THE INFLUENCE OF THE TEMPERATURE AND SCALDING TIME ON THE TEXTURAL PROFILE OF CHICKEN MEAT

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Abstract

The research had as a general objective the assessment of the determinant effects of the parameters involved in the scalding process on the textural profile (TPA) of chicken meat. In order to carry on the study and the experiments we have formed three experimental batches, the biological material was represented by the "ROSS 308" broiler, 42 days old. The slaughtering production line was the logistic basis that allowed both changing technological parameters involved in the stunning for the three experimental batches (L1=50°C, L2=54°C, L3=58°C) (with 50 chickens/experimental batch) and in obtaining the main anatomical portion (chest, upper thigh, lower thigh).

For achieving the texture profile, was used the dynamometer Lloyd LFP, meat samples being shaped as a cylinder with a ϕ = 45 mm. The analysis of force - time curve of the TPA instrumental method has leaded to the obtaining of six instrumental parameters (hardness, cohesiveness, adhesiveness, gumminess, springiness, chewiness).

Chest muscle meat samples harvested from the three experimental lots have been described by a medium hardness ranging between 8.51±1.160 – 13.82±1.124 N. Calculation of the cohesiveness highlighted the highest average on the chest muscle harvested from L1 batch (0.39±0.018), followed in a descended way by the muscle harvested from L2 batch (0.36±0.016) and L3 batch (0.31±0.027) for the same cut anatomical region. Medium values that describe the elasticity of the muscle samples, following the same trend in terms of ranking experimental batches, explainable fact, because springiness is a parameter produced by cohesiveness and hardness.

Key words: scalding, temperature, time

INTRODUCTION

Consecutive to poultry industrialization was manifested the need to increase the speed of the slaughtering flow through the progressive introduction of mechanization and then of automation of various technological processes, in the past few decades industrial poultry processing recorded considerable developments. From the view of the breeder and processor, this aspect presents only a positive economic substrate, but from the consumer's point of view, concomitant with the modernization of the slaughtering flow also appears negative effects on the quality of resulted carcasses and meat.

The analysis of the poultry meat texture profile was performed in different studies [4, 5, 3], the measurements being effectuated on meat samples with ϕ between 2 – 2.54 cm at a deformation of 70 % and a transversal speed between 50 and 100 mm/min. The major problems about the poultry meat texture manifests especially in PSE meat, caused by post-slaughter pH rapid decrease when the body temperature is high [6]. This condition leads to reducing the water holding capacity of the meat [2] by applying rapid cooling diminishes the consequences [1].

MATERIALS AND METHODS

In order to carry on the study and the experiments we have formed three experimental batches, the biological material was represented by the "ROSS 308" broiler, 42 days old. The slaughtering production line was the logistic basis that allowed both changing technological parameters involved in the stunning for the three experimental

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The manuscript was received: 25.02.2015
Accepted for publication: 31.03.2015

batches (L1=50°C, L2=54°C, L3=58°C) (with 50 chickens/experimental batch) and in obtaining the main anatomical portion (chest, upper thigh, lower thigh).

To effectuate the mechanical determination was used the dynamometer Lloyd LFP plus, meat samples being shaped like a cylinder with a ϕ and H of 20 mm, involving the usage of a pressing cylinder with flat surfaces, with ϕ = 45 mm. Sectioning the meat samples under a cylinder shape was effectuated at room temperature through pressing the samples with a cylinder parallel to the direction of muscle fibers. The actual measurement involved effecting a double compression, with an intermediate break between compressions of 5 s at a speed of 10mm/min. and a final deformation of 80% from the initial height of the meat sample under test.

The analysis of force - time curve of the TPA instrumental method has leaded to the obtaining of six instrumental parameters *(hardness, cohesiveness, adhesiveness, gumminess, springiness, chewiness)*, illustrating a sample of force-deformation curve and TPA parameters.

The data were processed with the help of integrated software NEXYGEN Ondio in dynamometer Llyod LFP plus, that allowed to register and direct calculating of the values of each descriptive textural parameter, expressed in the form of peaks.

RESULTS AND DISCUSSIONS

The description of the textural profile of analyzed meat samples, depending on the cut region and technological parameters of scalding conditions was effectuated through 6 parameters resulted after a mastication „simulation” of meat samples. Thus, chest muscle harvested from the three experimental batches was described by a medium hardness ranging between 8.51±1.160 – 13.82±1.124 N, (table 1).

Table 1 Descriptive parameters for chest muscle texture

	Specification	Exp. Batch	$\overline{X} \pm s_{\overline{x}}$	V%	Interpretation of differences T-Test (2-tailed)	
CHEST	Hardness (N)	L1	**10.19**±0.939	29.129	L1-L2	t = -2.402; p = 0.040*
		L2	**13.82**±1.124	25.737	L1-L3	t = -0.920; p = 0.382ns.
		L3	**8.51**±1.160	43.139	L2-L3	t = -3.302; p = 0.009**
	Cohesiveness	L1	**0.39**±0.018	14.785	L1-L2	t = 1.275; p = 0.234ns.
		L2	**0.36**±0.016	13.759	L1-L3	t = 2.599; p = 0.029*
		L3	**0.31**±0.027	28.000	L2-L3	t = 1.511; p = 0.165ns.
	Adhesiveness (J)	L1	**-8.40E-04**±3.73E-04	140.577	L1-L2	t = -0.617; p = 0.552ns.
		L2	**-5.10E-04**±2.71E-04	168.103	L1-L3	t = -0.979; p = 0.353ns.
		L3	**-5.01E-04**±8.09E-05	51.086	L2-L3	t = -0.028; p = 0.978ns.
	Gumminess (N)	L1	**5.59**±1.017	57.499	L1-L2	t = 0.894; p = 0.395ns.
		L2	**4.56**±0.276	19.094	L1-L3	t = 0.527; p = 0.611ns.
		L3	**5.02**±0.306	19.282	L2-L3	t = -1.119; p = 0.292ns.
	Springiness	L1	**0.55**±0.027	15.654	L1-L2	t = 1.746; p = 0.115ns.
		L2	**0.46**±0.049	33.825	L1-L3	t = 5.869; p = 0.000***
		L3	**0.31**±0.024	24.711	L2-L3	t = 2.545; p = 0.031*
	Chewiness (N)	L1	**2.90**±0.433	47.168	L1-L2	t = 0.979; p = 0.353ns.
		L2	**2.42**±0.159	20.722	L1-L3	t = -0.906; p = 0.388ns.
		L3	**3.26**±0.226	21.954	L2-L3	t = -2.931; p = 0.017*

T- test (2-tailed) –for each cut portion and textural profile parameter analyzed, compared to the experimental batches: ns. insignificant differences (p>0.05); * significant differences (p<0.05); ** distinct significant differences (p<0.01); *** really Significant differences (p<0.001).

The cohesiveness calculation highlighted the highest value on the chest muscle harvested from L1 chicken batch (0.39±0.018), followed in a descendent way by the muscle of L2 (0.36±0.016) and L3 (0.31±0.027) for the same cut anatomical region.

Descriptively, the gumminess of chest muscle was defined through a medium value interval between 4.56±0.276 – 5.59±1.017 N, that places the chest muscle coming from L2 chicken batch at upper pole value, while the lower value is attributed to chest muscle coming from L1 chicken batch.

The chewiness of muscle samples, being a parameter produced by springiness and gumminess, highlighted the medium values correspondent to chest muscle samples: 2.90±0.433 N on L1, 2.42±0.159 N for L2 and 3.26±0.226 N at L3.

Achieving the textural profile of the upper thigh harvested from chicken carcasses of the three experimental lots was highlighted through primary statistical estimators, mentioned in table 2. From the 6 analyzed parameters, medium hardness and cohesiveness of the meat samples expressed a hierarchy between batches similar to those obtained on chest muscle, ranging between 11.56±1.548 – 15.03±1.334 N, specific to meat hardness and 0.30±0.068 – 0.39±0.053 units for meat samples cohesiveness.

Physically measuring the adhesiveness, upper thigh muscle harvested from the three experimental batches was characterized by medium values ranged between -0.36±0.144 – -0.15±0.098 J, standing out a prominent increase of the values compared to a chest muscle of the chicken from all three experimental batches.

Table 2 Descriptive parameters for upper thigh texture

	Specification	Exp. Batch	$\overline{X} \pm s_{\overline{x}}$	V%	Interpretation of differences T-Test (2-tailed)	
UPPER THIGH	Hardness (N)	L1	**12.60**±1.878	47.150	L1-L2	t = -1.661; p = 0.131$^{ns.}$
		L2	**15.03**±1.334	28.061	L1-L3	t = -0.897; p = 0.393$^{ns.}$
		L3	**11.56**±1.548	42.359	L2-L3	t = -0.430; p = 0.677$^{ns.}$
	Cohesiveness	L1	**0.39**±0.053	42.502	L1-L2	t = 0.470; p = 0.650$^{ns.}$
		L2	**0.35**±0.039	34.939	L1-L3	t = 1.232; p = 0.249$^{ns.}$
		L3	**0.30**±0.068	71.008	L2-L3	t = 0.611; p = 0.557$^{ns.}$
	Adhesiveness (J)	L1	**-0.36**±0.144	125.151	L1-L2	t = -1.209; p = 0.257$^{ns.}$
		L2	**-0.15**±0.098	202.116	L1-L3	t = -0.261; p = 0.800$^{ns.}$
		L3	**-0.31**±0.149	152.882	L2-L3	t = 0.807; p = 0.441$^{ns.}$
	Gumminess (N)	L1	**4.75**±1.176	78.192	L1-L2	t = -0.441; p = 0.669$^{ns.}$
		L2	**5.29**±0.610	36.455	L1-L3	t = -0.746; p = 0.475$^{ns.}$
		L3	**6.19**±1.473	75.303	L2-L3	t = -0.509; p = 0.623$^{ns.}$
	Springiness	L1	**0.52**±0.072	43.231	L1-L2	t = -0.656; p = 0.528$^{ns.}$
		L2	**0.69**±0.206	94.162	L1-L3	t = -0.300; p = 0.771$^{ns.}$
		L3	**0.58**±0.154	84.767	L2-L3	t = 0.424; p = 0.682$^{ns.}$
	Chewiness (N)	L1	**3.16**±0.806	80.720	L1-L2	t = -0.866; p = 0.409$^{ns.}$
		L2	**4.35**±1.068	77.735	L1-L3	t = -0.888; p =0.398$^{ns.}$
		L3	**4.77**±1.379	91.320	L2-L3	t = -0.231; p =0.822$^{ns.}$

T- test (2-tailed) –for each cut portion and textural profile parameter analyzed, compared to the experimental batches: $^{ns.}$ insignificant differences (p>0.05); * significant differences (p<0.05); ** distinct significant differences (p<0.01); *** really Significant differences (p<0.001).

Lower thigh muscle of the meat samples harvested from the three experimental batches was described by a medium hardness ranging between 11.16±1.501 – 16.22±1.686 N, higher values to those determined in upper thigh muscle at the same experimental batches.

Descriptively, the lower thigh gumminess was described through an average interval ranging between 5.25±0.630 – 7.91±1.587 N, that places the muscle harvested from L3 batch at a value upper pole, while the lower pole is attributed to lower thigh muscle harvested from L1 chicken batch. The same trend is maintained also for lower thigh chewiness, correspondent average values ranging between 3.92±0.575 – 5.81±1.061 N (table 3).

Table 3 Descriptive parameters for lower thigh texture

	Specification	Exp. Batch	$\bar{X} \pm s_{\bar{x}}$	V%	Interpretation of differences T-Test (2-tailed)	
LOWER THIGH	Hardness (N)	L1	**16.22**±1.686	32.873	L1-L2	t = -2.013; p = 0.075$^{ns.}$
		L2	**11.88**±1.754	46.677	L1-L3	t = 0.372; p = 0.719$^{ns.}$
		L3	**11.16**±1.501	42.526	L2-L3	t = -1.889; p = 0.091$^{ns.}$
	Cohesiveness	L1	**0.42**±0.078	59.051	L1-L2	t = 0.914; p = 0.385$^{ns.}$
		L2	**0.32**±0.042	40.413	L1-L3	t = 0.999; p = 0.344$^{ns.}$
		L3	**0.30**±0.068	72.073	L2-L3	t = 0.356; p = 0.730$^{ns.}$
	Adhesiveness (J)	L1	**-0.31**±0.147	149.813	L1-L2	t = 0.495; p = 0.632$^{ns.}$
		L2	**-0.51**±0.484	299.350	L1-L3	t = 0.495; p = 0.632$^{ns.}$
		L3	**-0.03**±0.032	302.989	L2-L3	t = -2.041; p = 0.072$^{ns.}$
	Gumminess (N)	L1	**5.25**±0.630	37.959	L1-L2	t = -1.006; p = 0.341$^{ns.}$
		L2	**6.74**±1.111	52.152	L1-L3	t = -1.466; p = 0.177$^{ns.}$
		L3	**7.91**±1.587	63.441	L2-L3	t = -0.793; p = 0.448$^{ns.}$
	Springiness	L1	**0.43**±0.095	70.144	L1-L2	t = -0.433; p = 0.675$^{ns.}$
		L2	**0.55**±0.227	129.549	L1-L3	t = -0.169; p = 0.869$^{ns.}$
		L3	**0.47**±0.220	148.938	L2-L3	t = 0.248; p = 0.809$^{ns.}$
	Chewiness (N)	L1	**3.92**±0.575	46.392	L1-L2	t = -0.973; p = 0.356$^{ns.}$
		L2	**5.09** ±1.004	62.360	L1-L3	t = -1.472; p = 0.175$^{ns.}$
		L3	**5.81**±1.061	57.721	L2-L3	t = -0.564; p = 0.586$^{ns.}$

T- test (2-tailed) –for each cut portion and textural profile parameter analyzed, compared to the experimental batches: $^{ns.}$ insignificant differences (p>0.05); * significant differences (p<0.05); ** distinct significant differences (p<0.01); *** really significant differences (p<0.001).

CONCLUSIONS

From the textural profile perspective comparative between batches, chest muscle harvested from chicken carcasses L1 batch was favorable characterized due to high cohesiveness, gumminess and springiness consistent to intermediate hardness and chewiness and minimum adhesiveness, being ranked first in terms of textural quality, followed in a descendent way by the textural quality of meat harvested from L2 and L3 batches.

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