QUANTITATIVE CHARACTERISATION OF CHICKEN BREAST OPTIMISED WITH DIFFERENT AMOUNTS OF BRINE

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Abstract

Chicken meat is considered an affordable source of high-quality protein and a complete provider of essential nutrients required for proper bodily functions. It has gained popularity not only in developed countries but especially in nations with growing economies. While the meat processing industry emphasizes the technological aspects of meat, consumers are keen on its sensory and nutritional attributes. This study aimed to characterize and compare three batches of chicken breast pastrami injected with three different brine percentages (5%, 8%, and 12%) in terms of physicochemical attributes (pH, colour, moisture, protein, lipid, and salt content) as well as sensory characteristics. The study results revealed significant differences between the pastrami batches concerning moisture and protein content ($p<0.05$). The brine percentage had a notable impact on the colour and pH properties of the meat products. In terms of cross-sectional colour, the data analysis indicated that meat samples injected with the higher LBI3 brine percentage exhibited increased lightness (73.13) and a more pronounced yellow hue (9.40) compared to the other two samples injected with 5% brine (70.97, and 8.90, respectively) and 8% brine (71.25, and 8.73, respectively). In terms of sensory evaluation, the samples were assessed for attributes such as colour, texture, juiciness, flavour, and overall acceptability. The batch of chicken breast pastrami injected with 8% brine (LBI2) received favourable scores for overall quality and colour, whereas the LBI3 batch distinguished itself with texture and juiciness, which were highly appreciated by the evaluators.

Key words: meat technology, chicken breast, brine injection

The increasing global population is driving a growing demand for animal protein on a global scale as efforts are made to meet the expanding protein needs of people. In this context, poultry meat consumption is steadily on the rise (Weimer L.S. *et al*, 2022). Modern consumers, in particular, exhibit a strong preference for the animal protein found in poultry meat, which has led to an increased focus on the quality of poultry meat products (Grasso A.C. *et al*, 2021).

In recent years, there has been a shift in consumer behaviour from the consumption of whole chickens to portioned chicken, with a particular emphasis on chicken breast fillets and processed products. These changes have been motivated by the need for convenience in meal preparation in today's fast-paced, industrialized era, as well as the desire to cater to consumer preferences for specific chicken parts (Nusairat B. *et al*, 2022). Different production methods have varying impacts on carcass and meat quality. The price of poultry meat is primarily influenced by the commercial characteristics of carcasses. While the meat processing industry emphasizes the technological aspects of meat, consumers are increasingly interested in the sensory and nutritional qualities of meat. The visual appearance of meat is also gaining importance. Health considerations remain a significant concern for all parties involved, from producers to consumers (Baéza E. *et al*, 2022).

For consumers seeking poultry meat with exceptional quality and sensory characteristics, the product range has expanded to include meat produced under the national food quality assurance program. Regarding the superior quality attributes of 'premium' meat, external sensory features, such as the absence of external hematomas and a colour ranging from light pink to pink, are taken into account, as well as physical attributes indicating meat safety and durability (Grzybowska-Brzezińska M. *et al*, 2023).

The objective of this study is to determine the physicochemical and sensory quality of three batches of poultry meat preparations with a compact structure, manufactured using the chicken breast pastrami production method, with the specification of injecting brine at three different percentages: 5%, 8%, and 12%.

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MATERIAL AND METHOD

The research material comprised three batches of chicken breast pastrami, with each sample batch containing six samples. The samples from each batch were utilized for assessing physicochemical characteristics such as pH, color, chemical composition, salt content, and for the analysis of sensory properties. The chicken breast underwent trimming, tendon removal, and was adjusted to a uniform weight. Subsequently, brine was prepared, consisting of water, ice flakes, and salt, within a double-walled electric kettle filled with glycerol.

The injection treatment involved brine injection at 5%, 8%, and 12%. An INWESPOL AN-10 machine equipped with ten needles was used for the injection process.

The pH analysis was conducted using a portable meat pH meter, Hanna model HI99163, by inserting the penetration electrode at three different points on each piece of pastrami. The instrument used for these measurements was pre-calibrated for pH values of 4 and 7. Between calibrations and readings, the instrument's electrode was cleaned with distilled water to prevent any influence on the results obtained.

Colour determinations of the chicken breast pastrami samples were performed using a colourimeter programmed with the CIE Lab* system (Konica Minolta CR-410T), which was calibrated before assessing the colour of each sample batch.

For the measurement of proximate chemical composition, which includes water, protein, fat, and salt content, approximately 100 g of each sample was finely shredded and placed in a Petri dish. The proportions of the mentioned parameters were determined via near-infrared transmission spectroscopy using a FoodCheck analyzer.

For the sensory analysis, the samples were sliced into uniform pieces and stored under refrigerated conditions until the actual analysis. Descriptive sensory testing was conducted with the voluntary participation of a group of 5 evaluators, each possessing moderate experience in sensory profiling. These evaluators were pre-trained on attributes that could effectively describe the samples being assessed. They individually analyzed sensory attributes, including colour, odour, aroma, texture, juiciness, and overall impression for each sample. Scores were assigned on a scale ranging from 0 (no perception) to 100 (highly perceptible).

The results obtained for the physicochemical parameters, along with the findings from the sensory analysis, were subjected to ANOVA statistical testing, and mean values were compared using Tukey's test at a significance level of 5% ($p < 0.05$).

RESULTS AND DISCUSSIONS

The average pH values observed in the chicken breast pastrami samples, post-heat treatment, fell within the range of 5.15 to 5.79 (*table 1*). Notably, the percentage of injected brine significantly influenced the pH value, with sample LBI3, injected with 12% brine, demonstrating a pronounced increase in acidity. pH serves as a quantifiable indicator of a food product's acid-base equilibrium. The observed slight elevation in pH value can be attributed to the heightened salt content incorporated into the product. It is well-established that salts exert an influence on the acidity-alkalinity balance in meat.

For comparison, Kim Y. *et al* (2015) reported pH values of 6.31±0.05 for injected and heat-treated chicken breast, which were notably higher than those observed in the present study. Results consistent with the findings of the present study were reported by Ha H. *et al* (2019), who documented pH values of 6.15±0.01 for a control sample of chicken breast that underwent a 30% brine injection.

In terms of colour attributes, both surface and cross-sectional analyses indicated that the sample injected with the highest brine percentage (12%) exhibited markedly higher lightness (L*) values (46.640 ± 0.959 and 73.128 ± 1.390, respectively), with a statistically significant distinction from the remaining results. The escalation in meat lightness with the increasing percentage of injected brine can be attributed to the dilution effect that occurs following brine injection, which introduces water and salts. Furthermore, the resultant meat colour is perceptibly influenced by the volume of salt incorporated. In parallel with the changes in lightness, the mean values for parameter b* (yellow-blue) exhibited a discernible increase solely in the case of the 12% brine-injected sample, while the 5% and 8% injection batches displayed negligible distinctions.

In terms of the colour parameter a*, there was a notable decrease in the intensity of the red hue, observed with the progressive rise in injection percentage. This phenomenon was apparent on both the product surface and in the cross-section, where values transitioned from 2.980±0.730 and 2.110±0.711, respectively, to a level of 1.780±0.506 and 1.670±0.311, respectively (*table 1*). However, statistically significant differences ($p<0.05$) were only discerned for the LBI3 sample.

Similar outcomes were observed in a study conducted by Kim D. H. *et al* (2021), where an increase in lightness (L*) and b* values, coupled with lower a* parameter values, was noted following the injection of beef with a 30% brine, as compared to an uninjected control sample. Kim Y. *et al* (2015) reported values for lightness (L*) similar to those observed in our study, at 70.59±2.66, but exhibited

higher values for a* (4.83±0.72) and b* (23.56±0.93) for injection-marinated chicken breast.

Chotyakul N. and Tanakamolpradit T. (2023) documented a comparable trend in colour parameters L* and b*, with values increasing as the injection percentage elevated from 10% (L*=73.79±0.64, b*=14.95±0.39) to 20% brine (L*=77.86±1.59, b*=15.21 0.29).

Contrastingly, Luckose F. *et al* (2017) reported a divergent phenomenon in the context of chicken jerky production. In their study, the application of salting and drying treatments led to results opposite to those obtained in our research, where injection salting and smoking heat treatments were employed. These authors noted that a reduction in salt content, in conjunction with high drying temperatures, resulted in increased lightness (L*) and decreased a* values. This effect was attributed to Maillard reactions and the reduction of myoglobin and metmyoglobin during the drying process.

Table 1

pH and colour of injected chicken breast pastrami

		Section colour			Surface colour		
	pH	***L****	***a****	***b****	***L****	***a****	***b****
LBI1	5.752±0.290^{a}	70.974±2.822^{a}	2.110±0.711^{b}	8.902±0.961^{a}	43.140±1.335^{a}	2.980±0.730^{b}	14.720±1.198^{ab}
LBI2	5.798±0.210^{a}	71.250±1.922^{a}	2.080±0.228^{b}	8.730±0.272^{a}	43.216±0.868^{a}	2.740±0.472^{b}	13.760±0.470^{a}
LBI3	6.156±0.097^{b}	73.128±1.390^{b}	1.670±0.311^{a}	9.400±0254^{a}	46.640±0.959^{b}	1.780±0.506^{a}	15.380±0.589^{b}

a, b, c, - The same superscript letter within the same column means there is no significant difference between any two means (p>0.05).
L * = Lightness, a * = redness, b * = yellowness; LBI1 – Brine injection 5%; LBI2 – Brine injection 8%; LBI3 – Brine injection 12%.

The proximate analysis results of the chicken breast patrami according to the injected concentration are presented in *table 2*. The moisture content of the three samples fell within the range of 74.32% to 76.82%. Notably, the moisture content of the starch samples exhibited an increasing tendency in direct proportion to the increasing percentage of brine injected, with the highest moisture level observed in the sample subjected to 12% brine injection (LBI3).

The lipid content of the chicken breast samples remained largely unaffected by the injection parameters (p>0.05). The lipid content ranged from 1.48% (LBI2) to 1.66% (LBI1). These findings align with those reported by Ha H. *et al* (2019) in their study, where chicken breast injected resulted in a lipid content of 1.59±0.25% for the control sample within their research.

In the case of chicken pastrami, the protein content displayed a diminishing trend with increasing injection percentages, with statistically significant differences (p<0.05) observed only in the instance of sample LBI1, which exhibited the highest protein level at 21.75%. This variance in protein content can be attributed to the capacity of brine to facilitate the solubilization of certain meat proteins. This effect stems from the denaturation process undergone by proteins in the presence of salts and water within the brine. Moreover, during the brine injection procedure, some proteins may be leached or washed out from the meat, potentially leading to a reduction in overall protein content.

The results derived from the chemical analysis in this study yielded values lower than those presented by Kim Y. *et al* (2015), who conducted a comparative study of three chicken breast maturation methods (tumbling, tenderization, and injection). Kim Y. *et al* (2015) reported moisture levels of 73.77% and a protein content of 22.86% for injected samples. In contrast, the samples in the current study exhibited higher levels of fat and salt compared to the findings of Kim Y. *et al* (2015). The salt content exhibited a subtle increase that was directly proportional to the increased percentage of brine injection. However, statistically, the differences observed between the three sample batches were not deemed significant (p>0.05).

Table 2

Proximate analysis of brine injected chicken breast patrami

	Moisture	Fat	Proteins	Salt
LBI1	74.320±0.334^{a}	1.660±0.167^{a}	21.750±0.418^{a}	1.608±0.391^{a}
LBI2	75.420±0.909^{a}	1.480±0.178^{a}	20.540±0.219^{b}	1.708±0.285^{a}
LBI3	76.820±0.936^{b}	1.620±0.083^{a}	19.260±0.180^{b}	1.802±0.122^{a}

a, b, c, - The same superscript letter within the same column means there is no significant difference between any two means (p>0.05).
LBI1 – Brine injection 5%; LBI2 – Brine injection 8%; LBI3 – Brine injection 12%.

The analysis of the descriptive profile of chicken breast pastrami yielded pertinent outcomes for characterizing the sensory quality of the investigated products. *Figure 1* illustrates the mean results achieved by aggregating the scores provided by five evaluators during the sensory evaluation session.

A comprehensive assessment of the average results for the sensory attributes assessed reveals a relatively harmonious sensory profile among the three product batches studied. Generally, the

distinctions observed between the LBI1, LBI2, and LBI3 batches were less pronounced for attributes associated with aroma (6.58 points), colour (8.98 points), and overall acceptability (8.87 points), and slightly more significant for texture (14 points) and juiciness (14.5 points). In the context of these scores, it was discerned that the most substantial disparities resulting from the injected brine volume were discernible in the realm of textural attributes, with juiciness being particularly affected.

In regards to the overall acceptability of the products within each analyzed batch, it is notable that the LBI2 batch obtained the highest scores, tallying 80.12 points, followed by the LBI1 batch with 75.58 points, while the L3 batch achieved a score of 80.12 points.

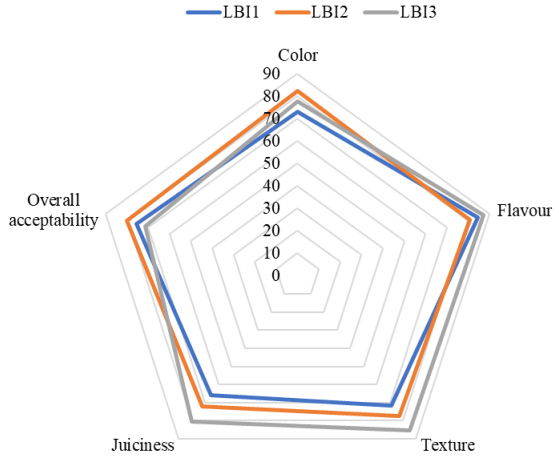

Figure 1 **Sensory traits of chicken breast pastrami**

CONCLUSIONS

The study has revealed that brine injection and heat treatment can exert a considerable influence on the physicochemical and colour characteristics of chicken breast pastrami. These changes are influenced by the percentage of brine used and may vary depending on the specific preparation methods.

The pH values of the samples demonstrate variance in response to the brine percentage injected, with a conspicuous trend towards heightened acidity (a reduction in pH values), particularly evident in the sample injected with 12% brine. This escalation in acidity can be ascribed to the amplified quantity of salt introduced into the product through the brine mixture. The colouration of the samples is significantly influenced by the brine injection percentage, with an increasing percentage of injection correlating with increased lightness (L*) and yellow-blue coordinate (b*), alongside a decrease in the a* colour parameter.

In terms of chemical composition, the brine injection process exerts a marked influence on the moisture and protein content of chicken pastrami, while demonstrating no statistically significant impact on fat and salt content.

Chicken breast pastrami, subjected to varying brine injection percentages, displayed noticeable disparities in terms of texture and juiciness. However, a relatively evenhanded sensory profile was observed concerning attributes such as flavour, colour, and overall acceptability. Among the batches, LBI2 garnered favourable evaluations regarding the overall impression. These findings underscore the noteworthy impact that selecting an appropriate brine percentage can have on the sensory quality of the product.

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