International Journal of Agriculture Innovations and Research
Volume 7, Issue 5, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 19/02/2019 | Accepted on: 20/03/2019 | Published: 04/04/2019

Characteristics of Se'i (Rotenese Smoke Beef) Treated with Roselle Calyces and Liquid Smoke

Gemini E.M. Malelak [1*], Arnol. E. Manu [1], Gusti. A.Y. Lestari [1] and I. Gusti. N. Jelantik [1]
[1]Faculty of Animal Husbandry, Nusa Cendana University. Jl. Adisucipto Penfui, Kupang West Timor (NTT), Indonesia 85001.
*Corresponding author email id: geminimalelak@yahoo.com.au

Abstract **– The objectives of this study were to determine the effect of Roselle calyces (*Hibiscus sabdariffa*) (RC), liquid smoke (LS) and a combination of both (RCLS) on taste, pH, total plate count (TPC) and cholesterol content in *se'i* (*Rotenese smoke beef*). The experiment was assigned in a completely randomized design (CRD) with six treatments and three replications. The six treatments were: Control (C) = *se'i* conventional (without treatment), RC_1 = roselle calyces 4% (v/w), RC_2 = roselle calyces 8% (v/w), LS = liquid smoke (5%) (v/w), $RCLS_1$ = roselle calyces 4% + liquid smoke 5%, $RCLS_2$ = roselle calyces 8% + liquid smoke 5%. Data were analyzed using Analysis of variance (ANOVA) and continued by Duncan multiple range tests (DMRT) to detect difference between means. Taste and aroma were analyzed with Kruskal Wallis test followed by Mann Whitney test to detect difference between means. Result showed that treatments decreased aroma and taste score, TPC numbers and cholesterol content of *se'i* ($P<0.05$) but not effect pH value. It can be concluded that roselle and, the combination of roselle + S*chleichera oleosa* liquid smoke is more effective in reducing bacterial numbers in se'i compare to S*chleichera oleosa* liquid smoke. S*chleichera oleosa* liquid smoke and control bring same effect on taste and TPC numbers since both of them contain similar bioactive compounds. Adding liquid smoke or/and roselle reduce cholesterol content but not influence pH value of se'i.**

Keywords **– Se'i, Roselle Calyces, Liquid Smoke, Total Plate Count.**

I. Introduction

Se*'i* (Rotenesse smoked meat) usually made from beef, slicing into rope-shape, spicing with salt and saltpeter (KNO_3) then smoking uses *Schleichera oleosa* wood. Nowadays *se'i* had made from any kind of meat such as pig, goat, lamb, buffalo, deer and even fish meat. *Se'i* has made been produced in home and industrial scale too.

One of the safety points of *se'i* depends on level of carcinogenic compounds which always containing in smoked meat product. The carcinogenic compounds: polycyclic aromatic hydrocarbon (PAH) and benzo (a) pyrene are produced during pyrolysis of wood. When *se'i* is smoking all components from smoke, include PAH and benzo (a) pyrene, inherent directly into meat surface. While in liquid smoke, level of the carcinogenic compounds is low since before applied in food, the liquid smoke was redestilated and filtrated.

Se'i has specific characteristics in color, aroma and taste. However, the characteristics can change if during processing some additives are added. Generally, plant materials, which are rich in bioactive compounds usually, are added in meat processing in order to inhibit lipid oxidation and reduce microbial numbers.

One of plants that usually used in meat processing is roselle calyces since in roselle calyces contain anthocyani--ns, ascorbic acid and phenolic (Abou-Arab *et al*., 2011). The phenolic content in the plant consists mainly of anthocyanins like delphinidin-3-glucoside, sambubioside, and cyanidin - 3 - sambubioside mainly contributing to their antioxidant properties (Aurelio *et al*., 2007) and the amount of cyaniding - 3 - sambubioside is lower than delphinidin - 3 - sambubioside (Peng-Kong *et al*., 2002). Ascorbic acid also has antioxidant properties (Christian and Jackson, 2009). Anthocyanins and organic acids in roselle had the ability as an antioxidant (Bozkurt and Belibag (2009). The antioxidant properties rely on pH (2–7) in which the ability of antioxidant decreases when pH increases (Sukhapat *et al*., 2004).

Roselle calyces also contain antimicrobial compounds. It was reported that roselle calyces could inhibit growth of Staphylococcus *aureus* dan *Escherichia coli* (Nwaiwu *et al*., 2012) and also *Escherichia coli* and *Salmonella* (Pliego, 2007). It also proved to inhibit food spoilage bacteria such as *Bacillus cereus, Salmonella typhimurium* DT104, *E coli* O157 : H7, *Listeria monocytogenes* and *Staphylococcus aureus* (Chao and Yin, 2009) and inhibit *E. coli* and *Staphylococcus aureus* in milk (Higginbotham *et al*., 2014). The addition of 1.5% - 6% of dried roselle calyces in broiler diets reduced bacterial number both in fresh and cooked chicken meats (Onibi and Osho, 2010).

Addition of roselle during se'i processing can influence the organoleptic properties. Malelak *et al* (2017) reported that adding roselle calyces extract increased taste and tenderness of se'i. While in Sucuk ((a vegetarian dryfermented sausage) addition of roselle can enhance the color, flavor, and texture (Karabacak and Bozkurt, 2008).

One of the problems with meat products is cholesterol content in association with high blood pressure, cardiovascular diseases and so forth. This experiment aims to investigate the effect of using liquid smoke or roselle calyces and mixed liquid smoke and roselle calyces in organoleptics aspects, pH, bacterial count and cholesterol content on se'i.

II. Materials and Methods

Beef were taken from butt and rump of Bali cattle as many as 10 kgs were purchaged in meat shop in Kupang. The beef was trimmed of fat and excessive of connective tissues and nine kgs of beef left. Then, the beef cut into rope-shaped was about 3 cm in thickness, added 20 g of refined and ground table salt and 300 mg of saltpeter of kg^{-1} meat then mixed well. The beef divided into six groups namely: Control (C) = *se'i* traditional, without

Copyright © 2019 IJAIR, All right reserved

adding liquid smoke or roselle calyces. RC_1 = roselle calyces 4% (v/w), RC_2 = roselle calyces 8% (v/w), LS = liquid smoke (5%) (v/w), $RCLS_1$ = roselle 4% + liquid smoke 5%, $RCLS_2$ = roselle 8% + liquid smoke 5%. Each group consists of three replications.

Roselle and Liquid Smoke

Calyxes of roselle was obtained from Oefafi village - Kupang - East Nusa Tenggara province. The calyxes were separated from seed and dried in oven at temperature of 60° C for 3 days, then blended with Philips blender to abtain the mass. To obtain 4% and 8% (w/v) of roselle extract, each of 4 and 8 g of roselle mass poured into volumetric glass and added distilled water up to 100 ml, stirred at 60^{0}C for 5 min and filtered with Whatman (No. 41) (Karabacak and Bozkurt, 2008) with modification. The filtrate then stored in refrigerator (4^{0}C) for 2 days before using.

Schleichera oleosa liquid smoke was obtained from Department of Technology Agriculture, Gadjah Mada University. It was produced in 400^{0}C pyrolysis temperature, destilated and filtrated.

Five ml of *Schleichera oleosa* liquid smoke (LS) poured in the batches and mixed well in batches (one kg of meat, saltpeter and salt). Four or eight grams of powder rossele calyces poured into jar and added distillated water to reach 100 ml, shake thoroughly then pour into the batches (RC_1 or RC_2) respectively. For $RCLS_1$ or $RCLS_2$ roselle added first to the batches then, followed by liquid smoke then mixed well. All treatment then cured for ± 12 h and then smoked used *Schleichera oleosa* wood except for LS, $RCLS_1$ and $RCLS_2$ were smoked in oven at 100°C until well done. When the beef surface was dry, firmness and the color turned to bright red, the smoking was stopped. Triplicate pieces of meat, 100 g of each piece, were carried out for each group of *se'i* used as samples.

Sensory Evaluation

A fifteen non- trained panelists, 18–24 years old, were selected on the basis of their experience in consuming *se'i*. All the panelists were student at Animal Sience Faculty of Nusa Cendana University, East Nusa Tenggara, Indonesia. The panelists asked to examine the taste of se'i for hedonic–scale rating test. Briefly, explanation about the score sheet was held before that.

As many as 30 g of samples were sliced, put into small glass jars, and allowed to stand for several hours. The panelists examined the aroma after one minute opening the jars. The aroma and taste score was 5 = like very much, 4 = like moderately, 3 = like slightly, 2 = dislike moderately, 1 = dislike very much. 5 for each replication from the treatments, the aroma was measured twice.

pH Determination

pH value was measured using a Hanna digital pH-meter at ambient temperature. A 10 g of *se'i* was minced and then homogenized with 10 ml distilled water and filtered (with Whatman paper no 4). Standardized the pH meter between pH 4.0 and 7.0. The filtrate pH obtained was recorded inserting the probe of the pH meter into the filtrate for 30 second then the value was read. For each treatment, measurements were made in triplicate.

Total Plate Count

Se'i sample about 25 g were cut using scalpel and forceps, added 1.50% sterile water then homogenised in Stomacher 400 (Colworth, London, U.K.) for 1.5 min. Total viable counts (aerobic mesophiles) were made on Plate Count Agar (PCA, Oxoid, U.K.) and were incubated at 35^{0}C for 48 h (Viuda-Martos *et al*., 2011).

Cholesterol Content

Cholesterol content was determined in accordance with the methodology saponification followed by high perfor--mance liquid chromatography (HPLC) (AOAC official Method 994.01).

Statistical Analysis

All data obtained from the experiment were analyzed by analyses of variance (ANOVA). Duncan Multiple Range Test (DMRT) was used to determine differences among mean values SPSS 18.

III. Results

The aroma and taste score of se'i adding liquid smoke or/ and roselle can be seen in (Table 1). Result of statistic analysis showed that treatment reduced score of aroma and taste ($P<0.05$), except taste score in control and in LS 5% was same.

Table 1. Average of aroma and taste score of se'i treated with liquid smoked and roselle

Treatment	Aroma	Taste
Control (C)	4,9 ±0.5^a	4.02 ± 0.6^a
Liquid smoke (LS) 5%	3.7 ± 0.8^b	4.1 ± 2.4^{ab}
Roselle extract 4% (RC_1)	3.6 ± 1.2^b	3.7 ± 0.8^b
Roselle extract 8% (RC_2)	2.8 ± 0.9^d	3.2 ± 0.9^c
Roselle extract 4% +l iquid smoke 5% ($RCLS_1$)	3.4 ± 0.9^c	3.3 ± 0.8^c
Roselle extract 8% + Liquid smoke 5% ($RCLS_2$)	3.1 ± 0.7^c	3.7 ± 0.8^b

pH values, TPC and cholesterol content of se'i samples were shown in Table 2. pH value of se'i was not affected by treatments ($P>0.05$). All treatments decreased TPC values of *se'i* ($P<0.05$) except addition of liquid smoke (LS) 5% was same with control. The lowest TPC values were in *se'i* treated with roselle extract 8% (RCE_2).

Table 2. Average pH value, Total plate count (log cfu/g ± SD) and cholesterol content (of *se'i* treated with liquid smoke and roselle extract.

Treatment	pH	Total plate count (log cfu/g)	Cholesterol (mg/100g)
Control (C)	6.13 ± 0.01	3.40 ± 0.05^c	55.27 ± 1.15^c
Liquid smoke (LS) 5%	6.31 ± 0.02	3.37 ± 0.24^c	52.84 ± 0.46^b
Roselle extract 4% (RC_1)	6.41 ± 0.02	3.16 ± 0.11^b	52.84 ± 0.46^b
Roselle extract 8% (RC_2)	6.21 ± 0.09	2.98 ± 0.92^a	52.54 ± 0.46^b
Roselle extract 4% +l iquid smoke 5% ($RCLS_1$)	6.16 ± 0.07	3.16 ± 0.21^b	51.55 ± 0.40^b
Roselle extract 8% + Liquid smoke 5% ($RCLS_2$)	6.16 ± 0.07	3.19^b ± 0.58^b	44.57±1.23^a

$^{a, b}$ significantly difference at $P < 0.05$. ± std (standard deviation).

Copyright © 2019 IJAIR, All right reserved

All treatments decreased cholesterol content of se'i (P<0.05) and the lowest number was in se'i treated with roselle extract 8% + Liquid smoke 5% ($RCLS_2$).

IV. Discussion

Sensory Evaluation

The result of sensory evaluation in this experiment was disagreement with Malelak *et al* (2017) who reported that given 5% (v/v) coconut shell liquid smoke increased *se'i* taste score but did not influence aroma. As can be seen in Table 1 that score taste in control and in LS 5% was same. It could due to in control se'i was smoked using *Schleichera oleosa* wood, and the liquid smoked that used in this experimant was *Schleichera oleosa* liquid smoke. In both gas smoke and liquid smoke contain same compounds thus brought same effect on *se'i* taste. The compound in liquid smoke that play an important role in flavour was phenol (Cardinal *et al*., 2006; Varlet *et al*., 2007). Phenol compound in *Schleichera oleosa* liquid smoke was 0.18% while Tranggono *et al* (1996) reported that phenol in coconut shell liquid smoke was 5.13%. It could expalined that the different effect of adding liquid smoked on *se'i* taste in Malelak *et al* (2015a) and this experiment caused by the different of phenol content in the liquid smoke used.

Bozkurt and Belibagl (2009) found that addition of roselle increased flavour of kavurma and in sucuk (Karabacak and Bozkurt, 2008). The low score taste in se'i could be due to in se'i processing there were not many ingredients used, only salt and saltpeter, thus when roselle added in se'i was directly effect the taste. While in kavurma fat was added and in sucuk some ingredients garlic, pepper, sugar cumin and others.

Rabe *et al* (2003) reported that volatile compounds in fat content play an important role in aroma. Fat content in *se'i* decreased when roselle (RC_1 or RC_2) or liquid smoke (LS) was given, but $RCLS_1$ or $RCLS_2$ was stable (Malelak *et al* (2015b). In this experiment the aroma of se'i was added LS, RC_1 or RC_2 decreased as a result of fat content decreased. On the other hand, the aroma of *se'i* that given $RCLS_1$ or $RCLS_2$ decreased even the fat content was stable. This research indicated that another factors also affected *se'i* aroma beside fat content.

pH Values

pH values and TPC values of se'i samples were shown in Table 2. Statistical analysis showed that all treatments was not effect pH value of se'i (P>0.05). This result was in agreement with (Karabacak and Bozkurt, 2008) whose reported that addition of roselle did not change pH of sucuk and also in kavurma (Bozkurt and Belibagli, 2009). Malelak *et al* (2015a) also reported that using of *Schleichera oleosa* liquid smoke alone or combined with *Citrus aurantifolia* extract did not change the pH of se'i. Arizona *et al* (2011) also reported that using of canary liquid smoke also did not alter pH of beef ,but coconut liquid smoke decreased beef meat ball pH (Arnim *et al*., 2012).

Total Plate Count (TPC) Values

Statistical analysis showed that all treatments decreased TPC values of *se'i* (P<0.05) except addition of liquid smoke (LS) 5%. This result was similar to Malelak *et al* (2015a) that giving 5% (v/v) coconut shell liquid smoke did not change the TPC values of se'i, however when the liquid smoke combined with *Citrus auratifolia* extract reduced the TPC values. The result indicated that antioxidant compounds' content in liquid smoke was lower than in roselle extracts. The effect of liquid smoke as antioxidant depends on the phenolic and carbonyl compounds, however carbonyls have antibacteia activities stronger than phenols (Milly, Toledo and Chen, 2008). The phenols and carbonyls contain in the *Schleichera oleosa* liquid smoke used in this experiment were 0,18% and 3,15% respectively.

The lowest TPC values were in *se'i* treated with roselle extract 8% (RCE_2). The roselle calyces contain some bioactive compounds in which have antimicrobial activity such as organic acids, anthocyanins, phenolic acids and alkaloids (Christian and Jackson, 2009). The main organic acid in roselle calyces are citric acid, malic acid and others, result in low pH approximately 2 – 2.5 (Ali *et al*., 2005), and contribute to antimicrobial activity (Morales-Cabrera *et al*., 2013). Citric acid has antibacterial activity (Hussain *et al*., 2015). Roselle calyces used in this experiment contains organic such as citric acid 2.025%, ascorbic acid 0.106%, tartaric acid 2.167%, malic acid 1,89%, oxalate acid 1.89% and succinic acid 1.761%, and pH values is 2.2. Saliani et al (2015) stated that the antimicrobial activity of Zinc Oxide Nanofluid against *Escherichia coli* O157: H7 and *Staphylococcus aureus* decreased as the pH increased from acidic to neutral

A pH value of se'i was not affected by either *Schleichera oleosa* liquid smoke or extract of roselle calyces, or their combination. In fact that the bacterial numbers of se'i reduced when added roselle or/and liquid smoke. One information missed in this experiment was the pH value of *se'i* before smoking. Since, it could be speculated that pH of se'i reduced before smoking, during curing time, then when smoking the pH value was same as a result of heat and smoking effect.

Maximum limitation of bacterial contamination permitted in smoked meat was $1x10^5$ cfu (5-log cfu/g (National Standard Board of Indonesia**,** 2009). In Table 2 showed that bacterial numbers of all se'i samples were below the numbers, thus it is safe to be consumed.

Cholesterol Content

All treatments decreased cholesterol content of se'i (P<0.05) and the lowest number was in se'i treated with roselle extract 8% + Liquid smoke 5% ($RCLS_2$). Cholesterol is a waxy, fat-like material that is found in meat and also in human body. Consuming meat and meat products could enhance blood cholesterol in human body, even in the human body itself contain cholesterol. It was reported that high-fat intake related to high risk of colon, breast and prostate cancer (Reddy, 1995). Thus, consumers are prefer to chose meat or meat products with low fat and cholesterol.

One alternative to reduce cholesterol content in meat and meat products was added plant materials during

Copyright © 2019 IJAIR, All right reserved

processing. Sadler (2004) stated that to reduce fat and cholesterol content in meat and meat products could use dietary fiber. Used culban seed reduced cholesterol content in egg yolk (Calislar and Demirtas, 2017). Beside organic acids, roselle calyces also contain protein, calorie, fiber and micro-nutrients (Akandi *et al.*, 2009). Whereas in *Sceicherea oleosa* liquid smoke contains phenols, carbonyls and organic acids. The result of this experiment indicated that roselle calyces are more effective in reducing cholesterol and fat compared to liquid smoke.

V. Conclusions

It can be concluded that roselle alone, or the combination of roselle + S*chleichera oleosa* liquid smoke is more effective in reducing bacterial numbers in se'i compare to S*chleichera oleosa* liquid smoke alone. S*chleichera oleosa* liquid smoke and S*chleichera oleosa* liquid smoke (as control) bring same effect on taste and TPC numbers since both of them contain similar bioactive compounds. Adding liquid smoke or/and roselle reduce cholesterol content but not influence pH value of se'i.

Acknowledgment

Authours are grateful to the Directorate General of Higher Education, Ministry of Technology Research and Higher Education for financial support.

References

[1] A.A. Abou-Arab, F. Abu-Salem, and E.A. Abou-Arab. (2011). Physico-chemical properties of natural pigments (anthocyanin) extracted from Roselle calyces (*Hibiscus sabdariffa*). *Journal of American Science.* 7(7): 445-456. http: //www.americanscience .org

[2] D. Aurelio, R.G. dgardo, and S. Navarro Galindo. (2007). Thermal kinetic degradation of anthocyanins in a roselle (Hibiscus sabdariffa L. cv. ´Criollo´) infusion (Online). Available http: //www.blackwell-synergy.com/doi /pdf / 10.1111 /j.1365-2621.2006.01439.x.

[3] W. Peng-Kong, S. Yusof, H.M. Ghazali, and Y.B. Che Man. (2002). Physico-chemical characteristics of roselle (*Hibiscus sabdariffa* L). *Nutrition and Food Science*. 32:68-73.

[4] K.R. Christian, and J.C. Jackson. (2009). Changes in total phenolic and monomeric anthocyanin composition and antioxi--dant activity of three varieties of sorrel (*Hibiscus sabdariffa*) during maturity. *J Food Comp Anal.* 22:663-667

[5] H. Bozkurt, and K.B. Belibagli. (2009). Use of Rosemary and *Hibiscus sabdarifa* L in roduction of Kavurma, a cooked meat product. *Journal of the science of food and agriculture.* 89 (7): 1168.

[6] N. Sukhapat, S. Ungphaiboon, A. Itharat, J. Puripattanavong, and S. Pinsuwan. (2004). Influence of pH on antioxidant activity of Roselle (Hibiscus sabdariffa L.) extract in aqueous solution. The 10th World Congress on Clinical Nutrition: Nutrition in the Next Decade: Nutraceutical/Functional Food: Product Performance in Health, Disease and Safety. Abstract book. Organized by PSU, INC and BIOTEC, 30 Nov- 3 Dec., 2004. Phuket, Thailand. p.184.

[7] N.E. Nwaiwu, F. Mshelia, and I.A. Raufu. (2012). Antimicrobial activities of crude extracts of Moringa Oleifera, Hibiscus S and Hibiscus Esculentus seeds against some enterobacteria. *J Appl Phytotechnol Environ Sanit*. 1:11-16.

[8] M.P.C. Pliego. (2007). Effect of natural antimicrobials against salmonella, *Escherichia coli O157 : H7 and Listeria monocytogenes.* Thesis- Texas A and M University.

[9] C.Y. Chao, and M.C. Yin. (2009). Antibacterial effects of roselle calyx extracts and protocatechuic acid in ground beef and apple juice. Foodborne Pathog Dis. 6(2), 201–206.

[10] K.L. Higginbotham, K. P. Burris, S. Zivanovic, P. M. Davidson, and C.N. Je. Stewart C.N. Jr. (2014). Antimicrobial activity of Hibiscus sabdariffa aqueous extracts against Escherichia coli O157 : H7 and Staphylococcus aureus in a microbiological medium and milk of various fat concentrations. J Food Prot. 77(2) : 262–268.

[11] G. Onibi, and B.I. Osho. (2010). Oxidative stability and bacteriological assessment of meat from broiler chicken fed diets containing Hibiscus sabdariffa calyces. *African Journal of Biotechnology*. 6: 2721-2726. http://www.academicjournals.org/ AJB

[12] G.E.M. Malelak., H.J.D. Lalel., P.R. Kale. and I.G.N. Jelantik. (2017). The Sensory Properties, Color, Microbial, Lipid Oxidation, and Residual Nitrite of *Se'i* Marinated with Lime and Roselle Calyces Extract. Media Peternakan 40(3) : 194-201. DOI : https://doi.org/ 10.5398/ medpet.2017. 40.3.194.

[13] S. Karabacak, and H. Bozkurt. (2008). Effects of *Urtica dioca* and *Hibiscus sabdarifa* on the quality and safety of sucuk (Turkish dry-fermented sausage). *Meat Science*. 78: 288-296.

[14] M. Viuda-Martos, Y. Ruiz-Navajas, J. Fernández-López, and J. A. Pérez-Álvarez. (2011). Effect of packaging conditions on shelf-life of Mortadella made with citrus fibre washing water and thyme or rosemary essential oil. *Food and Nutrition Sciuences., 2: 1-10.*

[15] Association of Official Analytical Chemist (AOAC). (1995). Official Methods of Analysis. 16th Ed. Association of Official Analytical Chemists. Arlington, Virginia.

[16] M. Cardinal, J. Cornet, T. Serrot, and R. Baron. (2006). Effect of the smoking process on odour charactheristics of smoked hearing (Clupea harengus) and relationships with phenolic compound contnt. *Food Chemestry.* 96: 137-146.

[17] V. Varlet, C. Prost, and T. Serot. (2007). New procedure for the study of odour presentativeness of aromatic extracts from smoked salmon. *Food Chem*., 100:820-829.

[18] Tranggono, Suhardi, B. Setiadji, P. Darmadji, Supranto, and Sudarmanto. (1996). "Identifikasi Asap Cair dari Berbagai Jenis Kayu dan Tempurung Kelapa". *Jurnal Ilmu dan Teknologi Pangan.,* 1(2):15-24

[19] G.E.M. Malelak, G.M. Sipahelut, I.G.N. Jelantik, M.R. Denoratu, and H.J.D. Lalel, (2015a). Characteristics of Se'i (Rotenesse smoked meat) Treated with Coconut Shell Liquid Smoked and Citrus aurantifolia Extract. *Media Peternakan.* 38 (2): 89-94.

[20] S. Rabe, U. Krings, and R. G. Berger. (2003). Influence of oil-in-water emulsion properties on the initial dynamic flavor release. *J Sci Food Agric.* 83-1124.

[21] G.E.M. Malelak, G.M. Sipahelut, M.R. Denoratu, and I.G.N. Jelantik. (2015b). Effects of Hibiscus sabdariffa and Schleichera oleosa Liquid Smoke on Lipid Content, Lipid Oxidation and Residual Nitrite in Se'i (Rotenese Smoke Beef). The 6th International Seminar on Tropical Animal Production Integrated Approach in Developing Sustainable Tropical Animal Production October 20-22, 2015a, Yogyakarta, Indonesia. Hal: 683.

[22] R. Arizona, E. Suryanto, and Y. Erwanto. (2011). The effect of canary shell liquid smoke concentration and storage time on chemical and physical quality of beef. *Buletin Peternakan.* 35(1): 50-56.

[23] Arnim, Ferawati, and Y. Marlida. (2012). The effect of liquid smoke utilization as preservative for meatballs quality. *Pakistan Journal of Nutrition*., 11(11): 1078-1080.

[24] P.J. Milly, R.T. Toledo, and J. Chen J. (2008). Evaluation of liquid smoke treated ready-to-eat (RTE) meat products for control of Listeria innocua M1. *Journal of food Sciece*., 73 :M179-183.

[25] B.H. Ali, N. Wabe, and G. Bluden. (2005). Phytochemical, pharmacological, and toxicological aspects of Hibiscus sabdariffa L: a review. *Phytother Res.* 19:369-375.

[26] M. Morales-Cabrera, J. Hernandes-Morales, G. Leyva-Ruelas, Y. Salinas-Moreno, L. Soto-Rojas, and J. Castro-Rosas. (2013). Influence of variety and extraction solvent on antibacterial activity of roselle (*Hibiscus sabdariffa L*) calyces. *J. Med. Plant. Res*., 7:2319-2322.

Copyright © 2019 IJAIR, All right reserved

[27] G. Hussain, A. Rahman, T. Hussain, S. Uddin, and T. Ali. (2015). Citric and lactic acid effects on the growth Inhibition of *E. coli* and *S. typhymurium* on beef during storage. *Sarhad Journal of Agriculture*., 31(3): 183-190.

[28] M. Saliani, R. Jalal, and E.K. Goharshadi. (2015). Effects of pH and Temperature on Antibacterial Activity of Zinc Oxide Nano--fluid Against *Escherichia coli* O157: H7 and *Staphylococcus aureus*. Jundishapur J Microbiol 8(2): e17115. https://www. ncbi. nlm nih.go v/pmc/articles/PMC4376975/

[29] National Standard Board of Indonesia. (2009). Maximum permitted contaminated microbes in food. Indonesian National Standard (SNI) 7388: 2009.

[30] B.S. Reddy. (1995). Nutritional factors and colon cancer. Critical reviews. *Food Science and Nutrition.,* 35:175-190.

[31] M.J. Sadler. (2004). Meat alternatives – market developments and health benefits. *Trends Food Sci Technol*., 15:250-260.

[32] S. Calislar, and I. Demirtas. (2017). Effects of Culban seed (Vicia peregrine L.) on performance and egg characteristics of laying hens. *J.Agr. Sci. Tech*., 19:581-589

[33] W.B. Akanbi, A. B. Olaniyan, A. O. Togun, A. E. O. Hupeja, and A.O. Alaniran. (2009). The effects of organic fertilizer on growth, calyx yield and quality of roselle (*Hibiscus sabdariffa L*). *Am-Eurasian J. Sustain. Agric*. 3:652-657.

AUTHORS PROFILE'

First A. Author
Gemini E. M. Malelak.

Education	University	Field/ year
Undergraduate	Nusa Cendana University (West Timor, Indonesia)	Animal Husbandry/ December, 1988
Master degree	The University of Queensland, Brisbane Australia	Meat Science/ March, 1997
Doctoral degree	Nusa Cendana University (West Timor, Indonesia)	Meat Science. Januari 2019

Jobs;
A Lecturer at Animal Husbandry Faculty, Nusa Cendana University since March 1990 until now.

Publication. :
2015. Characteristics of Se'i (Rotenesse Smoked Meat) Treated with Coconut Shell Liquid Smoked and Citrus aurantifolia Extract. Media Peternakan. 38(2). Year 2015. https: // journal.ipb.ac.id/index.php https: // doi.org/10.5398/medpet.2015.38.2.89 2017. The Sensory Properties, Color, Microbial, Lipid Oxidation, and Residual Nitrite of Se'i Marinated with Lime and Roselle Calyces Extracts. Media Peternakan, 40(3):194-201. https: // doi.org/10.5398/medpet.2017.40.3.194 http://medpet.journal .ipb.ac.id/

Second Author
Arnol E Manu.

Education	University	Field/ year
Undergraduate	Nusa Cendana University (West Timor, Indonesia)	Animal Husbandry/ 1992
Master degree	The University of Gadjah Mada, Yogyakarta, Indonesia	Animal Production/ 2001
Doctoral degree	The University of Gadjah Mada, Yogyakarta, Indonesia	Animal Production/ 2008

Jobs;
A Lecturer at Animal Husbandry Faculty, Nusa Cendana University since March 1994 until now.

Third Author
Gusti A Y Lestari.

Education	University	Field/ year
Undergraduate	Mataram University (West-east, Indonesia)	Animal Husbandry/ 1988
Master degree	The University of Gadjah Mada, Yogyakarta, Indonesia	Nutrition Ruminant/ 2000

Jobs;
A Lecturer at Animal Husbandry Faculty, Nusa Cendana University since March 1990 until now.

Fourth A. Author
I Gusti N Jelantik

Education	University	Field/ year
Undergraduate	Nusa Cendana University (West Timor, Indonesia)	Animal Husbandry/ March, 1990
Master degree	The Royal Veterinary and Agricultural University, Denmark	Ruminant nutrition / 1996
Doctoral degree	The Royal Veterinary and Agricultural University), Denmark	Tropical cattle production system, 2001

Jobs;
A Lecturer at Animal Husbandry Faculty, Nusa Cendana University since March 1991 until now.

Books.

1. R Copland, IGN Jelantik, ML Mullik, HLL Belli, J. Sogen, A. Nale F. Benu. 2011. Evaluating Strategies to Improve Calf Survival in West Timor Villages. ISBN 978 1 921738 99 9. ACIAR, Canberra, Australia. A Parker, R Copland, T Schatz, C L Penu, ML Mullik, IGN Jelantik, I Benu. 2012. Improving Calf Survival and Growth Rates for the Beef Supply Chain in Indonesia. ACIAR, Canberra, Australia.

Publication

1. Jelantik, IGN and P Kune. 2011. District variation of Bali cattle reproductive performance in The Province of East Nusa Tenggara. Journal of Dry Land Sciences. Vol. 2. No. 2 : 147-154.
2. IGN Jelantik, R Copland and I Benu. 2012. Longterm effects of pre-weaning calf starter supplementation on rumen environment of young male Bali bulls maintained on silage and concentrate. .....
3. IGN Jelantik, MR Weibsjerg and J Madsen. 2012. Intake, rumen degradation and utilisation of urea-ammoniated grass hay by Kacang goats as affected by supplementation of sun-dried fish or fish meal. Animal Production. Vol.14.no.2:77-86.

Copyright © 2019 IJAIR, All right reserved