Research Article

THE CHARACTERISTICS OF SALTED EGG IN THE PRESENCE OF LIQUID SMOKE

J. M. W. Wibawanti, M. Meihu, A. Hintono, Y. B. Pramono

ABSTRACT: Salted egg is one of the most traditional and popular preserved egg products. Therefore, the objectives of this study were to investigate the changes on the characteristics of duck egg salted at different times. Currently, diversification of product salted egg could be used Liquid Smoke (LS). Split Plot in time with a basic design Completely Randomized Design (CRD) was used throughout the research. They were run triplicate. The viscosity of egg white control was significant compared with salted egg of LS treatment ($p < 0.05$). Moisture content and total solid of egg white control was significant compared to that salted egg with LS treatment ($p < 0.05$). The viscosity of egg white and moisture contain decreased from an initial value ($p < 0.05$). Moisture contents and total solid of egg yolk control were no different statistically compared to that salted egg of LS treatment ($p > 0.05$). Significant of total solid along was increased during salting time ($p < 0.05$).

Keywords: salted egg, liquid smoke, characteristics of product

INTRODUCTION

Salted egg is one of the most traditional and popular preserved egg products. It can be made by brining eggs in saturated saline or by coating the egg with soil paste mixed with salt for about 15-30 days (Chi and Tseng, 1998). Generally, salted eggs are duck eggs, because its characteristics are better than chicken eggs (Li and Hsieh, 2004). The customer expect in yolk egg more than white. The desirable characteristics of salted egg yolk include orange color, oil exudation, and gritty texture (Li and Hsieh, 2004; Kaewmanee *et al*., 2009).

Salt can be used as food additive, not only mainly for preserving, but also for improving the taste of the product. During salting, the yolk gradually becomes solidified and hardened. Egg white loses viscosity and becomes watery (Chi and Tseng, 1998). The rate of salt penetration into egg white and yolk governed by salting method may have an impact on changes in composition as well as characteristics of egg, especially yolk. Additionally, salting time also plays a role in the formation of salted egg with desirable (Kaewmanee *et al*., 2009).

Currently, salted egg product has been diverse into smoked-salted egg. The traditional way of smoking was substituted by LS. LS associated in food product for optimize antimicrobial properties, antioxidant potential and sensory properties (Paul *et al*., 2005). Therefore, the objectives of this study were to investigate the changes on the characteristics of duck egg salted at different times.

MATERIALS AND METHODS

The research has been done on October 2011 at the Laboratory of National Research and Development Center for Egg Processing, Food Science and Technology Collage, Huazhong Agricultural University, Wuhan, Hubei Province, China.

Submitted 19/02/2013, Accepted 07/04/2013. J. M. W. Wibawanti is from Department of Animal Science, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang. M. Meihu is from Department of Food Science and Technology, Huazhong Agricultural University, Hubei-China. A. Hintono, Y. B. Pramono are from Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Indonesia.

Material

The materials were prepared in making salted egg were: fresh duck eggs (*Anas platyrhynchos*), Liquid Smoke of coconut shell (LS), salt, and some of chemicals.

Method

Fresh duck eggs (*Anas platyrhynchos*) were obtained with a weight range 65-75g, less than 3 days after laying. The commercial eggs were collected from farm in the Wuhan city, Hubei Province, China and used in this research. Eggs were randomly selected during the sampling. They were cleaned and washed with tap water. Duck eggs were salted by immersing method with presence of LS.

Split Plot in time with a basic design Completely Randomized Design (CRD) was used throughout the research. The main plot treatments were supplementation of LS with differences concentration (control, 1% LS, and 1.25% LS). The sub plot treatments were salting time process (0, 1, 2, 3, and 4 weeks). Statistical analysis was done by the statistical program the SAS 9.13 system for windows. One-way analysis of variance (ANOVA) was carried out and means comparisons were done using Duncan's multiple range tests.

Determination Viscosity. Salted egg white was separated from egg yolk manually. The preparation solution of egg white (35 ml) was measured using Viscometers at room temperature (26-28 °C). The adapter consisted of a cylindrical sample holder and spindle (LV-61). The rotational speed was controlled at 600 rpm. The viscosity was measured and expressed as centipoises.

Determination of Moisture Contents. Moisture was determined by oven drying at 105^0C. The empty of aluminum dishes were weighted and dried in oven 105^0C for 3 h. Afterward they were transferred into desiccators at room temperature. Samples were measured about 3 grams into the aluminum dishes. They were dried in the oven for stable weight at temperature 105°C. After that they have transferred into the desiccators to cool. They were weighted until constant. The differences in the weight before and after oven drying were used % moisture and % total solid. The percentage of moisture content was calculated as follows based on (Fuentes *et al*., 2010).

Determination of Total Solid. Salted egg white and yolk were separated manually for determination of moisture contents. After that, it was obtained for determine the value of total solid. The percentage of total solid was calculated as follows: 100 –value of moisture contents (%).

rearrangement of the structure network is responsible for the decrease in the apparent viscosity. The egg white loss viscosity and become watery (Chi and Tseng, 1998). Yang and Baldwin (1995) was suggested that the changes in viscosity of egg white associated with the unfolding and aggregation of egg white proteins. They also showed that the viscosity of egg white was positively related to foaming ability. Foaming ability as high viscosity was obstructed air incorporation during mixing.

Table 1. Viscosity (cP) of Salted Egg White

Treatment	Fresh Egg	1 Weeks	2 Weeks	3 Weeks	4 Weeks
Control	90.55±2.5^{a}	84.90±3.38^{b}	74.80±4.78^{c}	61.77±0.66^{d}	42.10±1.05^{e}
1% LS	90.6±0.75^{a}	85.70±1.56^{a}	76.03±2.18^{b}	63.13±0.85^{c}	57.27±2.66^{d}
1.25% LS	90.7±1.73^{a}	85.03±3.09^{a}	77.03±0.53^{b}	64.80±0.53^{c}	51.37±0.25^{d}

Table 2. Moisture Contents (%) of Salted Egg

Egg	Treatment	Fresh Egg	1 Weeks	2 Weeks	3 Weeks	4 Weeks
White	Control	87.14±0.03^{a}	86.16±0.22^{a}	85.80±0.03^{a}	85.66±0.08^{a}	84.85±0.11^{b}
	1% LS	87.13±0.07^{a}	86.38±0.22^{b}	85.52±0.91^{c}	85.85±0.17^{bc}	84.44±0.15^{d}
	1.25% LS	87.11±0.09^{a}	86.02±0.73^{b}	85.34±0.81^{b}	85.47±0.07^{b}	83.74±0.63^{c}
Yolk	Control	46.36±0.39^{a}	42.13±0.79^{b}	41.42±1.47^{c}	33.07±1.42^{d}	26.51±0.43^{e}
	1% LS	46.26±0.35^{a}	43.95±0.61^{b}	39.35±0.71^{c}	32.50±0.81^{d}	24.54±0.15^{e}
	1.25% LS	46.05±0.18^{a}	44.63±0.78^{b}	37.39±1.48^{c}	33.31±0.52^{d}	24.40±0.85^{e}

Table 3. Total Solids (%) of Salted Egg

Egg	Treatment	Fresh Egg	1 Weeks	2 Weeks	3 Weeks	4 Weeks
White	Control	12.87±0.01^{a}	13.84±0.22^{a}	14.21±0.03^{a}	14.25±0.08^{a}	15.15±0.11^{b}
	1% LS	12.87±0.07^{a}	13.62±0.21^{b}	14.48±0.91^{c}	14.15±0.17^{c}	15.56±0.15^{d}
	1.25% LS	12.89±0.09^{a}	13.98±0.73^{b}	14.66±0.81^{c}	14.53±0.07^{bc}	16.26±0.63^{d}
Yolk	Control	53.64±0.39^{a}	57.87±0.79^{b}	58.78±1.47^{b}	66.89±1.43^{c}	73.49±0.43^{d}
	1%LS	53.74±0.35^{a}	56.05±0.61^{b}	60.65±0.71^{b}	67.50±0.81^{c}	75.46±0.15^{d}
	1.25% LS	53.74±0.36^{a}	55.37±0.78^{b}	62.61±1.48^{b}	66.69±0.52^{c}	75.60±0.85^{d}

Note for Table 1–3: mean ±SD (n = 3), subscript indicates significant differences ($p < 0.05$)

RESULTS AND DISCUSSION

Viscosity of Salted Egg White

Viscosity of egg white with treatments of LS was showed in Table 1. After salting process up to 4 weeks, the viscosity of egg white decreased from an initial value ($p < 0.05$). The viscosity of egg white control was significant compared with salted egg of LS treatment ($p < 0.05$). There were any interactions ($p < 0.05$) between LS treatments and salting time with respect to viscosity.

After salting process up to 4 weeks, the viscosity of egg white control was decreased initial value from 90.55 to 42.19. Salted egg of LS 1% was decreased initial value from 90.6 to 57.27. Viscosity for salted eggs of LS 1.25% was decreased initial value from 90.7 to 51.37. Generally, viscosity value of salted egg white with presence of LS was found value higher than control.

Viscosity was presented to elucidate the effect of concentration of LS on cleavages of egg white protein. Therefore, LS was used more likely cleaved shell membrane rather than egg white protein, in which salt could be penetrated more efficiently. Viscosity of egg white was decreased during salting time. It was indicated as decreasing number of interactions in egg white structure occurring during storage time. Li Can *et al.* (1995) and Mukhopadhyay *et al.*(2010) had reported, the viscosity of egg albumen was done dependent on the age, mixing treatment, temperature, and rate of shear.

Sakanaka (2004) have observed that the complex of the white egg decreased with time. It seems that

Moisture Content of Salted Egg

Moisture content has been impact on the quality and durability of food. It was associated some water loss (Gomez-Guillen *et al*., 2000). The results of moisture content with the treatment of LS during salting time were presented in Table 2. Significant of moisture content of salted egg white decreased along with the increase of salting time ($p < 0.05$). Moisture content of egg white control was significantly different compared to that salted egg with LS treatment ($p < 0.05$). They were no interactions ($p > 0.05$) between LS treatments and salting time with moisture content of egg white. Moisture contents of salted egg white with presence of LS were found lower than control. LS component may be due role osmosis process during salting time. Dehydration of egg white moisture was induced penetrations salt and LS levels.

Salted egg yolk was decreased moisture value during salting time for 4 weeks ($p < 0.05$). Moisture contents of egg yolk control were no different statistically compared to that salted egg of LS treatment ($P > 0.05$). Treatments of LS and salting time were any interaction ($p < 0.05$) respect to moisture content of egg yolk. Generally, moisture contents of salted egg yolk with presence of LS were found value lower than control.

Moisture of salted egg white was found differences value at the same period of salting time. LS of coconut shell during salting process might improve cleave the protein in egg membrane or reduced viscosity of egg white to some degree. This led to greeter penetration of salt from egg white to the yolk, especially at the exterior portion. The salting process was decreased gradually involves moisture content of salted egg white by LS. It most likely due to the loss of water from egg white to the outside caused osmosis process. The moisture of egg yolk during salting was decreased value mostly with the hardening process of yolk. Chi and Tseng, (1998) reported that high salt contents which water could be migrated from egg yolk to egg white, then to environment through the egg shell as determined by pore sizes and structure of egg shell.

Total Solids of Salted Egg

Changes value of total solid of egg white and yolk were observed during salting time (Table 3). Significant differences ($p < 0.05$) of were presented value of total solid of control sample compared to that salted egg white of LS treatment. Total solid of salted egg white with presence of LS were found value higher than control. The salted egg white was increased value of total solid during salting time ($p < 0.05$). They were no interaction between treatments of LS with salting time ($p < 0.05$). Total solid of egg with treatment of LS 1.25% was found value higher than control. Total solid of egg white with salting time increased during salting time, which it was indicated as decreasing moisture content of egg white during brining process.

Total solids of salted egg yolk with treatment LS was found no differences statistically compared to that salted egg without LS ($p > 0.05$). The total solid of eggs yolk were increased value during salting time ($p < 0.05$). They were any interaction between LS treatments with salting time ($p < 0.05$). The control samples of total solid of egg yolk were showed value from 53.64 to 73.49 %, after salting process. The salted eggs with 1% LS were presented value from 53.74 to 75.46%. The salted eggs with 1.25 % LS were found value from 53.74 to 75.60%.

Generally, the dehydration of salted egg caused the solidification of egg yolk initiated near the vitelline membrane, which proceeded toward the center. Hardening ration of egg yolk was caused with dehydration process of egg yolk. It was induced by salt at higher levels hardening of egg yolk (Kaewmanee *et al*., 2011). Lai *et al*. (1999) have observed moisture content degreased caused by the increase in the NaCl content in the albumen, which quicker than that in the yolk.

CONCLUSION

The result showed that LS treatment and salting time have influence on the characteristics of salted egg products. The viscosity and moisture contents were decreased, while total solid increased value during salting time. The moisture of egg yolk during salting was decreased value mostly with the hardening process of yolk.

ACKNOWLEDMENT

The work was supported by the earmarked fund for Modern Agro-industry Technology Research System and "Beasiswa Unggulan" (BU) Scholarship Program from Planning and Overseas Cooperation Bureau (BPKLN) Ministry of Education Republic of Indonesia.

REFERENCES

Chi, S. P., and Tseng, K. H. 1998. Physicochemical Properties of Salted Pickled Yolk from Duck and Chicken Eggs. Journal of Food Sci. 33: 507-513.

Fuentes, A., I. F. Segovia., J. A. Serra., J. M. Barat. 2010. Development of a Smoked Sea Bass Product with Partial Sodium Replacement. Journal of Food Science and Technology. 43: 1426-1433.

Gomez-Guillen. M. C., P. Montero., O. Hurtado., and A. J. Borderias. 2000. Biological Characteristics Affect the Quality of Farmed Atlantic Salmon and Smoked Muscle. Journal of Food Science. 65 (1): 53-60.

Kaewmanee, T., S. Benjakul., and W. Visessanguan. 2009a. Changes in Chemical Composition, Physical Properties and Microstructure of Duck as Influence by Salting. Journal Food Chemistryl. 112: 560-569.

Kaewmanee, T., S. Benjakul., and W. Visessanguan. 2009b. Effect of Salting Process on the Chemical Composition, Texture Properties and Microstructure of Duck Egg. Journal Science of Food Agric. 89: 625-633.

Kaewmanee, T., S. Benjakul., and W. Visessanguan. 2011. Effect on NaCl on Thermal of Aggregation of Egg White Proteins from Duck Egg. Journal Food Chemistry. 125 : 706-712.

Kaewmanee, T., Benjakul, S., Visessanguan, W., and Gamonpilas, C. 2011. Effect of Sodium Chloride and Osmotic Dehydration on Viscoelastic Properties and Thermal-Induced Transitions of Duck Egg Yolk. Food Bioprocess Technology. Springer Science and Business Media.

Lai, K. M., S. P. Chi and W. C. Ko. 1999. Changes in Yolk States of Duck Egg during Long-Term Brining. 47: 733-736.

Li-Can, E. C. Y., W. D. Powrie., and S. Nakai. 1995. The Chemistry of Eggs and Egss Products. In Egg Scince and Technologi. W. J. Stadelman and O. J. Cotterill. Food Product Press. An Imprint of the Haworth Press, Inc. New York, London.

Li, J and Hsieh, Y, P. 2004. Traditional Chinese Food Technology and Cuisine. Asia Pasific Journal Clin Nutr 13: 147-155.

Paul, J., Milly., T. Romeo., Toledo., and S. Ramakrishnan. 2005. Determination of Minimum Inhibitory Concentrations of Liquid smoke Fractions. Journal of Food Science. 70: M12-M17.

Sakanaka, S., and Y. Tachibana. 2006. Active Oxygen Scavening Activity of Egg Yolk Protein Hydrolysates and Their Effects on Lipid Oxidation in Beef and Tuna Homogenates. Food Chemistry 95: 243-249.

Yang, S. C., and R.E. Baldwin. 1995. Functional Properties of Eggs in Foods. In: Stadelman, W.J., Cotterill, O.J. (Eds.), Egg Science and Technology, fourth ed. Food Products Press, New York.