AgroLife Scientific Journal - Volume 8, Number 1, 2019
ISSN 2285-5718; ISSN CD-ROM 2285-5726; ISSN ONLINE 2286-0126; ISSN-L 2285-5718

UTILIZING CORN OIL IN PROCESSING OF CULLED LAYER HENS SAUSAGES

Hendronoto Arnoldus Walewangko LENGKEY[1], Primiani EDIANINGSIH[2], Eka WULANDARI[1], Andry PRATAMA[1], Jajang GUMILAR[1], Wendry P. SETYADI[1], Lilies SURYANINGSIH[1], Roostita Lobo BALIA[1], Violeta Caro PETROVIC[3]

[1]University of Padjadjaran, Food Technology Department, Animal Husbandry, Jl Raya Bandung-Sumedang km 21 Jatinangor 45363, Indonesia
[2]University of Padjadjaran, Animal Production Department, Animal Husbandry, Jl Raya Bandung-Sumedang km 21 Jatinangor 45363, Indonesia
[3]Institute for Animal Husbandry, Belgrade, 11080 Zemun, Serbia

Corresponding author: lengkeyhendronoto@gmail.com

Abstract

The purpose of this study was to obtain the appropriate percentage of the quality and acceptance of culled layer hens sausages, because various factors during the processing process had an impact on the quality characteristics and acceptance of the final sausage products.The use of culled layer hens has been widely used and chicken sausages are the preferred and consumed products in various countries. Fresh culled layer hens sausages, were processed with several concentrations of corn oil (5%, 10%, 15%, 20% and 25%). This study uses a 5 x 4 Completely Randomized Design (CRD), with five different percentage of corn oil, and four replications, to determine its effect on pH, moisture content and fat content respectively on physical and chemical properties and its acceptance of sensory properties,. The samples are tested immediately (day zero) at room temperature. The results are the moisture and fat content has significance, but the sausage pH are not significant between the treatments. The conclusion is, that the corn oil addition has improved the quality of fresh culled layer hens sausages.

Key words*: corn oil, culled layer hens sausage, physical, chemical and sensory quality.*

INTRODUCTION

The increased number of population growth needs enough food stock to fulfill the food necessity, and it is known that meat is the primary source of animal protein. Demand rate of chicken meat is 4% more than its production rate (Lengkey et al., 2014).

Chicken meat can be supplied from the poultry farm, either from the broiler or from the layer hens. Layer hens have double benefits, beside production eggs, they can also produce meat after their production period over.

Unproductive layer hens also can be used to produce meat, and then to be sold as culled layer meat, since they have tough meat (Lengkey, 1991). Poultry products are popular because of low fat content, and is perceived as wholesome, healthy and nutritious (Naveena et al., 2012).

Culled layer hens (spent hens) are the main by-product of egg industry, the meat from these birds is considered as low quality because of its age and relative toughness and therefore sold at a lower market price. The availability of broiler meat all through the year to meet the local demand does not necessitate meat tenderization thereby diminishing the demand for meat from spent hens.

Hence meat from these birds needs sufficient processing to improve its acceptability (Ilayabharathi et al., 2012).

The advantage of meat processing is the integration of certain animal tissues into the food chain as valuable protein-rich ingredients. Thus, there are economic, dietary and sensory aspects that make meat processing one of the most valuable mechanisms for adequately supplying animal protein to human populations. Meat and meat products are very important in human nutrition, because they are an excellent source of protein with a well-balanced composition of amino acids (Fellows, 1990; Heinz, Hautzinger, 2007; Hasan, 2015).

Fresh sausages are meat products that usually made of beef, and the commercial sausages

have fat contents around 20% directly after manufacture (Olivares et al., 2010); or for chicken viennas can add 10% vegetable oil and 20% chicken fat emulsion (Heinz, Hautzinger, 2007). Fresh sausages fat has contributes the flavor, texture, juiciness, and determined the quality and acceptability of sausages; also as source of essential fatty acids, fat soluble vitamins that constitutes as energy sources, and most of all are various properties of fresh sausages; that determined the quality and acceptability of sausages. Culled layer hens contain lesser fat than broilers. In this regard, the addition of corn oil will give positive effect on consumer acceptance. High acceptability of sausages with high fat, due to their appearance and also to other characteristics such as flavor. Raw sausages fat content was higher than cooked sausages, because the cooking temperature will decrease the fatty acids (Asmaa et al., 2015). It means, that superheated steam in cooking has great impact on fat reduction for chicken sausages.

Many studies have reported new formulations for sausages production, using olive, soy, flaxseed, soybean, canola and linseed oils as partial substitutes for animal fat (Muguerza et al., 2001; Muguerza et al., 2004; Fernandez-Gines et al., 2005; Ospina-E et al., 2010). Quality characteristics of spent chicken sausages for fat is 13.76% and moisture 56.64% (Ilayabharathi et al., 2012). This study want to determine the best percentage of corn oil addition based on pH, moisture, fat content and consumer acceptability of fresh culled layer hens sausages.

MATERIALS AND METHODS

The research was performed on 30 fresh, boneless culled 70 weeks Hy-line breed layer hens meat, with 1.6 kg averages body weight, from Missoury breeding farm and the ingredients, from supermarket in Sumedang, Bandung, Indonesia.

Preparation of sausages

Five batches of fresh sausages (10 kg meat batter for each batch) with different corn oil contents (5%, 10%, 15%, 20% and 25%) were manufactured. The meat batter was stuffed into 1.50 cm diameter collagen casings; produced 20 sausages from each batch, and the final weight was 500 g for each sausage. Two sausages from each batch were used to control the pH by introducing a pH meter Jenway 3310. From each batch, 200 g of the meat batter were collected to study the effect of corn oil on fat content; 150 g of the sample were minced and used for moisture content and pH analyses. All of the results were expressed as the mean of four replicates at each sampling time.

Physical and chemical analysis

The sausages pH was determined by homogenizing 10 g of each sample with distilled water in a 1: 10 sample: water ratio and then using pH-meter Jenway 3310 for 5 minutes until the pH reading were performed.

The determination of pH was performed at day 0 post production (fresh sausages). The moisture content was determined also at day 0 post production (fresh sausages) according to the official method for analysis of meat products (AOAC, 1997), using two sausages per batch, by weighing 10 g of sample in aluminum dish and kept in an oven drying at 105^0C for overnight. The fat content of the sample were determined using Soxhlet extraction with petroleum ether as a solvent (AOAC, 1997).

Sensory analysis

Sensory analysis was conducted by 30 untrained panelists whose ages ranged between 19 - 50 years, recruited among students, faculty and staff members from the university campus. The panelists were asked to express their opinion of the sausages regarding the aroma, taste, texture and overall acceptance. All data were recorded on a questionnaire designed to indicate the degree of likeness for the sausages of each treatment using a non-structured scoring scale of nine points (from 1 = disliked extremely to 9 = liked extremely). Panelists were served with randomized slices of sausages, two per treatment, together with room temperature water to clean the palate between samples.

Samples were coded with three random numbers. The presented data are mean values of 30 panelists.

Statistical analysis

This work used an experimental plan with completely randomized design 5 x 4 (CRD), with 5 different percentages of corn oil, and 4

replications, to study the effect of corn oil over pH, moisture and fat content respectively on the physical, chemical and sensory quality; and the samples were analyzed immediately (day zero) at room temperature.

All analysis were performed in duplicate, and the data were evaluated by one way analysis of variance (ANOVA) using the SPSS 21.0 version statistical package (IBM Statistics version 21) software package.

The averages were compared by Duncan's multiple range test at a confidence level of 5% ($p \leq 0.05$) for sensory analysis, the ability of each descriptor to discriminate between samples was investigated using Kruskall-Walis test.

Data obtained from physical-chemical analysis were analyzed using mean comparisons, analysis of variance (ANOVA) and Duncan multiple range test to see significant differences ($p<0.05$) in the formulation of fresh culled hens sausages.

RESULTS AND DISCUSSIONS

Physical and chemical composition of fresh culled layer hens sausage

Based on the results of physical-chemical analysis, the addition of corn oil improved the quality of the culled layer hens' sausages. Mean of pH, moisture and fat percent value, of fresh culled hens sausages are given in Table 1. The results obtained from this experiments show that corn oil added in the culled hens sausages show significance different ($p<0.05$), for moisture and fat content in mean percent, except the pH that has no significant different. The pH content of culled layer hens sausages ranged between 5.50 and 5.60. The normal pH of meat products range from 4.8-6.8, while that of fresh sausages has been suggested to be at a pH of not less than 5.5 (Romans et al., 2001; Cocolin et al., 2004). It means that fresh culled hens sausages are in the range of normal fresh sausages.

Table 1. The average physical and chemical composition of fresh culled hens chicken sausages

	Treatments				
	T-1	T-2	T-3	T-4	T-5
pH	5.50 ± 0.040^{a}	5.55 ± 0.022^{a}	5.57 ± 0.031^{a}	5.58 ± 0.255^{a}	5.60 ± 0.010^{a}
Moisture (%)	58.35 ± 1.242^{a}	57.10 ± 1.576^{b}	55.01 ± 2.034^{b}	53.96 ± 1.234^{c}	50.25 ± 0.511^{c}
Fat (%)	18.79 ± 0.241^{a}	19.38 ± 0.327^{b}	19.60 ± 0.146^{b}	20.00 ± 0.104^{c}	20.29 ± 0.119^{d}

Notes: T-1 = sausages batter + 5% corn oil
T-2 = sausages batter + 10% corn oil
T-3 = sausages batter + 15% corn oil
T-4 = sausages batter + 20% corn oil
T-5 = sausages batter + 25% corn oil

The pH values are not significantly different even the pH value was found to increase as the corn oil in the sausage was more added. T-5 treatment (25% corn oil added) has the highest pH value (5.60 ± 0.010), while the lowest pH value (5.50 ± 0.040) is T-1 (5% corn oil added), so the pH value for the culled hens sausages is affected by the addition of corn oil. It means that corn oil increase the pH value of the product. A work on chicken broiler, spent hens and duck meat, also there was no significant different on pH of the sausages (Subhasish et al., 2006). The fat content of the culled layer hens sausages are 18.79%, 19.38%, 19.60%, 20.00% and 20.29%, respectively. The fat content of the sausages are increase as the corn oil added more in the sausages batter. Moisture content ranging from 50.25 to 58.35%. The moisture content of fresh culled hens sausages are significant different ($p<0.05$). The moisture contents are 58.35%, 57.10%, 55.01%, 53.96% and 50.25%, respectively. The result showed that an increase of corn oil added in sausages, makes the moisture content decreases.

The reduction in moisture content, caused the increase in fat content. Fat content are between 18.79% to 20.29% (18.79%, 19.38%, 19.60%, 20.00% and 20.29%, respectively). In this work, the increase of moisture content was accompanied by decreasing of fat content ($p<0.05$). This is in line with a work on pork fat replacement in dry fermented sausages (Jimenez-Colmenero et al., 2013). Higher fat contents resulted in processing fermented sausages that replacement of pork backfat with olive oil, was reported (Muguerza et al., 2002). The fat content of chicken sausage is 20.00% (Heinz and Hautzinger, 2007). So using 20% corn oil in fresh culled hens sausages are fulfill the sausage condition. Fat content in culled hens sausages was exhibited also a significant difference ($p<0.05$) among treatments. While for the proximate analysis, since T-4 formulation, showed better properties.

Table 2. The sensory quality average scores of fresh culled layer hens sausages

	Treatments				
	T-1	T-2	T-3	T-4	T-5
Aroma	7.500 ± 0.572[a]	7.568 ± 0.504[a]	7.648 ± 0.699[a]	7.700 ± 0.836[a]	7.800 ± 0.714[a]
Taste	5.10 ± 0.500[a]	5.25 ± 0.101[a]	5.255 ± 0.101[a]	5.33 ± 0.007[a]	5.37 ± 0.015[a]
Texture	5.440 ± 0.140[a]	5.48 ± 0.836[a]	5.63 ± 0.204[a]	5.74 ± 0.178[a]	5.89 ± 0.230[a]
Overall	7.533 ± 0.507[a]	7.567 ± 0.504[a]	7.663 ± 0.674[a]	7.700 ± 0.836[a]	7.800 ± 0.714[a]

The sensory quality of fresh culled layer hens sausage

The sensory quality average scores of fresh culled layer hens' sausages are given in Table 2. The sensory attributes were aroma, taste, texture and overall acceptance. According to the sensory analysis, the results are different; depending on the addition of the corn oil; but the scores of all sensory quality are increase as more corn oil percentage added in the batter. Even there are increase on fat content, but there was no significant different, between the treatment. The overall results of sensory quality ranges from 7.533 to 7.800.

From the results above, this product gets a positive rating (between like moderately to like extremely). The results of this work indicate that corn oil has good effect in fresh culled hens' sausages.

The aroma in fresh sausages was not well developed, it was differed than the fermented sausages that has been developed occur during fermentation and drying (Flores et al., 2004). That is why in this work, the aroma has no significant difference in fresh culled hens sausages.

The texture in solid food emulsions are determined by the composition of the food, homogenization conditions and post-processing operations. Sausages are oil in water emulsions, and the continuous phase is a complex colloidal system of gelatin, protein, minerals and vitamins, and the dispersed phase is fat globules (Fellows, 1990). Sensory analysis shows that corn oil has significance effect on culled layer hens sausages.

Corn oil proved suitable for the production of fresh culled layer hens sausages. Sensory quality was acceptable in all sausage variants, but somewhat better aroma, taste and texture were detected in sausages produced since added of 20% corn oil. Considering the results obtained, it may be concluded that the application until 25% corn oil could improve the quality of fresh culled layer hens' sausages.

CONCLUSIONS

This study clearly revealed that addition of corn oil could make much difference in the chemical composition of final products. The sensory analyses results revealed that the product added since 20% corn oil (T-4) was found to be better in quality attributes. Therefore, could be used to produce a high quality fresh culled layer hens sausages.

The corn oil addition in processing culled layer hens sausages determines the increase of the pH and moisture content, but the fat content was decreased, and the sensory quality also was acceptable. It means the corn oil has improved the physico-chemical quality of fresh culled layer hen's sausages. It could be concluded from this work that the tough culled layer hens meat, by value-addition with corn oil, and processing as sausage, can be converted into an acceptable product.

It is concluded that the addition of 20% corn oil, could be useful to improve the final quality of fresh culled layer hens sausages.

REFERENCES

Asmaa A.A., Zzaman, W., Tajul A.Y., 2015. Effect of superheated steam cooking on fat and fatty acid composition of chicken sausages. International Food Research Journal 22 (2): 598-605.

Cocolin, L., Rantsion K., Iacumin L., Urso R., Cantona C., Comi G., 2004. Study of the Ecology of Fresh Sausage and Characterization of Population of Lactic Acid Bacteria by Molecular methods. Applied and Environmental Microbiology. 70: 1883-1894.

Fellows P.J., 1990. Food Processing Technology. Ellis Horwood. New York. h.103.

Fernandez-Gines J.M., Fernandez-Lopez J., Sayas-Barbera E., Perez-Alvarez J.A., 2005. Meat Products as functional foods: A review. J. of Food Science. 70 (2): R37-R53.

Flores M., M-Asuncion D., Marco A., Toldra F., 2004. Effect of *Debaryomyces* spp. on aroma formation and sensory quality of dry-fermented sausages. Meat Science 68: 439-446.

Hasan S., Gatellier P., Lebert A., Picgirant L., Mirade P.S., 2015. Effect of Combined Salt and Animal Fat

Reductions on Physicochemical and Biochemical Changes during the Manufacture of Dry-fermented Sausages. Trends in Food Sciences and Technology.

Heinz G., Hautzinger P., 2007. Meat Processing Technology. RAP Publication 2007/20. FAO of the UN Regional Office for Asia and Pacific. Bangkok. p 12, 402.

Ilayabharathi D., Sheriff F.R., Manohar G.R., 2012. Shelf-life of Spent Chicken Sausage and Its Organoleptic Qualities. Tamilnadu J. Veterinary and Animal Sciences 8 (2): 60-67.

Jimenez-Colmenero F., Triki M., Herero A.M., Rodriguez-Salas L., 2013. Healthy oil combination stabilized in a konjac matrix as pork fat replacement in low-fat, PUFA-enriched, dry fermented sausages. LWT-Food Science and Technology 51: 158-163.

Lengkey H.A.W., 1991. Pengaruh Penyuntikan Papain terhadap Keempukan Karkas Ayam Petelur Afkir (The Effect of Papain Injection on Culled Layer Hens Tenderness). Majalah Ilmiah Universitas Padjadjaran (Scientific Journal Universitas Padjadjaran). Bandung. No. 2. Vol. 9: 57-62.

Lengkey H.A.W., Garnida D., Suryaningsih L., 2014. The Effect of Length of Soaking in Papain on Meat Water Content, pH and Tenderness of Culled Layer Hens. J. of Animal Science. Sofia. Vol. LI, No.1/2: 159-161.

Muguerza E., Fista G., Ansorena D., Astiasaran I., Blaukas J.G., 2002. Effect of Fat level and Partial Replacement of Pork Backfat with Olive oil on Processing and Quality Characteristics of Fermented Sausages. Meat Science. 61: 397-404.

Muguerza E., Gimeno O., Ansorena D., Astiasaran I., 2001. Effect of Replacing pork backfat with pre-emulsified Olive oil on Lipid Fraction and Sensory Quality of Chorizo de Pamplona - a Traditional Spanish Fermented Sausage. Meat Science, 59: 251-258

Muguerza E., Gimeno O., Ansorena, D., Astiasaran I., 2004. New Formulations for Healthier Dry Fermented Sausages: A review. Trends in Food Science & Technology. 15 (9): 452-457.

Naveena B.M., Muthukumar M., Muthulakshmi L., Anjaneyulu A.S.R., Kondaiah N., 2012. Effect of Different Cooking Methods on Lipid Oxidation and Microbial Quality of Vacuum-packaged Emulsion Products from Chicken. J. of Food Processing and Preservation 38 (1): 39-47.

Olivares A., Navarro J.L., Salvador A., Flores M., 2010. Sensory acceptability of slow fermented sausages based on fat content and ripening time. Meat Science 10-2010.

Ospina-E J.C., Cruz-S. A., Perez-Alvarez J.A., Fernandez-Lopez J., 2010. Development of Combination of Chemically Modified Vegetable Oils as Pork backfat Substitutes in Sausages Formulations. Meat Science, 84 (3): 491-497.

Romans, J.R., William J.C., Carloson C.W., Greaser M.L., Jones K.W., 2001. The Meat We Eat. 4th ed. Interstate Publ. Inc. Danville.

SPSS software package 21.0 version

Subhasish B., Chakraborty A., Sarkar., 2006. Comparison among Qualities prepared from Chicken broiler, Spent hen and Duck meat. The J. of Poultry Sci. 43: 180-186.

*** AOAC, 1997. Official methods of analysis. 14th ed. Association of Official Analytical Chemists. Washington DC.