EFFECTS OF COLLAGEN AND MECHANICALLY DEBONED CHICKEN MEAT ON QUALITY CHARACTERISTICS OF SEMI-DRIED CHICKEN JERKY

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Abstract – This study was to evaluate the effects of collagen and mechanically deboned chicken meat (MDCM) on quality characteristics of semi-dried chicken jerky (restructured chicken jerky). The restructured chicken jerky were formulated with 10% MDCM based on total weight. Restructured chicken jerky was produced with three different formulations containing 1, 2, and 3% collagen addition. The quality characteristics improved with increasing amounts of collagen. In particular, the shear force and processing yield was significantly improved. Thus, we concluded that collagen powder is useful source to supplement negative effects of MDCM.

Key Words – restructured, tumbling, snack

I. INTRODUCTION

In Korea, jerky traditionally has been made as thin shape from whole muscles through marination and drying processing (An *et al*., 2010). Recently, the various types of jerky such as slice and stick etc. have been developed due to demand for consumer preferences (Thomas *et al*., 2007). Especially, restructured jerky prepared with ground meat have a lower price and usability of consumption. Thus, meat product manufactures are possible to decrease production costs and can be can make the figuration of the product size and shape for mass production (An *et al*., 2010).

Mechanically deboned chicken meat (MDCM) is obtained from the remaining chicken extruded by using machine to seperate the chicken bones, thus MDCM have relatively inexpensive as a by-product in industrial use, because the prices of manufactured end products can be reduced [3]. But, addition of MDCM into meat products have the negative effects, including acceleration of lipid oxidation and reduced processing suitability which results in decreased textural properties of the final product (Pereira *et al*., 2011).

Collagen, which is mainly obtained from the skin and connective tissue of animal, is a structural protein. In wide range of industrial fields, collagen has been used as functional materials due to several advantages, such as anti-aging, antihypertensice, and carcinostatic effects(Gómez-Guillén *et al*., 2011). In addition, collagen have funtional properties, which are the ability to form a gel and emulsion, its water binding capacity, antimicrobial, and antioxidant properties in foods, so many studies are being carried out to utilize collagen for improving qaulity characteristics of food (Gómez-Guillén *et al*., 2011).

Therefore, the purpose of this study was to evaluate effects of collagen powder on quality characteristics of restructured chicken jerky prepared with MDCM. This study will provide the useful manufacturing method of MDCM as well as collagen for restructured chicken jerky.

II. MATERIALS AND METHODS

1. Preparation of materials

A commercial sample of chicken breast meat was purchased from a local market. Chilled MDCM from Jung Woo Food Ltd. (Pocheon-si, Gyeonggi-do, Korea) used to bein fed. Pork collagen powder was supplied by Sias Ltd. (Cheongwon-gun, Chungcheongbuk-do, Korea). The meat was trimmed of visible fat before use for restructured chicken jerky processing, and was ground through a grinder with an 8 mm plate (PM-100, Mainca, Barcelona, Spain)..

2. Manufacturing semi-dried jerky

The formulation of restructured chicken jerky (%, w/w) was shown in Table 1. All samples were composed of 90% chicken breast meat and 10% MDCM, and added curing solution with containing 0, 1, 2, and 3% collagen powder, respectively. The ground chicken breast meat was mixed with curing solution by hand for 3 min. The

meat was then continuously tumbled in a tumbler (MGH-20, Vackona, Germany) at -3 ºC for 30 min at 25 rpm. Cured meat was stuffed into cellulose casing (*Φ* - 20 mm), and dried in a convection dry oven (Enex-CO-600, Enex, Korea) for drying 55 °C (30 min) → smoking 65 °C (30 min) → slow drying 65 °C (70 min) → slow drying 75 °C (60 min) → dry cook 75 °C (10 min). After drying, the casing was removed from restructured chicken jerky, and then the restructured chicken jerky was vacuum-packaged into polyethylene bags and stored at 4 °C until analysis.

Table 1. Formula for manufacturing restructured chicken jerky

Ingredients (%)	Added collagen powder levels[d] (%)			
	0	1	2	3
Chicken breast	90	90	90	90
MDCM[a]	10	10	10	10
Total	100	100	100	100
Collagen	0	1	2	3
Water	10	10	10	10
Soy sauce	4	4	4	4
NPS[b]	1.2	1.2	1.2	1.2
Red pepper paste	3.3	3.3	3.3	3.3
Sugar	2	2	2	2
Sorbitol	6	6	6	6
Pepper	0.2	0.2	0.2	0.2
Ginger powder	0.1	0.1	0.1	0.1
Garlic powder	0.2	0.2	0.2	0.2
Onion powder	0.2	0.2	0.2	0.2
MSG[c]	0.1	0.1	0.1	0.1
Red pepper powder	0.5	0.5	0.5	0.5

[a]MDCM: mechanically deboned chicken meat.
[b]NPS: nitrite pickled salt (99.4:0.6).
[c]MSG: L-mono sodium glutamate.
[d]Treatments: 0, no added collagen; 1, added 1% collagen; 2, added 2% collagen; 3, added 3% collagen

3. Analysis of semi-dried chicken jerky

3.1 pH measurement

The pH values of restructured chicken jerky were determined in a homogenate prepared with 5 g of sample and distilled water (20 ml), using a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). All determinations were performed in triplicate.

3.2 Instrumental color evaluations

The color of the cooked restructured chicken jerky were measured by the CIE LAB system using a color meter (Minolta Chroma meter CR-210, Japan; illuminate C, calibrated with white plate, L^*=+97.83, a^*=-0.43, b^*=+1.98). Six measurements for each of five replicates were taken. Lightness (CIE L*), redness (CIE a*), and yellowness (CIE b*) values were recorded.

3.3 Processing yield

Processing yield (%) was determined on individual treatments by calculating the weight differences before and after drying as follows.

Processing yield (%)
= [jerky weight after drying (g)
/ cured meat weight before drying (g)] × 100

3.4 Proximate composition

Compositional properties of the restructured chicken jerky were measured using AOAC (2000).

3.5 Shear force measurement

The shear force value was determined with a Warner-Bratzler shear attachment on a texture analyzer (TA-XT2*i*, Stable Micro System Ltd., Surrey, UK). Test speeds was set at 2 mm/s. Data were collected and analyzed from the shear force values to obtain the maximum force required to shear through each sample and were then converted into N.

3.6 Rehydration capacity

Samples for Rehydration capacity were cut into pieces approximately 1 cm × 1 cm × 1 cm in size. Samples were placed in glass beakers containing 10 volume distilled water. Rehydration capacity was conducted at 30 ± 1 ºC for 5, 10, 15, 30, 45, 60, and 120 min. Rehydration capacity was determined by calculating the weight differences of sample before and rehydration capacity.

3.7 Statistical analysis

An analysis of variance was performed on all the variables measured using the general linear model (GLM) procedure of the SAS statistical

package (2010). Duncan's multiple range test ($P < 0.05$) was used to determine the differences between treatment means.

III. RESULTS AND DISCUSSION

Table 2. Effects of collagen on pH value and color parameters of restructured chicken jerky prepared with MDCM

Traits	Added collagen powder levels[1)] (%)			
	0	1	2	3
pH	5.88 ±0.04	5.87 ±0.05	5.92 ±0.03	5.90 ±0.04
CIE L* (lightness)	35.43 ±1.55^{B}	37.90 ±1.10^{A}	36.52 ±0.62^{B}	35.43 ±0.63^{B}
CIE a* (redness)	20.19 ±1.13^{A}	19.65 ±0.87^{AB}	19.55 ±0.33^{B}	18.51 ±1.70^{C}
CIE b* (yellowness)	23.91 ±0.63^{B}	24.97 ±0.52^{A}	24.21 ±1.20^{B}	20.55 ±0.92^{C}

All values are mean ± standard deviation of three replicates.
$^{A-C}$ Means within a column with different letters are significantly different ($P < 0.05$).
[1)]Treatments: 0, no added collagen; 1, added 1% collagen; 2, added 2% collagen; 3, added 3% collagen

The effects of collagen on the pH value and instrumental color of restructured chicken jerky made from MDCM were shown in Table 2.

Table 3. Effects of collagen on proximate composition, processing yield, and shear force of restructured chicken jerky prepared with MDCM

Traits	Added collagen powder levels[1)] (%)			
	0	1	2	3
Moisture (%)	47.15 ±0.09^{B}	45.85 ±0.03^{D}	46.12 ±0.10^{C}	48.84 ±0.18^{A}
Protein (%)	31.57 ±0.01^{D}	33.15 ±0.07^{A}	33.04 ±0.03^{B}	32.03 ±0.03^{C}
Fat (%)	5.14 ±0.50	5.04 ±1.21	5.04 ±0.78	5.15 ±0.78
Ash (%)	4.48 ±0.01^{B}	4.54 ±0.01^{A}	4.44 ±0.01^{C}	4.11 ±0.10^{D}
Processing yields (%)	56.37 ±0.56^{C}	56.62 ±0.77^{C}	57.69 ±0.62^{B}	59.02 ±0.11^{A}
Shear force (N)	92.24 ±0.73^{B}	95.46 ±1.02^{B}	104.68 ±0.63^{A}	103.40 ±0.63^{A}

All values are mean ± standard deviation of three replicates
$^{A-D}$ Means within a column with different letters are significantly different ($P < 0.05$).
[1)]Treatments: 0, no added collagen; 1, added 1% collagen; 2, added 2% collagen; 3, added 3% collagen.

The addition of collagen did not significantly affect pH value of the jerky ($P > 0.05$). The CIE L* (lightness) and CIE b* (yellowness) of the restructured chicken jerky with containing 1% collagen (T1) was higher than those of the other treatments ($P < 0.05$). As increase in added collagen level, the redness of restructured chicken jerky was decreased. T3 treatments showed the significant lowest redness among the all treatments ($P < 0.05$). The experimental results for shear and proximate composition were shown in Table 3. The restructured chicken jerky containing 3% collagen powder showed the highest moisture content ($P < 0.05$), however, ash content is the lowest value ($P < 0.05$). The treatment added 1% collagen (T1) had the highest value in protein content ($P < 0.05$). There was no significant difference in fat content among the treatments ($P > 0.05$). In this study, the processing yields of restructured chicken jerky were shown in Fig. 1. The increased collagen powder levels contributed to improve processing yields ($P < 0.05$). This result is associated with water holding capacity of collagen. For shear force, the addition of collagen increased the value of restructured chicken jerky.

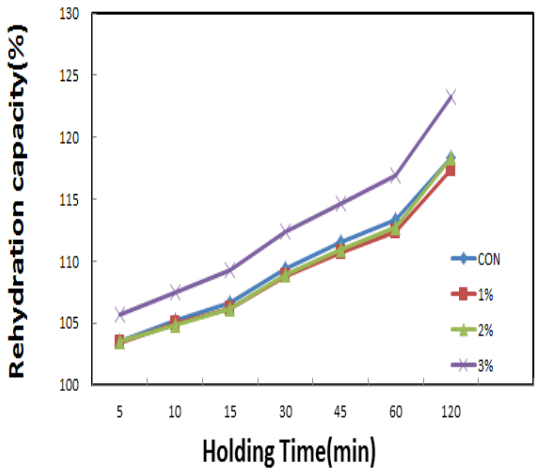

Fig.1 Comparison on rehydration capacity of restructured chicken jerky with various levels of collagen. (◇) Treatments: 0, no added collagen; (□) 1, added 1% collagen; (△) 2, added 2% collagen; (X) 3, added 3% collagen.

The treatment containing 3% collagen (T3) had the highest values in hydration capacity (Fig. 1), however, the similar tendency passed holding time were obtained among the other treatments (0, 1, and 2% collagen treatments).

IV. CONCLUSION

These results showed that the addition of 3% collagen powder improves the quality characteristics of restructured chicken jerky prepared with MDCM, and we concluded that collagen powder is useful source to supplement negative effects of MDCM.

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