SHEAR FORCE AND COOKING WEIGHT LOSS OF BROILER MEAT SUBMITTED TO DIFFERENT COOKING METHODS

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Abstract – The aim of this study was to evaluate the efficiency of different methodologies of cooking and the storage time of samples to perform cooking weight loss and shear force tests (0 and 24 hours post-cooking), in breast, thighs and drumsticks samples. Ten carcasses of conventional Cobb lineage broilers were used. Water bath method provided the samples a significant increase in weight loss. There was an interaction (P<0.05) between the method of cooking and time post-cooking for shear force of breast and drumstick meat. Breast meat samples cooked in a grill and analyzed after 24 hours post-cooking were more tender than the others. Drumstick samples analyzed 24 hours post-cooking and cooked in water bath were more tender than the samples cooked in a grill. Between the samples cooked in grill, the samples analyzed 24 hours post-cooking were harder than the others. The cooking weight loss is higher when the water bath is used. To analyze shear force, chicken breast and drumsticks samples may be cooked both in a water bath and grill without altering the results, since the analysis is performed right after sample cooking and cooling.

Key Words – Breast, Drumstick, Thigh

I. INTRODUCTION

The cooking process comprises physicochemical changes between food components intentionally caused by the effect of heat transfer to improve their palatability and digestibility. In different cooking methods, the heat transfer forms, temperature and duration of the process are some of the factors responsible for changes which can alter the characteristics of a food [1]. Thus, the aim of this study was to evaluate the efficiency of different cooking methods and storage time of the samples for further cooking weight loss and shear force tests in commercial cuts of broiler carcasses.

II. MATERIALS AND METHODS

This study was developed in Technology Laboratory of Animal Products in São Paulo State University – UNESP, Jaboticabal, São Paulo, Brazil. Ten carcasses of Cobb lineage broilers were purchased from a commercial slaughterhouse and used in this study. After deboned, the *Pectoralis major* (breast), *Peroneus longus* (thigh) and *Biceps femoris* (drumstick) muscles were collected. The cooking weight loss (CWL) in water bath and grill and shear force were evaluated. To evaluate the CWL, samples were cooked in a water bath according to methodology described by Honikel [2]. For cooking on grill, samples were packed in aluminum foil and cooked in a preheated grill until they reached 75°C internal temperature, adapting methodology described by Honikel [2] for cooking on hot plates. From cooked samples, subsamples with known area (cm^2) were obtained and submitted to cut in Texture Analyser TA-XT2i texturometer coupled to Warner Bratzler device, which determined the shear force in kgf. Shear force was evaluated after sample cooking and cooling at room temperature (0 hours) and after 24 hours kept under refrigeration. For CWL statistical analysis, a completely randomized design with two treatments (water bath and grill) was performed in ten replications. To evaluate the shear force, a completely randomized design in 2x2 factorial, with two cooking methods and two testing time (0 to 24 hours post-cooking), in ten replications. Data were submitted to analysis of variance and means were compared by Tukey test (5%) using the SAS statistical program [3].

III. RESULTS AND DISCUSSION

Table 1 shows the cooking weight loss percents in breast, thigh and drumstick meat. Cooking in

water bath showed a significant increase of weight loss.

Table 1 Cooking weight loss (CWL) of Cobb broilers, submitted to different cooking methods

CWL (%)			
	Breast	Thigh	Drumstick
Water bath	29.48 A	35.87 A	36.54 A
Grill	19.89 B	26.26 B	32.18 B
P-value	<0.001	<0.001	<0.001
CV (%)	13.31	10.82	5.56

Averages followed by distinct letters differ according to Tukey's test. The following abbreviations are used: CV, coefficient of variation.

According Potter & Hotchkiss [4] the use of heat sources such as grill, heat the molecules of meat in successive layers, which primarily determines the coagulation of outside proteins, forming a wrapper that prevents loss of meat components to the outside before its internal temperature increases resulting in lower losses during cooking, as observed in this study.

There was an interaction ($P<0.05$) between cooking method and time post-cooking to shear force analysis from breast and drumstick meat (Table 2), whose breakdowns are shown in Table 3.

Table 2 Shear force (kgf/cm²) of breast, thigh and drumstick meat of Cobb broilers, submitted to different cooking methods

	Breast	Thigh	Drumstick
Cooking method (C)			
Water bath	1.769	1.826 B	2.769
Grill	1.797	3.615 A	3.844
Time post-cooking to analysis realization (T)			
0 hours	2.011	2.211 B	2.653
24 hours	1.555	3.230 A	3.959
P-value (C)	0.8590	<0.001	0.0024
P-value (T)	0.0104	<0.001	0.0005
P-value Int. (CxT)	0.0495	0.0841	0.0493
CV (%)	19.69	11.72	20.19

Averages followed by distinct letters differ according to Tukey's test. The following abbreviations are used: NS, not significant; CV, coefficient of variation.

There was significant difference between the tested methods for thigh meat. Cooking in water bath resulted in more tender meat than the samples cooked on grill.

Table 3 Breakdown of cooking method x time post-cooking to shear force analysis realization (kgf/cm²)

Breast		
	0 hours	24 hours
Water bath	1.829 Aa	1.708 Aa
Grill	2.192 Aa	1.403 Ab
Drumstick		
Water bath	2.433 Aa	3.104 Ba
Grill	2.873 Ab	4.815 Aa

Averages followed by distinct capital letters in the column are different according to Tukey's test. Averages followed by distinct lowercase letters in the row are different according to Tukey's test.

Thigh samples that remained in refrigerator for 24 hours presented lower tenderness than samples analyzed right after cooking, possibly due to a dryness derived from the low storage temperatures and also due to the small size of each sample.

For shear force of breast meat there was no difference between cooking methods, however, the samples cooked in grill and analyzed after 24 hours were more tender (Table 3).

The results of this study are even lower than those found by Scatolini et al. [5] who obtained, on average, 2.51 kgf for breast meat cooked in water bath.

Related to drumstick meat, samples analyzed 24 hours after cooking and cooked in water bath were more tender than samples cooked in grill.

Between samples cooked in grill, the samples analyzed 24 hours after cooking were also harder, possibly due to the sample size, associated to dryness produced by refrigerator temperature.

IV. CONCLUSION

Cooking in a water bath provides greater weight loss to samples. Samples of breast and drumsticks can be cooked both in water bath and grill without altering the analysis results, since they are made right after cooking and cooling of the samples. Samples of thigh should be cooked in a water bath and analyzed right after cooking and cooling.

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