International Food Research Journal 21(1): 135-137 (2014)
Journal homepage: *http://www.ifrj.upm.edu.my*

Protein solubility behaviour of fresh and frozen chicken meat in slaughtering and non slaughtering condition

[1*]Nahar, M. K., [2]Zakaria, Z. and [1]Hashim, U.

[1]*Institute of Nano Electronic Engineering (INEE), Universiti Malaysia Perlis, Malaysia*
[2]*School of Bioprocess Engineering, Universiti Malaysia Perlis, Malaysia*

Article history

Received: 12 July 2013
Received in revised form: 3 September 2013
Accepted: 10 September 2013

Keywords

Protein solubility
Slaughtering
Chicken meat
Buffer solution

Abstract

This work was investigated the protein solubility properties of meat from chicken in different body part. The effects of fresh and freezing condition were studied on the protein solubility as a functional property of slaughter and non slaughtering chicken meat. Solubility of proteins was significantly reduced for slaughtering fresh meat and in contrast, non slaughtering fresh meat shows the higher protein solubility. On the other hand, frozen storage meat showed the difference amount of protein solubility between slaughtering and non slaughtering condition meat. Freezing condition also showed that the different solubility of different body part meat. The protein solubility of some parts was significantly increased and some were decreased between the slaughtering and non slaughtering condition.

© All Rights Reserved

Introduction

Chicken proteins play the most important roles in human nutrition, particularly in western countries where maximum protein intake from chicken meat. In recent years, consumption of chicken meat and additional processed chicken products has greatly increased worldwide. One of the reasons for the increased consumer first choice of chicken products is the greater availability of choice for chicken cuts, such as breast, thigh and wings (Hrynets *et al.*, 2011). Solubility of proteins under varying conditions is one of its important functional properties, such as gelation, foaming and emulsification; thus the protein may possess acceptable properties, e.g. texture nutritional value, acceptable flavour, and odour (Kinsella *et al.*, 1976).

Omana *et al.* (2010) reported that the protein solubility from chicken thigh meat was determined at pH ranging from 1.5 to 12.0 and the highest solubility of proteins was found to be at the extremes of pH (in alkaline and acidic range. Solubility of sarcoplasmic protein was significantly affected by the interaction between classes of meat and storage (Chan *et al.*, 2011). The basis for using pH-shifting processing on mechanically separated turkey meat utilization is the fact that solubilisation of muscle proteins is highest at high and low pH values (Hrynets *et al.*, 2011). Although protein solubility studies were investigated, development of protein solubility in relation with some factors such as slaughtering, non-slaughtering, different body parts, were not found in the literature. The objective of the present work was to recover soluble proteins from minced chicken meat by centrifugation, and to observe their protein solubility in different part of chicken body. The study was based on two variables: slaughtering condition of the chicken (slaughtering and non slaughtering) and mode of storage condition on the protein concentration (fresh and frozen) (Huidobro *et al.*, 1998).

Materials and Methods

Materials

Monosodium phosphate (NaH_2PO_4), disodium phosphate (Na_2HPO_4), Citric acid ($C_6H_8O_7$), glycine ($C_2H_5NO_2$) and sodium hydroxide (NaOH) were all obtained from Merck Chemical Industries Co. Ltd. (Malaysia). Folin-Ciocalteau reagent was purchased from Sigma-Aldrich, Malaysia. All the chemicals were used of purest grade available. All solutions were prepared with distilled water.

Sample collection

A piece of skinless and boneless broiler chicken meat was collected from a large local commercial market. After 4 hours slaughtering meat and non slaughtering meat were collected. The samples were kept at 0°C and brought to the research laboratory under refrigeration.

Preparation of meat sample

First we had processed the fresh chicken meat and then frozen chicken meat which was taken from research laboratory freezer. The preparation of muscle samples began with the removal of any epimysial

*Corresponding author.
Email: *knahar_98@yahoo.com*

connective tissue, visible fatty tissue and covering muscle from frozen meat and cut into small pieces. It was then minced in using a food processor for 2 min to prepare samples. Minced samples were subjected to analysis instantly.

Preparation of buffer solutions

The appropriate molar concentration of the buffer solutions was prepared by dissolving the suitable amount of 0.1 M monosodium phosphate (NaH_2PO_4), Citric acid ($C_6H_8O_7$) and glycine ($C_2H_5NO_2$) in distilled water while adjusting the pH with 0.1 M disodium phosphate (Na_2HPO_4), 0.2 M disodium phosphate (Na_2HPO_4), and 0.1 M sodium hydroxide (NaOH) respectively.

Extraction of protein from meat

For the extraction of protein, four grams of minced meat was homogenized with 80 ml of ice-cooled buffered solution in a homogenizing tube placed in ice for 4 min. The homogenates solutions were centrifuged using SiGmA 3-18k Sartorius centrifuge machine at 10,000*g* for 1 hour at 4°C. After centrifugation the protein isolate obtained the resultant supernatants were used for the determination of protein.

Measurement of protein concentration

Protein concentration in the sample supernatant was determined by the Lowry method (Lowry *et al.*, 1951), measuring absorbance at 660 nm using a Thermo Spectronic (Genesys-20) spectrophotometer according to the manufacture's direction. The bovine serum albumin was used as the standard.

Results and Discussion

Protein solubility of fresh meat

Protein solubility is not only significant nor the determination of the optimum condition for protein extraction, but also of great importance applications in food industry (Hrynets *et al.*, 2011). Three groups meat proteins can be found into based on their solubility characteristics: sarcoplasmic (water soluble), myofibrillar (salt-soluble), and connective tissue (insoluble) proteins (Xiong, 1997). Solubility of protein is a good marker of protein denaturation and is fundamentally related to its hydrophobicity/hydrophilicity balance (Van Laack *et al.*, 2000; Omana *et al.*, 2010). However, at isoelectric point the lower solubility of protein is needed to precipitate the solubilised proteins (Van Laack *et al.*, 2000).

In the present study, we examine the slaughtering fresh meat of different body part. Effects of

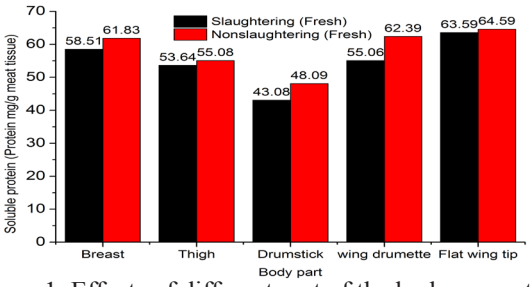

Figure1. Effects of different part of the body on protein solubility in slaughtering and non-slaughtering condition from chicken fresh meat

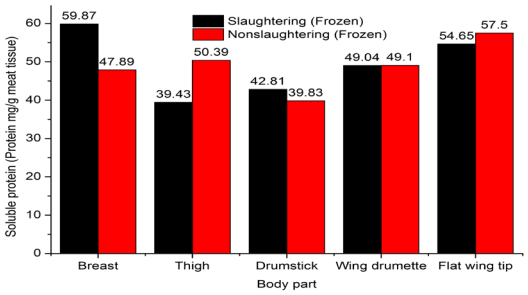

Figure 2. Effects of different part of the body on protein solubility in slaughtering and non-slaughtering condition from chicken frozen meat

slaughtering and non slaughtering condition on protein solubilities are shown in Figure 1. The higher protein solubility of fresh meat is observed with the non slaughtering condition and in contrast, the lower protein solubility of slaughtering condition is found averagely. Here we observe that protein solubility of slaughtering condition is lower than non slaughtering condition. Kristinsson and Hultin (2005) reported that lower solubility was a outcome of improper protein unfolding.

Protein solubility of frozen meat

In the frozen condition different body parts meat shows different protein solubility in slaughtering and non slaughtering condition. Freezing caused some parts meat proteins solubility decreases. This decrease may be connected to the instability of proteins due to aggregation behaviour during the freezing process (Chan *et al.*, 2011). A reduction in protein solubility was also found in chicken actomyosin after freezing storage, which was generally due to the association/dissociation of actomyosin most important to the formation (Cofrades *et al.*, 1996). Some parts meat protein solubility was increased in the freezing process. Farouk, Wieliczko, and Merts found an increase in sarcoplasmic protein solubility in beef after freezing (Farouk *et al.*, 2004). Differences of protein solubility were found between slaughtering and non-slaughtering meat in the fresh and frozen condition. However, the protein solubility difference is significant in some body part of chicken meat,

whereas in some part differences are not significant.

Conclusions

This study was investigated the solubility of protein from chicken fresh and frozen meat which was affected by slaughtering condition. In the fresh condition, the highest protein solubility was achieved at non slaughtering condition than the slaughtering meat. On the other hand, in the frozen meat condition showed that thigh and flat wing tip meat were found in higher protein solubility in non slaughtering condition and breast and drumstick meat were observed at lower solubility than slaughtering meat. In contrast, only one part meat as wing drumette was found in same protein solubility in slaughtering and non slaughtering condition.

References

Chan, J.T., Omana, D.A. and Betti, M. 2011. Effect of ultimate pH and freezing on the biochemical properties of proteins in turkey breast meat. Food Chemistry 127: 109-117.

Cofrades, S., Careche, M., Carballo, J. and Colmenero, F. J. 1996. Freezing and frozen storage of actomyosin from different species. Zeitschrift für Lebensmittel-Untersuchung und Forschung 203: 316-319.

Farouk, M., Wieliczko, K. and Merts, I. 2004. Ultra-fast freezing and low storage temperatures are not necessary to maintain the functional properties of manufacturing beef. Meat science 66: 171-179.

Hrynets, Y., Omana, D.A., Xu, Y. and Betti, M. 2011. Comparative study on the effect of acid-and alkaline-aided extractions on mechanically separated turkey meat (MSTM): chemical characteristics of recovered proteins. Process Biochemistry 46: 335-343.

Huidobro, A. and Montero, P. 1998. Emulsifying properties of an ultrafiltered protein from minced fish wash water. Food Chemistry 61: 339-343.

Kinsella, J.E. and Melachouris, N. 1976. Functional properties of proteins in foods: a survey. Critical Reviews in Food Science and Nutrition 7: 219-280.

Kristinsson, H.G., Theodore, A.E., Demir, N. and Ingadottir, B. 2005. A Comparative Study between Acid- and Alkali- aided Processing and Surimi Processing for the Recovery of Proteins from Channel Catfish Muscle. Journal of food science 70: C298-C306.

Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. 1951. Protein measurement with the Folin phenol reagent. Journal of Biology and Chemistry 193: 265-2n dark meat: chemical and functional properties of recovered proteins. Process Biochemistry 45: 375-381.

Van Laack, R., Liu, C., Smith, M. and Loveday, H. 2000. Characteristics of pale, soft, exudative broiler breast meat. Poultry Science 79: 1057-1061

Xiong, Y. 1997. Structure-function relationships of muscle proteins. Food Science and Technology-New York-Marcel Dekker-: 341-392.