EFFETCTS OF CHICKEN FEET GELATIN ON QUALITY PROPERTIES OF SEMI-DRIED CKICKEN JERKY

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***Abstract*— the aim of this study was carried out to investigate the effect of chicken feet gelatin on quality properties of semi-dried chicken jerky. The swollen chicken feet with hydrochloric solution (0.1N HCl) were neutralized with flowing tap water and then was extracted 75 °C hot water. Chicken feet gelatin was dehydrated at the freeze-dryer. The experimental design of semi-dried jerky prepared with CON (chicken meat: 100%), C01 (chicken meat: 99%, chicken feet gelatin: 1%), C02 (chicken meat: 98%, chicken feet gelatin: 2%). After tumbling with curing solution, the cured meats were stuffed into cellulose casing and then dried. Water and protein content were increased with increasing of chicken feet gelatin level (P<0.05). However, fat and ash content was decreased with increasing of chicken feet gelatin level. Drying yields was increased with increasing of chicken feet gelatin feet gelatin level (P<0.05). But, shear force and pH were decreased with increasing of chicken feet gelatin level (P<0.05). There was no difference among the chicken jerky preparations within feet gelatin level in water activity and sensory evaluation (P>0.05).**

***Index Terms*—chicken, feet, gelatin, semi-dried jerky**

I. INTRODUCTION

Jerky is one of the oldest meat products treated by salting and drying to reduce water activity. Jerky are the result of application of the hurdle technology such as temperature, water activity, and organic acids and spices in the preparation (Leistner, 1987). Jerky has traditionally been prepared with sliced whole muscle of large animal followed by marination and drying. However, Choi, An, and Hong (1993) produced the restructured pork jerky by adding meat emulsion to improve the binding ability, and Choi et al. (2008) reported effects of pork/beef levels and the casings on the quality properties of semi-dried jerky. In many countries, consumption of various jerky such as beef jerky, pork jerky, and turkey jerky has been increased in the past several years because of its easy preparation, light weight, rich nutrient content, and stability without refrigeration. However, chicken have been little studied in whole muscle and ground semi-dried jerky.

Chicken meat has been very popular among many countries because it provides excellent animal protein to consumers in developing countries. Most processed chicken products are ready-to-cook products such as smoked thigh, chicken nuggets, and sausages. Especially, chicken meat is good source to make jerky because poultry meat has high protein and low fat. Recently, consumer requirement for food which is safe, healthier, diverse and convenient is increasing. Gelatin is good sources in healthier food industry.

Gelatin is a gelling protein, which has widely been applied in food and pharmaceutical industries. In food industry, gelatin is utilized in confections (mainly for providing chewiness, texture, and foam stabilization), low-fat spreads (to provide stabilization and texturization), bake goods (to provide emulsification, gelling, and stabilization), and meat products (to provide water-binding). Moreover, it is normally recommended to enhance protein levels and to reduce carbohydrate in food for diabetic patients. Thus, the amount of gelatin used in the worldwide food industry is increasing (Montero & Gómez-Guillén, 2000). In many countries, most commercial gelatin is made from hide of porcine and bovine (Binsi, Shamasundar, Dileep, Badii, & Howell, 2009; Cho, Gu, & Kim, 2005). However, frequent outbreaks of bovine spongiform encephalopathy (BSE) and foot/mouth diseases have been a barrier to be used, and thus use of new gelatin sources such as poultry skin, feet, and bone has increased to replace mammalian resources (Gudmundsson, 2002; Karim & Bhat, 2009; Schrieber & Gareis, 2007).

The objective of this study was to evaluate the effects of chicken feet gelatin levels on the quality properties of semi-dried chicken jerky.

II. MATERIALS AND METHODS

1. Materials

Chicken breast and feet were provided by Maniker F&G Co., Ltd (Yonginsi 388-278, Korea). All subcutaneous fat

and visible connective tissue were removed from chicken breast. Lean materials were initially ground through an 8 mm plate. They were placed in polyethylene bags, vacuum packaged using a vacuum packaging system (FJ-500XL, Jujee Tech, Seoul, Korea) and stored at -21°C until required for product manufactures. Feet were skinned, washed using tap water, and were immediately frozen and stored at -21°C until used. All reagents were of analytical grade. All experiments were performed in duplicate with at least three replicates. The results were expressed as mean and standard deviation.

2. Preparation of gelatins

The cleaned chicken feet were soaked 10 volumes (v/w) of hydrochloric solution (0.1N HCl) at 18 °C for 24 h to be swollen. After the acid treatment, the feet were neutralized with flowing tap water. For hot-water extraction, they were placed in polyethylene bags and vacuum packaged using a vacuum packaging system (FJ-500XL, Jujee Tech, Seoul, Korea) and then they heated at temperature at 75 °C for 2h in a boiling water bath. The extracted gelatin was frozen at -70 ± 1°C and dried at -40 °C under 80 × 10^{-3} torr pressure using a freeze-dryer (PVTFD20R, Ilshinlab, Yangju, Korea). The gelatin was dehydrated until that reached a constant weight (<3% final moisture) for 48 h at the freeze-dryer.

3. Preparation of semi-dried jerky

The experimental design of semi-dried jerky prepared with CON (chicken meat: 100%), C01 (chicken meat:99%, gelatin: 1%), C02(chicken meat:98%, gelatin:2%). The composition (w/w) of jerky curing solution was water (10%), soy sauce (4%), salt (1.5%), red pepper paste (5%), starch syrup (4.2%), sugar (2%), D-sorbitol (6%), pepper (0.2%), ginger powder (0.1%), garlic powder (0.2%), onion powder (0.2), sodium nitrate (0.007%) as a coupler, sodium citrate (0.01%), potassium sorbate (0.1%), sodium erythorbate (0.03%), soup stock powder (0.1%) and teriyaki seasoning (0.1%). The frozen ground chicken breast was thawed at 4 °C overnight, cured by tumbling with curing solution, and stuffed into cellulose casing (Φ - 18 mm). Each preparation was cut to 15 cm-lengths. Samples were dried as follows: 55 °C (30 min) → 60 °C (150 min) → 73 °C (90 min) → 75 °C (10 min), in chamber (1600EL-C-Q, Kerres GmbH, Backnang, Germany). After cooling at 20 °C temperature, samples were removed cellulose casing.

4. Analytical methods

4.1. Compositional properties

Compositional properties of the semi-dried jerky were performed using AOAC (2000). Moisture content was determined by weight loss after 12 h of drying at 105°C in a drying oven (SW-90D, Sang Woo Scienctific Co., Bucheon, South Korea). Fat content was determined by Soxhlet method with a solvent extraction system (Soxtec® Avanti 2050 Auto System, Foss Tecator AB, Höganas, Sweden) and protein was determined by Kjeldahl method with an automatic Kjeldahl nitrogen analyzer (Kjeltec® 2300 Analyzer Unit, Foss Tecator AB, Höganas, Sweden). Ash was determined according to AOAC method 923.03.

4.2. Processing yields

Processing yield was determined by calculating the weight differences of jerky before and after drying as follows:

Processing yield (%) = (Jerky weight after drying / Cured meat weight before drying) × 100

4.3. pH and water activity

The pH of sample was determined with a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). pH values were measured by blending a 5 g sample with 20 ml distilled water for 60 s in a homogenizer (Ultra-Turrax T25, Janke & Kunkel, Staufen, Germany).

Samples for water activity were minced into pieces approximately 1 mm × 1 mm × 1 mm in size. The water activity of each sample was determined in duplicate with a hygrometer (BT-RS1, Rotronic ag., Bassersdorf, Switzerland).

4.4. Shear force measurement

Shear force values were determined with a Warner-Bratzler shear attachment on a texture analyzer (TA-XT2i, Stable Micro System Ltd., Surrey, UK). Test speeds were set at 2 mm/s. Data were collected and analyzed from the shear force values to obtain for the maximum force required to shear through each sample and were then converted into N.

4.5. Sensory evaluations

The semi-dried jerky processed with various pork/beef levels were subjected to sensory evaluations. The samples were served to 12 experienced panel members. Panelists were presented with randomly coded samples. The colour (1 = extremely undesirable, 10 = extremely desirable), flavour (1 = extremely undesirable, 10 = extremely desirable), tenderness (1 = extremely tough, 10 = extremely tender), juiciness (1 = extremely dry, 10 = extremely juicy), and overall acceptability (1 = extremely undesirable, 10 = extremely desirable) of the samples were evaluated using 10-point descriptive. Panelists were required to cleanse their palate between samples with water (Keeton, 1983).

5. Statistical analysis

An analysis of variance were performed on all the variables measured using the General Linear Model (GLM) procedure of the SAS statistical package (SAS Inst., 1999). The Duncan's multiple range test ($P<0.05$) was used to determine differences between treatment means.

III. RESULTS AND DISCUSSION

Table 1 show the proximate analysis of semi-dried chicken jerky prepared with various chicken feet gelatin levels. Fat content of CON had a higher than others. Water and protein content were increased with increasing of chicken feet gelatin level ($P<0.05$). In general, commercial intermediate-moisture (IM) foods have moisture contents of 20-40%. However, ash content was decreased with increasing of chicken feet gelatin level ($P<0.05$).

Table 1. Proximate analysis of semi-dried chicken jerky prepared with various chicken feet gelatin levels

Traits	CON	C01	C02
Water content (%)	37.13 ± 0.01^{c}	38.07 ± 0.17^{b}	39.29 ± 0.12^{a}
Protein content (%)	40.27 ± 0.06^{c}	41.60 ± 0.18^{b}	42.35 ± 0.11^{a}
Fat content (%)	8.90 ± 0.09	8.76 ± 0.25	8.60 ± 0.11
Ash content (%)	5.43 ± 0.06^{a}	5.05 ± 0.03^{b}	5.01 ± 0.01^{c}

All values are mean ± standard deviation
$^{a-c}$Mean values with different superscripts within a same row are significantly different ($P<0.05$).

The physicochemical properties of semi-dried chicken jerky prepared with various chicken feet gelatin levels is shown in Table 2. The pH values of semi-dried chicken jerky generally ranged from 6.02 to 6.0. The average pH for IM-meat products was in the broad range of 4.72-6.73. In this study, the water activity of semi-dried chicken jerky was within the range of 0.83-0.84. Processing yields was increased with increasing of chicken feet gelatin feet gelatin level ($P<0.05$). However, shear force was decreased with increasing of chicken feet gelatin level ($P<0.05$). Shear force is an important factor in the whole muscle and ground restricted jerky.

Table 2. Comparison on physicochemical properties of semi-dried chicken jerky prepared with various chicken feet gelatin levels

Traits	CON	C01	C02
pH	6.08 ± 0.01^{a}	6.06 ± 0.03^{b}	6.02 ± 0.02^{c}
Water activity	0.84 ± 0.01	0.83 ± 0.01	0.83 ± 0.01
Drying yield (%)	47.83 ± 0.44^{b}	48.40 ± 0.30^{ab}	49.35 ± 0.46^{a}
Shear force (N)	84.11 ± 4.07^{a}	76.62 ± 4.75^{b}	72.87 ± 4.28^{c}

All values are mean ± standard deviation
$^{a-c}$Mean values with different superscripts within a same row are significantly different ($P<0.05$).

The most important sensory attributes of jerky are texture, color, flavor, which is determined by the raw material and numerous technological factors. Sensory properties of semi-dried chicken jerky prepared with various chicken feet gelatin levels are shown in Table 3. There was no difference among the chicken jerky preparations within skin level in color, flavor, tenderness, juiciness, and overall acceptability ($P>0.05$). Texture of jerky-type snack foods is one of the most important sensory attributes, determining the uniqueness and market attractiveness of products.

Table 3. Comparison on sensory properties of semi-dried chicken jerky prepared with various chicken feet gelatin levels

Traits	CON	C01	C02
color	8.93 ± 0.46	8.47 ± 0.83	8.60 ± 0.51
Flavor	8.33 ± 0.82	8.27 ± 0.70	8.13 ± 0.64
Tenderness	8.00 ± 1.00	8.27 ± 0.88	8.40 ± 0.51
Juiciness	8.13 ± 0.92	7.93 ± 0.80	7.80 ± 0.86
Overall acceptability	8.33 ± 0.72	8.20 ± 0.68	7.93 ± 0.96

All values are mean ± standard deviation

IV. CONCLUSION

In conclusion, the result of the present study indicated that the effects of chicken feet gelatin on quality properties of semi-dried chicken jerky. Water and protein content were increased with increasing of chicken feet gelatin level. But, ash and fat content were decrease with increasing of chicken feet gelatin level. Shear force was decreased with increasing of chicken feet gelatin level, contrary to the drying yield. The panel members did not differ in their individual preferences. Therefore, using chicken feet gelatin was produced soft chicken semi-dried jerky.

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