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The Effect of the Submersion Length's in Virgin Coconut Oil on the Shelf Life of Chicken Meat under Room Temperature Storage

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Abstract: The research of the length submersion effect of chicken meat in Virgin Coconut Oil (VCO) on the shelf life of chicken meat under room temperature storage was done by using 4 kg breast meat of 6 weeks old broiler. The design of experiment was a completely randomized design where the treatment were 4 different submersion period of chicken meat in virgin coconut oil for 0 h (A), 1 h (B), 2 h (C) and 3 h (D) with five replication. The variables observed were content of moisture and protein, bacteria colony count and the shelf life of chicken meat. The result of this research indicated that submersion length's of the chicken meat in VCO has significantly decreased moisture content and bacteria colony count and increased the protein content and the shelf life of chicken meat. It showed that submersion of the chicken for 2 h in VCO has significantly improved the shelf life of the chicken meat (15 h) under room temperature.

Key words: Virgin coconut oil, submersion, shelf life, chicken meat

Introduction

The poultry meat is a good source of nutrient because it has much of important essential amino acid for developing, keeping and repairing the body tissue, where the compositions of chicken meat are: Moisture 70%, protein 20-35% and fat 2.5% (Mountney and Parkhurst, 1995). Another reason, it has high nutrient and a good pH for microorganism development that could cause of spoiling of the meat and also has the pathogen characteristic in the human being (Frazier and Westhoff, 1994). Therefore the meat can not store for along period and spoil early. The way one of keeping the meats for longer lasting and avoided from the pathogen bacteria is by preserving.

Some preservation method that can be done is by adding the preservative ingredient. The aim of adding is to destroy or killing the pathogen bacteria in foodstuff, how ever it would not reduce its nutrient (Buckle *et al*., 1978). The nature preservative ingredient that has better for the health as discovered in other preservative ingredient chemical is Virgin Coconut Oil (VCO).

Virgin coconut oil is the coconut oil fermentation that produced from the coconut milk fermentation by enzyme or microbe that is producing of enzyme and to break the protein that bind within oil and carbohydrate are using minimalized heat (Sibuea, 2005). In Coconut oil contains of high lauric acid. It is such as 44-52% of fatty acid number in coconut oil (Silhavy, 2005). According to Alvarado *et al*. (2005), lauric acid, with chemical formula $C_{11}H_{23}O_{23}$ COOH, contains of monolaurine (monogliseride compound) that has antimicrobial power to destroy fatty layer of RNA/DNA of virus, bacteria, yeast and protozoa.

Kabara (2005) reported that monolaurine is a moderate chain fatty acid that is very effective to reorganize the fatty layer at outer membrane of microbe. Sibuea (2005) showed that pathogen bacteria that can be killed by monolaurine were *Listeria monocytogenes*, *Staphilococcus aureus*, *Staphilococcus* agalactiae, *Helicobacter phylory*. Murphy *et al*. (2005) reported that pathogen bacteria in the raw meat and poultry materials were *Listeria sp*.

Through highly of monolaurine content in the Virgin Coconut Oil (VCO) is very potential to be food preservative related with bacteria's characteristic, with the result that the chicken meat was preservative by VCO can be release of pathogen bacteria without reducing nutrient value and can be keeping for along time.

Materials and Methods

Four kilogram of breast meat which has 6 week old broiler (Cobb strain) from local poultry house gives the feed (commercial ration) and drink by ad libitum. Then these are divided into four groups with 5 replication where it's consist of 4 slices meat for each replication of 50 gram/slice.

Virgin coconut oil could be produced from mixing the scraped of 7 kilogram ripped coconut by pouring of hot water (1: 2 w/v) and then squeezed and filtered. The coconut milk keeps for 3-4 h until the cream and skim of coconut milk separated, then the skim of coconut milk is took out, while the cream of coconut milk is fermented by adding yeast 10% and stirred. Then there is incubated at room temperature (28-35°C) for 12-24 h. After it is formed three layers such as protein, oil and water phase, the water is separated and can be used as the starter for next VCO production. The coagulate

protein and oil is heated for 10-40 min before the oil dregs turning to yellow and then is filtered to produce of two liters of virgin coconut oil.

Research methods: Completely randomized experimental design was chosen for this research with 4 treatments and 5 replication. The treatments are submersion of the chicken meat in VCO solution for 0 hour/control (A), 1 h (B), 2 h (C) and 3 h (D) and then stored them under room temperature until the chicken meat indicated spoiled. The variables observed were content of moisture (measured by thermogravitimetry method), protein content (measured by Kjeldahl method), bacteria colony count (measured by standard plate count method) and shelf life of chicken meat (measured by Eber test). All variable were measured when chicken meat indicated has spoiled. The data were subjected to the analysis of variance under completely randomized design (Steel and Torrie, 1995). The differences of treatments were tested by Duncan's multiple range test.

Results

Table 1 is indication that the moisture content of the chicken meat after spoiling was significantly ($p<0.01$) influenced by the length of submersion in the VCO solution, where is as longer of submersion going on as lower the moisture content of the chicken meat. At the longest submersion in VCO (3 h), D treatment had the lowest of posture content of the chicken meat among all of treatments, followed by the moisture content at C treatment, B treatment and the highest moisture content is at A treatment (control) that was not submerged in the VCO solution.

The protein content of the chicken meat is highest significantly ($p<0.01$) at D treatment that had 3 h of the submersion in VCO, followed by C treatment, B treatment and the lowest protein content is at A treatment. The bacteria colony count of the chicken meat when it was indicates spoiling is lowest significantly ($p<0.01$) at D treatment as well, that had 3 h of submersion in the VCO solution, mean while for the highest of bacteria colony count is at A treatment that had no submerged. The other side for B and C treatment is not significant ($p>0.05$).

Table 1: Effect of the submersion length in VCO solution on the moisture content, protein content, bacteria colony count and shelf life of the chicken meat when indicated spoiled under room temperature storage

Variable	A	B	C	D
Moisture(%)	77.09^{a}	74.25^{b}	72.93^{c}	72.87^{c}
Protein (%)	9.99^{a}	15.30^{b}	18.84^{c}	20.34^{c}
Bacteria colony count	17.16^{a}	9.27^{b}	9.17 ^{b}	6.13^{c}
Shelf life (h)	12.00^{a}	13.80^{b}	15.00^{c}	16.50^{cab}

Means with common superscript do not difference significantly ($p> 0.05$)

The chicken meat shelf life was significantly ($p<0.01$) influenced by the length of submersion in the VCO solution.

In this study, has indicated that chicken meat which had a longest of submersion in the VCO solution was had a longest of shelf life as well. The submersion of the chicken meat in VCO for 3 h (D treatment) is very significant ($p<0.01$) to increase of the chicken meat shelf life and the longest (16.50 h) among all of treatments, however there is not significant difference with C treatment which was submerged for 2 h in VCO.

Discussion

Compared to the control (A treatment), the chicken meat moisture content is lower for all treatments. Decreasing of chicken meat moisture content was following the length of submersion in VCO solution and it was caused in VCO solution contain of monolaurine which is to be able prevent of microorganism growth. As a mention by Silhavy (2005) and Alvarado *et al.* (2005) that in the coconut oil has a rich of lauric acid that consists of monolaurine compound which have an antimicrobial power. The longer of submersion in the VCO solution up to 3 h, so the monolaurine is more increasing that can be absorbed into meat tissue. With the result that during the storage, the bacteria and metabolism activities that are usually produce water at the end of metabolism can be pressed, until the water produced at the end, so the moisture content of the chicken meat is the lowest. This is consistent with Buckle *et al.* (1978) statement that at the end of bacteria metabolism always produces water.

The decreasing of disentangling rate of the chicken meat protein is followed by submersion period in the VCO solution, such as at D treatment that had the lowest of protein content among all treatments. This was caused of monolaurine in VCO can prevent the microbe growth in the meat such as proteolytic bacteria. The submersion in VCO caused the activities and metabolism of proteolytic bacteria that is able break out of protein has inhibited and it was caused of increasing of monolaurine absorption into the meat. As the result that is as long as the storage, disentangling of protein in the meat was also blocked, so the protein content in the chicken meat could be maintained. The result of this study is agree to Alvarado (2005) statement that the antibacterial characteristic which is had by monolaurine in VCO, is a potential to prevent the bacteria growth.

The degradation of the chicken meat's bacteria colony count was following with the length of submersion in VCO solution such as at D treatment and it was caused the many of dead bacteria by the monolaurine in VCO solution. Monolaurine can be destroy the lipid membrane bacteria that built bacteria's cell wall, so that the cell content will go out and the bacteria will be killed. Kabara (2005) reported that the monolaurine active in bacteria, yeast, mold and protozoa through torn of the

lipid membrane microorganism. Thus as longer the submersion in VCO solution as higher monolurine number that could kill the bacteria and the result the bacteria colony count of the chicken meat is less during the storage under room temperature. Base on the result of this study, the bacteria colony count of chicken meat at D treatment, which was submerged at longest period (3 h) in VCO, is lowest (6.13×10^{7} CFU $gram^{-1}$). The degradation is also caused by the low of VCO pH (4.64), as the result has high lauric acid content; where at the high acid condition is able to prevent the bacteria growth. This is consistent with Aberle *et al.* (2001) statement that amount of the meat microorganism will decrease when the pH is decline and the opposite.

The monolaurine content in VCO is able to observe by the chicken meat as long as the submersion, so that could increase the inhibition of bacteria growth during the storage at room temperature and was followed by the decreasing of bacteria activities in the meat. Sibuea (2005) suggested that the monolaurine is able to act as antibacterial by decreasing the bacteria growth as long as the storage and also able to raise the damage of foodstuff, so that the shelf life of chicken meat is longer. As the result of this study, the chicken meat at D treatment that was submerged in VCO solution for 3 h has a highest of shelf life such as 17.5 h. Even that was not difference significant compared to C treatment. At this treatment the bacteria colony count that could be spoiled of the meat had the lowest as well. This is consistent with the previous study (Frazier and Wedthoff, 1994) that the spoiled bacteria in the foodstuff would affect the foodstuff shelf life.

The conclusion, the increasing of the submersion period in VCO up to 2 h is significantly to improve of the chicken meat shelf life under room temperature storage.

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