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THE EFFECT OF CONCENTRATIONS OF LIME JUICE (*Citrus aurantifolia*) TOWARD ACCEPTABILITY AND STORAGE LIFE OF CULLED LAYER HENS MEAT

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Abstract

Acids, essential oils, saponins and flavonoids compounds in lime juice is expected to improve the storage life of culled layer hens meat. The research's aim is to obtain a correct concentration of lime juice as marinade of culled layer hens meat that can extend storage life with an acceptable acidity. Research carried out experiments in the laboratory using a completely randomized design with 5 treatments. It were 4 treatments of concentration of lime juice as a marinade of the meat (10, 20, 30, and 40%), and 1 treatment without marinade of lime juice. Each treatment had 5 times replication, so there were 20 treatments. The measured variables are early decay, total bacteria, pH, and acceptability of culled layer hens meat which had various treatments of lime juice concentration and without the treatment of lime juice. The results showed that concentrations of lime juice significantly affect extended early decay and total bacteria, but not significantly affect on pH of culled layer hens meat. Increasing concentrations of lime juice is followed by an increasing in pH, increasing in the storage life and decreasing the amount of bacteria.The meat accidity up to 30% lime juice (Citrus aurantifolia) marinade can still be accepted by the panelists.

Key words*: chicken, meat, lime juice, acidity, storage.*

INTRODUCTION

Culled layer hens meat has loamy texture and because of that it less prefered by costumers. Nevertheless culled layer hens meat still has its potential as food because the meat has high nutrition, but the meat also a good media for microorganism to grow which make the meat decay.

Meat decay can be delayed by natural preservative such as lime juice. It is because lime juice has big proportion of organic acid (ascorbic acid and citric acid). Beside it, lime juice contain saponin compound and flavonoid such as hesperidin, tangeretin, naringin, eriocitrin (Dewi Maharani, 2009). Lime juice contain flavonoid compound which has function as bacteriside and bacteriostatic. This compound can obstruct metabolism process on bacteria which can also obstruct bacteria growth (Cowan, 1999).

Birk et al. (2010) said that marinated meat with organic acid such as acetate acid, citric acid, tartaric acid, lactic acid or malic acid can decrease pH of the meat which can also decrease growth of bacteria *Campylobacter jejuni* for 25 days storage at 4°C. Aritonang and Mihrani (2008) reported that marinated local chicken in acetate acid for 15 minutes with concentration until 12% can decrease pH and bacteria number and extend meat storage.

According to the research of Hantoro (2012) that organic acid in lime juice such as citric acid, malic acid, lactic acid and small amount of tartaric acid with low concentration is able to penetrate the cell wall of salmonella bacteria. It is the same with the research of Razak et al. (2013), that lime juice had an obstruct effect toward the growth of bacteria *Staphylococcus aureus.*

The effectivenes of lime juice as preservative affected by the level of solution concentration as marinade because it affects amount of acid component which is diffused inside the meat and in the end will affect durability, pH and total amount of bacteria in culled layer hen's meat, but high concentration of lime juice will decrease acceptability. Therefore, the aim of this research is toget a perfect lime juice concentration which can extend the storage life and acceptable by panelist.

MATERIALS AND METHODS

This research used 20 culled layer hens strain Isa brown age 24 month, and 40 kg limes *Citrus aurantium, subspes. Aurantifolia, var.fusca*. To make solution concentration of lime juice, the lime should be washed and peeled and squeezed until 16.000 ml (assumed that 1 kg lime makes ± 400 ml lime juice) (Geugeut, 2010). The result of lime juice solution for various concentration treatment listed on Table 3. Then carcass of culled layer hen soaked in each lime juice concentration.

Table 1. Manufacture of various concentration of lime juice solution

Concentration (%)	Lime Juice (ml)	Aquades (ml)
Without Lime Juice	0	40000
10	400	3600
20	800	3200
30	1200	2800
40	1600	2400

The research was done by experiment with Completely Randomized Design with 5 treatments there are soaking without lime juice (P1), soaking with 10% lime juice concentration (P2), soaking with 20% lime juice concentration (P3), soaking with 30% lime juice concentration (P4) and soaking with 40% lime juice concentration (P4), each treatment were soaked for 30 minutes. Each treatments repeated 4 times.

The measured variables are pH, total early decay of bacteria, and acceptibility toward meat acid level.

RESULTS AND DISCUSSIONS

The effect of concentration of lime juice toward durable power and acceptability of culled layer hen meat acid is listed in Table 2.

Table 2. Result of statistical test of the treatment effect toward acceptability and storage life of culled layer hens meat

Variable	Lime Juice (%)				
	0	10	20	30	40
Early Decay (minute)	678 (a)	746 (b)	933 (c)	1001 (d)	1098 (e)
Total Count ($x10^6$ cfu/g)	87.32 (a)	43.85 (b)	24.38 (c)	10.68 (d)	2.75 (e)
Acidity (pH)	5.63 (a)	5.46 (a)	5.29 (a)	5.02 (a)	4.91 (a)
Acceptability (acid/no acid):					
Taste	No Acid	No Acid	No Acid	No Acid	Acid
Smell	No Acid	No Acid	No Acid	No Acid	Acid
Flavor	No Acid	No Acid	No Acid	No Acid	Acid

Description: Value which is followed by the same letter to the line show no significant effect

Data on Tabel 2 showed that increasing concentration of lime juice will be followed by increasing of early decay and decreasing of amount of each bacteria significantly different ($P<0.05$). This is because increasing of concentration of lime juice followed by increasing of meat acidity so that microorganism growth inhibited, specially not acid resistant microorganism. This is in line with opinion of Buckle et al. (2009) that only small microorganism founded and can damage food ingredient which is pickled, beside that lime juice contain flavonoid compound which has function as anti bacteria and has bacteriostatic character. This compound inhibit metabolism process on bacteria and caused the growth of bacteria inhibited (Cowan, 1999). The more increasing of lime juice concentration which is used in marinating, the more flavonoid content in lime juice which cause inhibiting bacteria activity, so that storage life of culled layer hen meat can be extended.

Inhibited mecanism of microbe growth by antimicrobe compound such as (1) cell wall devastation, which caused lisis or inhibit forming the cell wall growth, (2) change permeability sitoplasm membran which caused nutrition leaked inside the cell, (3) protein denaturation, (4) devastation of metabolism system inside the cell with inhibiting intracelullar enzyme process (Pelczar et al., 2005).

Soaking treatment of culled layer hen meat on concentration 10%, 20%, 30%, 40% and soaking without lime juice (0%) don't give significant effect to pH of culled layer hen meat. This is because adding lime juice as meat

marinade from concentration 0% untill 40% produce pH between 5,63 – 4,91. This showed that pH of culled layer hen meat is in the same acid group, which include not acid until medium acid ingredient food. According to Buckle et al. (2009) that food ingredient between pH 5.63 – 4.91 grouped into not acid until medium acid food ingredients. Decreasing of pH not only caused by lime juice soaking but also the stop of blood circulation and oxygen supply after the animal being slaughtered which is caused glycolysis, a breakage of glycogen into lactic acid which make decreasing of pH of culled layer hen meat.

Lowest meat acidity (pH 4.91), lowest amount bacteria (2,75 x 10^6 CFU/g) and longest early decay (18 hours 18 minutes) is on treatment concentration of 40% lime juice but for acceptability (taste, smell and flavor) on that concentration, panelist had taste the acidity on the meat. This is because of an increasing of lime juice concentration will be followed by increasing of acidity of the culled layer hen meat, and it showed in meat pH test which is showed decreasing of pH with increasing of lime juice concentration. This showed that in acceptability, optimum limit of using lime juice as mariate of culled layer hen meat is on concentration 30%.

CONCLUSIONS

1. Concentration of lime juice as marinade of culled layer hen meat affect early decay and total amount of bacteria, but do not affect pH.
2. Increasing concentrations of lime juice is followed by an increasing in pH, increasing in the storage life and decreasing the amount of bacteria.The meat accidity up to 30% lime juice (*Citrus aurantifolia*) marinade can still be accepted by the panelists.

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