INFLUENCES OF DIFFERENT HEATING CONDITIONS ON THE QUALITY OF NATIVE CHICKEN ESSENCE

Y. C. Lin, C. F. Chen, and F. J. Tan*
Department of Animal Science, National Chung Hsing University, Taiwan
*Corresponding author email: tanfj@dragon.nchu.edu.tw

Abstract – In this study, the different heating conditions of chicken essence were evaluated. The yield (%) was increased when heating at higher temperature and longer time. Moisture decreased with increasing temperature, but the ash and crude protein increased with increasing time. No significant differences were observed in the L* value of the samples between treatments, whereas the a* value was increased with increasing time, and the b* value was increased with increasing temperature and time. Total collagen content, essential amino acid, and total amino acid of native chicken essence were increased with increasing temperature and time. For the consumer and descriptive sensory evaluation, the highest scores of color, aroma, flavor and total acceptability were observed on the essence heated with high temperature and short time.

Key Words – chicken essence, temperature, time.

I. INTRODUCTION

Meat essences, particularly chicken essence, are commonly consumed in many Asian counties [1]. It is considered to provide nutrition, improve the athlete's physical fitness, quickly recovery, and enhance cognitive performance, particularly learning and memory. Heating condition including temperature and time are regarded as the important factors which influence chicken extraction; it also affects flavors of chicken essence. Therefore, this study was designed to compare the nutritional composition and taste-related compounds in the different heating condition of chicken essence.

II. MATERIALS AND METHODS

Preparation of broths

Forty-eight Taiwan native chickens were purchased from the local market. Carcasses were frozen in -20˚C and thawed 4˚C 48 h before use. After washing and removed of head, neck, caudal, claws, fat, kidneys and blood stains, carcasses were cut into eight pieces. Then, the carcasses were extracted to form chicken essence using a high-pressure autoclave. There were 4 treatments, including 115˚C for 6 h (HL), 115˚C for 4 h (HS), 105˚C for 6 h (LL) and 105˚C for 4 h (LS). After extraction, the upper layer of fat was discarded and filtered to remove residual oil and impurities. The samples were then packed and sterilized at 100˚C for 30 min, and then frozen at -20˚C for further analysis.

Physical and chemical analysis

1. Proximate analysis
   It was conducted to analyze the contents of water, crude protein, crude fat and ash according to the methods by AOAC [2].
2. The pH value
   10 mL sample was determined by digital pH meter (Suntex, TS-1, Taichung, Taiwan).
3. L*, a*, b* value
   For the instrumental color measurements, the L* (lightness), a* (redness) and b* (yellowness) values of samples were measured using a colorimeter (Nippon Denshoku Ze 2000, Japan).
4. Total collagen content
   The total collagen content was measured at 532 nm using a spectrophotometer (Spectrophotometer U-2900, Hitachi, Japan) according to the methods described by Kong *et al.* [3]. The total collagen content (mg/g) was calculated from the hydroxyproline content using a coefficient of 7.25.
5. Free amino acid content
   The free amino acid content was analyzed using the method described by Simpson *et al*. [4] with some modifications using HPLC.
6. Sensory evaluation

Consumer hedonic sensory characteristics including color, odor, flavor, viscosity and overall acceptance of samples were evaluated base on a 5-point scale, in which 1 = extremely dislike and 7 = extremely like. Descriptive sensory evaluation including color, meat odor, rancid odor, off-flavor, umami flavor, rancid flavor, bitter taste, viscosity, residual sense and total acceptability was also evaluated. Each item was base on a 7-point scale, in which 1 = the lowest intensity, the lightest color and the lowest overall acceptance.

III. RESULTS AND DISCUSSION

Figure 1 shows that the yield of the native chicken essence was increased with increasing temperature and time.

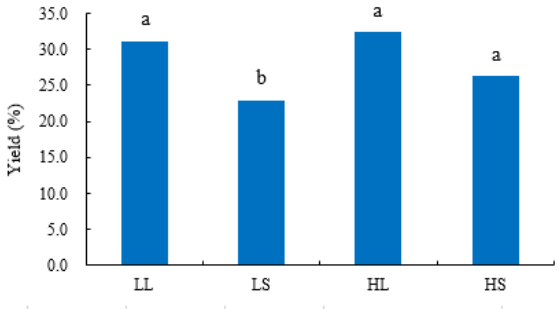

Figure 1. Yield (%) in native chicken essence. 105˚C / 6 h (LL), 105˚C / 4 h (LS), 115˚C / 6 h (HL), and 105˚C / 4 h (HS). Letters (a, b) denote significant difference (P<0.05) between treatments.

According to Bertola *et al.* [5], when the temperature increased, the denaturation of myosin and actin leading to the structural changes and expelled the sarcoplasmic fluid from the muscle fibers, as a results the water losses from meat tissue. In current study, the chicken essence heated with HL tended to have the highest yield.

The moisture, protein, and ash contents are shown in Table 1. The moisture content was decreased with increasing temperature, whereas the percentages of ash and crude protein were increased. The percentage of crude fat content was lower than 1% in all samples, and there were no significant differences between heating treatments (P>0.05); it might be because of most of the fat was removed before processing. The result of the proximate composition in this study was in agreement with Huang [6].

Table 1. Proximate composition in the chicken essence

Item	LL	LS	HL	HS
Moisture (%)	94.37 ± 0.14 ^{a}	93.48 ± 0.06 ^{ab}	92.62 ± 0.06 ^{b}	93.32 ± 0.08 ^{b}
Crude protein (%)	5.16 ± 0.20 ^{c}	5.24 ± 0.17 ^{c}	7.09 ± 0.34 ^{a}	5.83 ± 0.04 ^{b}
Crude fat (%)	0.74 ± 0.06 ^{a}	0.81 ± 0.06 ^{a}	0.83 ± 0.05 ^{a}	0.78 ± 0.06 ^{a}
Ash (%)	0.81 ± 0.07 ^{b}	0.94 ± 0.08 ^{ab}	0.99 ± 0.10 ^{a}	0.89 ± 0.04 ^{ab}

$^{a-c}$ Means with different superscripts in the same row are significant differences (P < 0.05).

The HL sample had significantly lower L* value than LS sample. However, the b* value was increased with increasing temperature and time, whereas the a* value was increased with increasing heating time. The LS sample had the highest L* value and the lowest of a* and b* values (Fig. 2).

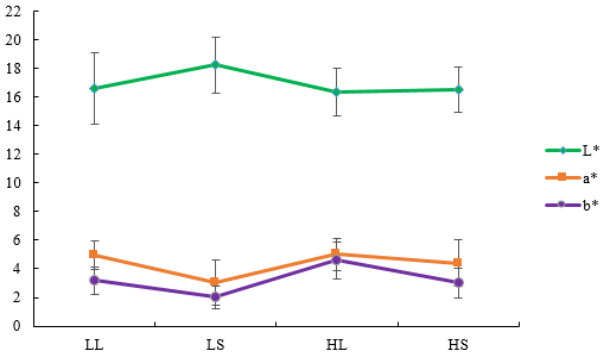

Figure 2. L*, a*, and b* values of native chicken essence. 105˚C / 6 h (LL), 105˚C / 4 h (LS), 115˚C / 6 h (HL), and 105˚C / 4 h (HS)

Figure 3 showed the total collagen content of the native chicken essences was increased with increasing temperature and time. The highest collagen content was observed in HL sample.

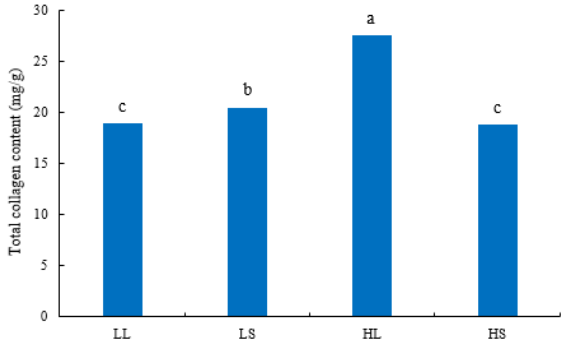

Figure 3. Total collagen content of the native chicken essence. 105˚C / 6 h (LL), 105˚C / 4 h (LS), 115˚C / 6 h

(HL), and 105˚C / 4 h (HS). Letters (a, b, c) denote significant difference (P<0.05) between treatments.

Table 2 shows the free amino acid content (mg/100g) of the chicken essence. The total amino acid and essential amino acid contents were increased with increasing temperature and time. It was observed that the highest total amino acid and essential amino acid content in HL treatment. Free amino acids are important factor for flavor development. For example, amino acids such as glycine, alanine, lysine, and serine have been shown to be associated with sweet flavor, whereas glutamic and aspartic acid contribute to the umami taste of meat. On the other hand, valine, isoleucine, leucine, phenylalanine, methionine, arginine, and histidine are associated with bitter tastes [7]. In the current study, HL sample had more amino acid contents which associated with the bitter taste than the others. On the other hand, HS treatment had the highest umami and sweet flavor factors, as well as the highest anserine and carnosine.

Table 2. Free amino acid content (mg/100g) in chicken essence

Free amino acid	LL	LS	HL	HS
Aspartic Acid	214.2	212.8	307.6	233
Glutamic acid	484.1	505.8	665	547.5
Cystine	0	0	0	16.6
Serine	100.3	103.4	136.9	109.8
Histidine	127.5	139.3	155.5	156.2
Glycine	671.2	630.9	1015	676.5
Threonine	73.5	77.8	106.1	85.2
Arginine	593.8	665.1	758.3	716.5
Alanine	302.2	296.9	426.9	319.2
Tyrosine	26.1	28.7	38.8	28.7
Valine	96.6	99.8	127.5	106.2
Methionine	10.9	15.6	30.6	28
Tryptophan	34.2	14.4	54.1	40.7
Phenylalanine	74.6	76.2	107.7	83.4
Isoleucine	49.2	54.4	78.3	60.9
Leucine	111.3	115.5	170.3	128.5
Lysine	179.6	193.5	256.7	215.5
Proline	242.4	217.6	358.0	245.6
Taurine	102.7	132.4	123.9	119.9
Anserine	377.1	472.6	507.2	518.4
Carnosine	138.6	155.4	165.1	171.7
Essential amino acid	1277.1	1373.8	1739.0	1535.9
Total content	4010.0	4208.0	5589.4	4608.1

The results of the consumer hedonic sensory evaluation in native chicken essences are shown on Figure. 4. LL and HS samples had higher scores in color and aroma attributes than HL and LS samples.

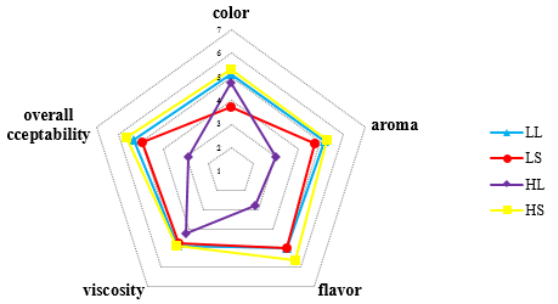

Figure 4. Consumer hedonic sensory evaluation of the native chicken essence.

In the flavor and total acceptability, consumer preferred HS sample than the others. This result might be because LS sample had the lowest color, aroma and flavor. On the other hand, HL sample was heated with the higher temperature and long time, which might cause the essence became burnt and had bitter taste, leading to the decreased score.

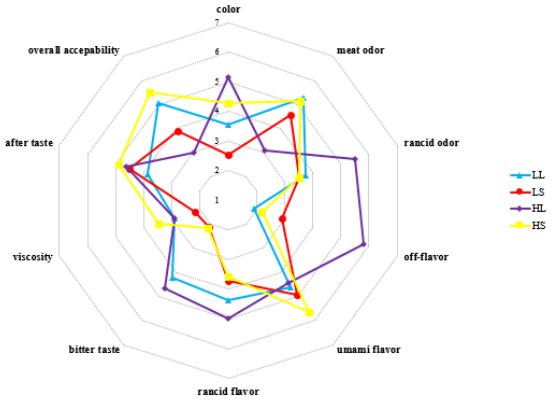

Figure 5. Descriptive sensory evaluation of the native chicken essence.

Figure 5 show the descriptive sensory evaluation in the native chicken essence. The color became darker with increasing temperature and time. The lowest score of meat odor was observed in HL sample. HL sample had the highest score of rancid odor, off-flavor, rancid flavor, and bitter taste. The results were similar to the consumer hedonic sensory evaluation one; the sample heated with high temperature and long time had decreased scores. On the other hand, the best performance of meat odor, umami flavor, viscosity, residual sense

and total acceptability were observed in HS sample.

IV. CONCLUSION

The highest percentage of the yield, crude protein and total collagen content were observed in the essence heated with 115˚C for 6 h (HL). The fat content was lower than 1% in all samples. The essence heated with 105˚C for 4 h (LS) had the highest lightness value as well as the lowest redness and yellowness values. The contents of total collagen content and total amino acid of the native chicken essence were increased with heating temperature and time. For the consumer hedonic sensory evaluation and descriptive sensory evaluation, HS sample performed the best, whereas HL sample showed the lowest ones. Overall, this study demonstrated that the difference of heating temperature and time significantly affected the physicochemical and sensory characteristics of the native chicken essence.

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