Influence of Tasting Spots on Texture of Chicken Breast Fillets

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Abstract: Despite the fact that a chicken breast is a single part, the fillet possesses different texture characteristics in different "tasting spots" within the fillet. The objective of this study was to identify differences in tasting spots on chicken breast fillets of large birds (4.0 – 5.5 kilogram) in their texture and sensory attributes. Researchers divided raw chicken fillets into two pieces, head and tail, and measured hardness using a texture analyzer. Non-trained participants rated sensory characteristics (appearance, initial taste, aroma, flavor, color, after taste, texture, overall quality, overall liking) of the cooked chicken breast fillets. Texture analyzer data showed that there was a significant difference in hardness between two different parts of the raw chicken breast fillet (head and tail). Also, analysis of the sensory attributes indicated a significant difference in liking of appearance and texture of the cooked fillet.

Keywords: Chicken breast fillet, Tasting spots, Texture, Hardness, Tenderness, Texture analyzer, Sensory evaluation.

INTRODUCTION

Texture is one of the crucial attributes for determining the sensory quality of foods (along with appearance, initial taste, aroma, flavor, color, after taste, overall quality, overall liking) [1]. The tenderness of meat products influences consumers' overall judgment of food quality [2]. With poultry meats, tenderness is the most important factor dictating food quality and consumer acceptability [3]. The texture of chicken breast is especially important because it is the most valuable part of the chicken carcass for Americans who prefer white chicken meat to dark [4].

In the effort of improving the texture of poultry, the way in which poultry is raised and aged has been changed in the last decade [5]. Chicken aging (typically ranging from 0 – 24 hours) has been thought to affect texture; specifically, if the aging time is too short or if the chicken carcasses are deboned too early, it increases the toughness of the meat [5]. According to Santos and colleagues (2004), the ideal period of aging for texture, cohesion and juiciness is eight hours for chicken breasts using the Pectoralis major muscle. Extensive research has determined that feed used for the chickens have a major impact on the texture of the flesh [6-8]. Various aqueous marinades, such as mung bean and sprouted mung bean powder, have a beneficial tenderizing effect and increased positive sensory analysis scores on chicken, potentially due to the effect proteolytic enzymes have on the meat fibers [9]. Furthermore, existing literature indicates that tenderness can be influenced via production factors (*i.e*. genetic structure, growth rates, feeding processes, gender of chickens) [10] and cooking techniques (*i.e*. margination or cooking method) [11-13]. However, little information exists about potential differences in texture that may occur in one chicken fillet and the corresponding impact those texture differences may have on consumers' sensory perception of that fillet.

This study hypothesized that chicken breast fillets of large broiler chickens (weight of birds before slaughter ranged from 4.0 – 5.5 kilogram) have various texture profiles at different areas in the fillet. Because of this, if the whole chicken breasts were processed and cooked the same, customers having the chicken breast fillet may sense the texture differently in the fillet based on which piece of the breast they eat first. Based on texture analyzer data from raw (uncooked) chicken breasts, this study sought to identify how chicken breast texture can vary within the same breast filet. In addition, the authors were interested to see if the texture differences that were found using the texture analyzer were recognizable to untrained panelists tasting the cooked chicken breasts in the sensory evaluation.

MATERIAL AND METHODOLOGY

Testing procedures were conducted in two parts. The first part tested the texture of the raw material through instrumental method. Researchers measured the hardness level of the five different spots of each raw chicken breast fillet (see Figure **1**) on a texture analyzer (Model CT3 Texture Analyzer, Brookfield, Middleboro, M. A., U.S.A.). The texture analyzer was

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equipped with a TA-52 MOHRS shear blade probe, designed for testing the hardness of meat, poultry, fish, and other similar products. The head and tail parts of the chicken breast was initially determined based on the shape of the each fillet. The rounded, more full shape on one end of the fillet determined the head of the fillet. The tail was determined by finding the end of the fillet that gradually came to a point, as shown in Figure **1**. Researchers measured five different spots for hardness, and the spots were taken in consistent order from the head part to the tail part on each individual breast. After measuring the hardness level using texture analyzer (in gram force), each fillet was cut into two pieces (head and tail) and prepared for consumer sensory analysis. In the second part of the test, sensory data was collected from untrained participants who tasted the either the head or tail parts of the chicken breast fillets. Testing details are as follows.

Raw Material

A total of 41 broiler chicken breast fillets were prepared by a commercial processor. The pre-slaughter weight of the chickens ranged from 4.0 – 5.5 kilogram. Since the breasts are cut into specified portion sizes using high-pressure water-jet cutting [14], each fillet had a similar shape and weight (approximately 150 grams). Researchers numbered each fillet and tracked them throughout the entire test process, from the texture analyzer through consumer sensory evaluation data collection.

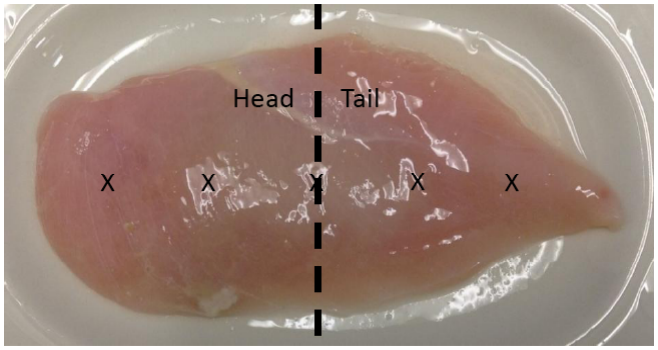

Figure 1: Texture Measuring and Cutting Points of Raw Chicken Breast Fillet.
The five points (marked as "x") of each raw fillet were selected. The first two and the last two points were measured for the hardness level. Samples were cooked and cut into the half on the middle point. The head and tail parts were served to two different participants.

Texture Analysis

Each raw chicken breast was measured individually for hardness level using a texture analyzer as recommended in the Brookfield's instruction manual. Texture Pro CT Software was used to collect the data. The analyzer was equipped with a 40.0 gram trigger load and was set to a 4.0 millimeter target value distance of penetration. The shear blade probe was used to measure the peak force of the first compression cycle. To compare differences in hardness level in different spots, five different points were selected in each fillet (see Figure **1**). Each point is equally spaced across the breast. We measure the first two points and the last two points to check if there are overall texture differences in one breast fillet between the head and the tail. To increase the accuracy of the hardness readings, researchers avoided any large areas of fat when they picked five measuring points. Researchers averaged the first two measurement points to determine the hardness of the fillet head, and averaged the last two measurement points to determine the hardness of the fillet tail. The middle point was used for cutting the filet in half after cooking to separate for sensory analysis.

Cooking Procedure

After the texture of each raw fillet had been analyzed, they were cooked immediately and served to sensory participants. Each fillet was grilled on a Char Broiler for four minutes on one side; the other side was cooked on a flat top grill for another four minutes until the inside temperature reached 73° Celsius (165° Fahrenheit). Each fillet was then cut in half based on the middle point (with each half being marked as a head or a tail) and served to two different participants. Each participant was served one half of a chicken breast fillet.

Sensory Analysis

A total of 82 participants were recruited via email listserv at a large university in the Northeast. Participants were untrained panelists resembling regular restaurant customers. Those with allergies or intolerances to chicken and those with known difficulties related to sensory testing were refrained from participating. Thirty-two of the participants (39.5%) were male. Age of the participants varied, and ranged from 18-65; additional age breakdowns of the participants can be found in Table **1**.

Chicken breast halves were randomly assigned to the participants; 41 participants received a fillet head, and the other 41 received the fillet tail. Each participant

was asked to observe, smell and taste the breast in order to evaluate the sensory properties of the chicken breast part they were given. Sensory evaluation sessions were conducted 20 minutes apart in order to give individual panelists enough time to taste and evaluate his or her fillet half. Each participant was asked to rate the sensory qualities of the breast fillet on a 9-point hedonic scale. One of the recruited participants was not able to finish the test; therefore, the total number of actual participants was 81.

Table 1: Participants' Age Distribution

Age Group	Frequency	Percent
18-24	12	14.8%
25-34	24	29.6%
35-44	10	12.3%
45-54	19	23.5%
55-65	16	19.8%
Total	81	100.0%

Statistical Analysis

SPSS (IBM SPSS Statistics19) was used to analyze texture analyzer data and sensory attributes. A paired t-test was used to compare the texture and sensory attributes between the head and tail part of the chicken breast fillet.

RESULTS AND DISCUSSION

Texture Analysis

Researchers used a paired t-test to compare hardness of the head and tail portions of the breast fillets. As mentioned earlier, each chicken fillet was cut into a half; researchers compared number averaged data points 1 and 2 of the head with number averaged data points 3 and 4 of the tail part. Table **2** shows the mean of hardness of head parts was 439.45 gram force (SD=91.66) and that of tail parts was 484.34 gram force (SD=134.72). The texture analyzer determined a significant texture difference between the head and tail of the filets ($M = -44.89$, $SD=121.30$, $t(40) = -2.37$, $p < 0.05$). This result suggested that the tail part of the chicken breast fillet showed significant higher hardness level compared to the head part through instrumental test.

Table 2: Mean Comparison for Hardness Level

	Head	Tail
Hardness level*	439.45± 91.66[a]	484.34± 134.72 [b]

* Hardness level unit: gram force (g)
[ab] Means within a row with different superscripts are significantly different ($p < 0.05$); n=41

Sensory Analysis

The sensory evaluation was conducted to verify the significant difference of the texture between the head and tail part through the instrumental method. Each participant tasted half of chicken breast fillet (either the head or tail part) and rated appearance, initial taste impression, liking of aroma, liking of flavor, liking of after taste, liking of texture, overall quality, and overall liking based on a 9 point hedonic scale (1-9, from dislike extremely to like extremely). All the chicken breast fillets are numbered and tracked. Paired t-test was conducted to compare the differences between the head and tail part of individual breast fillets. Overall, all sensory attributes indicated higher ratings for the fillet heads compared to the fillet tails. However, only liking of texture displayed statistically significant differences ($p=0.023$) in a paired t-test.

The summary of sensory attributes data can be found in Table **3**. As indicated previously, all of the means of sensory attributes of fillet heads were higher than those of fillet tails. This indicates participants prefer the sensory attributes of the head part to the tail part. To test the statistical significance, a paired t-test was conducted.

Table 3: Mean Comparison for Sensory Attributes

Sensory Attributes *	Head	Tail
Appearance	7.18±1.466[a]	6.53±1.724[b]
Initial Taste	7.18±1.394[a]	6.98±1.310[a]
Aroma	7.18±1.299[a]	6.85±1.210[a]
Flavor	7.28±1.377[a]	6.85±1.424[a]
After Taste	6.43±1.838[a]	6.20±1.454[a]
Texture	6.98±1.476[a]	6.28±1.552[b]
Overall Quality	7.08±1.575[a]	6.78±1.368[a]
Overall Liking	7.08±1.591[a]	6.78±1.250[a]

* Nine-point hedonic scale: 1=dislike extremely, 2=dislike very much, 3=dislike moderately, 4=dislike slightly, 5=neither like nor dislike, 6=like slightly, 7=like moderately, 8=like very much, 9=like extremely
[ab] Means within a row with different superscripts are significantly different ($p < 0.10$); n=40

Liking for appearance (t (39) = 1.742, p <0.10) and texture (t (39) = 2.082, p <0.05) showed a significant difference between the head and tail parts of a fillet using a paired t-test. Participants significantly prefer the appearance and the texture of the head part to the tail part. However, other sensory attributes (initial taste, aroma, flavor, after taste, overall quality, and overall liking) have no significant difference between the head and the tail parts. This indicates the participants did not recognize a significant difference in the other attributes except the appearance and the texture. Since the texture is an important index to determine the quality of poultry product, the researchers concluded that the significant difference in texture may indicate the meaningful result for many food processors. It is important to note that this result matches with the texture analyzer data result.

CONCLUSION

The texture of the chicken breast fillet is an important characteristic when determining the quality of, and preference for, the meat. The present study identified different texture profiles in individual chicken fillets. Based on the texture analyzer test result, we concluded that the tail part of a fillet has a tougher texture than the head part when the fillet is raw. This result is congruent with the sensory test results using non-trained participants. All of the sensory attributes (appearance, initial taste, aroma, flavor, after taste, texture, overall quality, overall liking) rated slightly higher by participants. However, only liking of appearance and texture had significant differences between the head and tail portions of the fillet; participants preferred the appearance and texture of the head portion to that of the tail portion.

The results of this study suggest that different cooking techniques may be needed for larger pre-slaughter weight chickens that range from 4.0 – 5.5 kilogram. Future studies may investigate the influence of different cooking techniques on tasting spots. Changing the cooking technique could reduce the sensory differences between the head and the tail that were detected by the texture analyzer and participants. This study results may also guide foodservice operations in their decision making process for purchasing poultry. Restaurants can consider purchasing smaller birds (1.0 – 2.0 kilogram) rather than larger birds for better texture and other sensory qualities. Future research conducted should compare and contrast the differences of texture and other sensory properties between the larger (over 5.5 kilogram) and smaller (1.0 – 2.0 kilogram) birds to see if differences exist.

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