill (Gorge Foreman, two cooking surfaces) at 170 ± 10ºC. The procedure was carried out until an internal temperature of 71°C was reached. When the end-point temperature had been attained, samples were removed and cooled in ice slurry. Time-temperature profile was recorded individually with a thermocouple inserted into the meat geometric centre (Yokogawa DX106-1-2).

Warner-Bratzler shear force (N) was determined using a texture analyzer (Stable Micro Systems TXT, UK) with a Warner-Bratzler cell. Four 1.27 cm round cores were obtained parallel to the muscle fiber (4). Cooking loss was calculated as the difference in samples weight before and after cooking, expressed as a percentage of the initial sample weight. Moisture, fat and protein were analyzed by AOAC (7). pH was measured with a pH-meter with puncture electrode.

A complete randomized block design was carried out. Analysis of variance with a significant level of 0.05 was performed using Statgraphics Centurion XV (StatPoint Tech, Inc., Warrenton, VA, USA).

III. RESULTS AND DISCUSSION

Raw muscle pH was 5.74 ± 0.17, moisture content: 75.26 ± 0.64%, lipid content: 2.87 ± 1.29% and protein content: 92.62 ± 2.26% (both on dry basis). These results are consistent with the data reported by Qiao *et al.* (8) and Pearson *et al.* (9), in poultry breast fillet. Values obtained after cooking are reported in Table 1. Shear force values were lower in grill than water bath treatment. This is consistent with the findings of Lyon & Lyon (10) in breast muscle cooked in water bath or belt grill oven. Likewise, beef (*longissimus dorsi*) cooked on iron grill pan resulted in lower shear force than water bath (11). Time-temperature profile for poultry meat heating is shown in Fig. 1. According to Ghita *et al.* (12) the best cooking conditions for chicken breast meat were found to be short cooking times and lower temperatures that led to a tender meat. In beef, Lawrence *et al.* (13) found that methods that used a shorter processing time resulted in a smaller number of myofibrillar protein and collagen per unit area to be sheared when comparing different cooking systems (oven, electric grill and belt grill). In the present study, the method with lower processing time (grill: 8 min vs water bath: 21 min) showed higher meat tenderness. After the heat treatment, no significant differences in cooking loss between cooking systems were found.

Table 1. Shear values (WB), cooking loss, moisture, lipids and protein content (dry basis) of *pectoralis* poultry meat cooked in water bath or grilled.

	Water bath	Grill
WB (N)	16.1±3.8[a]	13.0±2.6[b]
Cook. loss (%)	14.7±1.7[a]	16.4±2.9[a]
Moisture (%)	71.19±0.52[a]	70.66±0.70[a]
Lipids (%)	5.09±1.43[a]	5.04±1.58[a]
Protein (%)	90.15±2.00[a]	86.54±1.52[b]

a, b means within rows with different letters are significantly different (P<0.05).

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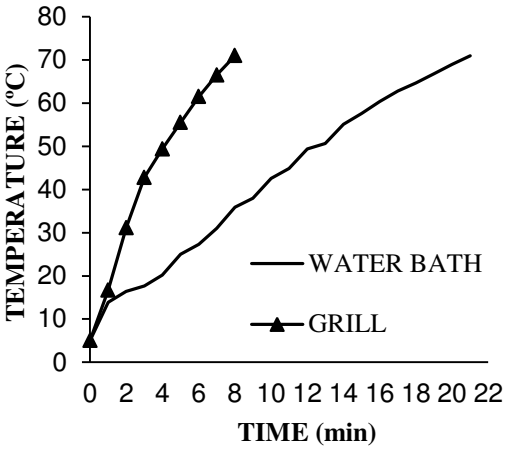

Figure 1. Time-temperature profile in *pectoralis* poultry meat cooked in water bath or grilled.

The raw meat showed higher moisture content than the cooked samples. Cooking produces an increase in palatability, digestibility and food security, and induces moisture reduction in meat (14, 15). No statistical differences were found in moisture and lipid content between treatments. Protein content was lower in grill than water bath, this is probably related with the slightly higher cooking loss (although no significant), observed in this treatment. In fish, comparing different cooking methods (baked, broiled, fried and microwave at 71°C internal temperature) it was found that the treatment with higher cooking loss had the lowest protein content (16).

IV. CONCLUSION

Grill cooked poultry meat showed lower shear force values and processing time than boiling water bath. Cooking loss, moisture and lipid content did not change due to the cooking system.

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