PROCEEDINGS

INTERNATIONAL FOOD CONFERENCE 2016

"INNOVATION OF FOOD TECHNOLOGY TO IMPROVE FOOD SECURITY AND HEALTH"

Surabaya, 20-21 October 2016

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INNOVATION OF FOOD TECHNOLOGY TO IMPROVE FOOD SECURITY AND HEALTH

October 20 – 21, 2016
Universitas Katolik Widya Mandala Surabaya
Surabaya – Indonesia

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Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya
Perhimpunan Penggiat Pangan dan Nutrasetical Indonesia (P3FNI)
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Indonesian Society for Lactic Acid Bacteria (ISLAB)

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PREFACE

Honorable and Distinguished Guests, Ladies and Gentlemen,

First of all, I would like to thank God the Almighty Father, for pouring His grace and blessings upon our lives. Especially, on this very special occasion, Thursday, 20^{th} October 2016, we all gather here on the 2^{nd} International Food Conference 2016 with the following theme "Innovation of Food Technology to Improve Food Security and Health". This great scientific event is held by the Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya (WMCUS), in collaboration with the Indonesian Association of Food Technologist (PATPI) Surabaya Chapter, P3FNI and is also supported by the Indonesian Society for Lactic Acid Bacteria (ISLAB), Pergizi Pangan Indonesia, and Asosiasi Profesi Keamanan Pangan Indonesia (APKEPI).

Therefore please allow me to express my sincerest gratitude and highest appreciation to all aforementioned parties which have actively expressed their strong care, commitment, and enthusiasm in handling various issues related to health promotion and well-being of the society through food consumption. This is, indeed, aligned with the theme of 56^{th} Anniversary of WMCUS, namely "Together with all nation's components, the University is strongly committed to establish a competitive Indonesian Golden Generation".

I believe this scientific meeting will provide a great opportunity for researchers and industry practitioners to disseminate and discuss their latest research innovation and findings in the areas of food technology, health, and food securities. This will result in strategy formulation to overcome problems related to the above fields. I hope this meeting may also expand and strengthen the collaboration between academia and industry practitioners.

Through this important event, food technology may be proven to become one of important contributing factors in promoting the quality of human lives. Ultimately, our nation's competitiveness will be enhanced and Indonesia will be more respected by other nations in the global era. May we continuously strive for excellence in our professional lives to serve the community at large so we may become the sign of God's presence and love.

May God bless us all !

Surabaya, 20^{th} October 2016

Rector

Drs. Kuncoro Foe, G.Dip.Sc., Ph.D.

INTRODUCTION TO THE SEMINAR

Honorable guests, ladies and gentlemen

First of all I would like to welcome you all in this beautiful city of Surabaya, Indonesia. We are delighted to have you here to meet and to share our knowledge, research, and discuss latest trend in the area of food technology and nutrition. The topics of our International Food Conference 2016 is "Innovation in food technology to improve food security and health" and this year is the second edition of the conference after successful first edition in 2011.

As we already aware that the field of Food Technology is growing rapidly and its development is making a great impact on the health and wellbeing of the society. Food technology covers wide range of area starting from the simplest food preservation such as sun drying, post harvest handling to reduce losses, to the advanced nanotechnology for functional food application. Therefore food technology has become one of the most important contributors in human life. Nowadays, food technology are not only intended to fulfill the foods needed for daily consumptions, but has also been an important factor playing role in combating health problems in the world. Research on health problems of the society has been polarized into two groups which are health problems because of malnutrition and health problems due to over nutrition and unbalanced dietary and lifestyle habit.

The aim of this conference is to provide forum for researcher and industries to disseminate their latest research innovation in food technology, health, and food security, create opportunities for researcher to discuss health and food security problems around the world as well as the strategy to manage such problems and also Strengthen the collaboration between universities and industries by designing an event for researcher and industries to gather and discuss opportunities for collaborations.

The participants including invited speakers are coming from different countries such as Australia, Malaysia, Vietnam, Italia, Nigeria, and Indonesia. There are total of 81 papers presented in both oral and poster presentation.

We would like to express our sincere gratitude to all of the invited speakers Ibu Tetty Sihombing from BPOM, Prof Son Radu, Dr. Peter Sopade, Prof. Endang Sutriswati, Prof. Hany Widjaja, Ir. Indah Kuswardani, Prof. Rindit Pambayun, Prof. Achmad Subagio, Prof. Anang Legowo, Dr. Tyas Utami, Dr. Agustin Wardani, Prof. Nuri Andarwulan, Mr. Lino Paravano, Prof Hardinsyah, and Prof. Marsono. We would like to express our gratitude to P3FNI and PATPI Surabaya for the assistance in preparation for this conference.

We would also like to thank our sponsors that made this event possible. Last but not least, I would like to thank all members of organizing committee for their full supports and commitments in preparing this conference. I wish that all of us will have a fruitful discussion and for all of you having a pleasant stay in Surabaya. Thank you.

Warm regards

Ignasius Radix AP Jati
Chair of Organizing Committee IFC 2016

CONTENTS

The Physical Properties and Acceptability of Duck Meat Cured in Curcumin Extract with Added STPP

Sri Hartati Candra Dewi*, Chatarina Wariyah, and Niken Astuti

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Abstract

Duck meat was taken from laying ducks which had become unproductive and also from older male ducks. The duck meat texture was tough and the high fat content of the duck meat caused it to oxidize easily during storage and processing. It is known that curing duck meat in curcumin extract and freezing for storage can inhibit oxidation of the fat, but the meat turns yellowish in colour and the texture of the frozen meat when cooked is tougher. The purpose of this study was to evaluate the effect of curing of duck meat in curcumin extract with the addition of STPP (sodium tripolyphosphate) on the physical properties (colour, texture and water holding capacity) of the duck meat and on its acceptability. The research used Randomized Complete Design, and the duck meat was cured in curcumin extract at concentrations of 0.3% and 0.4% (w/w), then STPP was added at various concentrations of: 0.0; 0.10; 0.15; 0.20 and 0.25% (w/w). The duck meat texture was tested using a Texture Analyzer and the colour tested with a Colour Reader. Acceptability of the cured duck meat with added STPP was determined by Hedonic Test based on smell, colour, texture and flavour. The results of this study concluded that raw duck meat texture was based on resistance to force and deformation, which were not significantly different. Resistance to force was between 545,91g and 597,76g and the deformation was between 70,47% and 73,03%. Water holding capacity of cured meat was between 40,05% and 46.77%, which is higher than fresh meat at 26,81%. However, the color of the cured duck meat wasn't as bright as fresh duck meat, as shown by the lightness (L) of between 34,04 and 36,46 against 34,43 for the fresh duck meat, and yellowness (b) of between 21,43 and 22,98 for cured meat and 22,49 for fresh meat. The research showed that the duck meat cured with curcumin extract at 0.3% and 0.4% concentrations and added with 0:10 to 0:20% STPP resulted in the most acceptable product, based on texture, color and water holding capacity, especially the brighter color and softer texture.

Keywords: duck meat, curcumin, STPP, texture.

Introduction

Duck (*Anasplatyrhynchos*) is a type of poultry farmed for meat and eggs. The quantities of duck meat on the market are still very limited as supply mostly comes from culled females (54.35%), but as much as 35.41% can come from male salvage and up to 18% from young females (Hardjosworo, 2001). Duck meat is the meat of culled non-productive female layers and older males. Reject duck meat has a clay-like texture and a fat content reaching 1.84%, in contrast to chicken meat at only 1.05% fat (Ali *et al.*, 2007). Unsaturated fatty acids (ALTJ) make up more than 60% of the total fatty acids, which results in the duck meat being easily oxidized, thereby degrading flavour, destroying nutrients and leading to a build-up of toxic substances. According to Baggio and Bragagnolo (2006) meat, during processing and storage, can be the subject of oxidation induced by the presence of heat, light, metal and oxygen which will produce ROS (Reactive Oxygen Species) such as aldehydes, peroxide and cholesterol oxides that can lead to degenerative diseases such as cardiovascular disease and early aging.

Attempts to inhibit oxidation of the fat in duck meat were made by Dewi and Astuti (2013) by adding 0.3% turmeric extract as a natural source of antioxidants and then curing for 10 minutes. Storage was undertaken for 8 weeks in a freezer. Turmeric is known to contain curcumin which can inhibit lipid peroxidation (Jayaprakasha *et al.*, 2006). The results show that extract of turmeric can inhibit an increase in the numbers of peroxides and TBARS of duck meat, and the texture of duck meat after storage becomes more tender. But curcumin is yellow in colour and has a distinctive turmeric flavour, which can affect the acceptability of the product. In addition, the research is still limited to storage only. Yet according to Sampaio *et al.* (2012), lipid oxidation will continue during cooking.

The problem is that the texture of duck meat becomes more tender after storage in a freezer (Dewiand Astuti, 2013), but according to Fernandes *et al.* (2013) storing lamb and mutton at freezing temperatures (-18^o C) causes low water retention or Water Holding Capacity (WHC), so that the texture of the meat after cooking is hard. Abdel *et al.* (-) states that the addition of sodium tripolyphosphate (STPP) to lamb meat which is to be frozen can inhibit the decrease in WHCcompared to the control, so the texture of the cooked meat is softer and is preferred by the consumer. And according to Marsha et al. (2013) the use of STPP in turkey meat, in addition to controlling the WHC, can also inhibit the oxidation of fat by slowing down the penetration of heat into the material. Hence this objective study to evaluate the effects of curing duck meat in curcumin extract, and the addition of STPP on the physical properties and acceptability of duck meat, both raw and after cooking.

Materials and Methods

This study was undertaken with the aim of producing duck meat with a soft texture after frozen storage, to measure the effects of antioxidants, provide high acceptability and stability during processing, and to be safe for human consumption.

Materials

The materials used for the study of duck meat were derived from duck breeders in the village of Argomulyo, Sedayu, Bantul, Yogyakarta. Turmeric, as a natural source of antioxidants, was purchased from a local market in the Yogyakarta area. Analysis of the base material (duck meat) included water content (AOAC, 1990). Water holding capacity (Hamm, 1960 in Soeparno, 2009) was tested using a Texture Analyzer and colour was tested using a Colour Reader. Chemicals used in all the pro qualifying analyses were obtained from Merck.

Methods

The research method consists of five steps. These are : 1) Preparation of turmeric curcumin extract by sorting tubers, then peeling and washing. Curcumin extraction using maceration method (Marsono *et al.*, 2005), 2) Curing fresh duck meat with turmeric curcumin extract (with a variation of 0.3% and 0.4%) and variation of the addition of STPP at 0.00; 0.10; 0.15; 0.20; and 0.25%, 3) Storage of duck meat (phase 2) at freezing temperatures (-10^{o}C) for 8 weeks, 4) Testing the physical properties (texture, color, WHC), 5) Determining the organoleptic acceptability of (phase 3) raw duck meat by sensory test.

Statistical analysis

The experimental design used was completely randomized design, factorial pattern with factors such as variation of the ratio of fresh meat to the amount of curcumin extract and STPP to determine the differences between treatments used by the F test, then the real difference between the samples was determined by Duncan's Multiple Range Test (DMRT) (Gacula and Singh, 1984)

Result and discussion

Texture of duck meat

The results showed that there was no interaction effect from each curcumin and STPP treatment on the texture of the cured duck meat (Table 1). The addition of 0.3% and 0.4% curcumin did not affect the texture of the cured raw duck meat. This is consistent with the results of research by Dewi and Astuti (2014) which states that adding curcumin only increases antioxidants, which does not affect the texture of duck meat. The texture of the cured raw duck meat is also not influenced by the addition of STPP because STPP, as well as increasing the water retention capabilities of meat during cooking, can also help maintain meat texture and tenderness (Petracci *et al.* 2013). Tender meat has a much higher market value than tough meat. This is likely due to the meat used being a sample of different muscles, as in this study by using only a few ducks but utilizing all the meat from each carcass. Soeparno (2009) states that muscle difference affects the texture and tenderness of meat.

Table 1. Texture of cured duck meat (g)

Curcumin (%)	STPP (%)					Average (ns)
	0	0,1	0,15	0,2	0,25	
0,3	559,25	542,50	686,50	599,88	578,38	593,30
0,4	565,75	650,50	509,01	491,94	554,88	554,42
Average (ns)	562,50	596,50	597,76	545,91	566,63	

Deformation of duck meat

Deformation is a change in the meat texture caused by cutting the meat to measure texture. Raw cured duck meat has relatively similar deformation and is not affected by curcumin treatment, STPP and interaction (Table 2). This may be because the texture is not significant so deformation is insignificant as well.

Table 2. Deformation of cured duck meat (%)

Curcumin (%)	STPP (%)					Average (ns)
	0	0,1	0,15	0,2	0,25	
0,3	55,44	77,63	64,51	72,65	72,22	68,49
0,4	69,57	68,43	76,42	69,32	72,00	71,15
Average (ns)	62,51	73,03	70,47	70,99	72,11	

If the cured duck meat was overcooked, the deformation was affected by the addition of STPP. Deformation of cured cooked duck meat was greatest with the addition of STPP by 0.1%. Higher additions of STPP showed no more significant deformation. This is because in meat products, STPP is generally used to maintain texture or tenderness after cooking.

Brightness (L) of cured duck meat

The brightness of cured duck meat was influenced significantly by the addition of STPP, but there was no significant effect from the addition of curcumin as well as its interaction (Table 3). The addition of 0.4%

curcumin gave the same relative brightness as the addition of 0.3%. Curcumin only serves to add antioxidants, which are substances that can inhibit an oxidation reaction in materials susceptible to oxidation (Fennema, 1996). It is likely that it has no real effect on the brightness of the flesh. The brightness of cured duck meat was significantly enhanced by the STPP treatment with the lowest brightness coming from the addition of 0.2% STPP and the highest brightness of 36.46 from 0.1% addition of STPP. Petracci *et al.* (2013), stated that some of the functional ingredients used in meat, STPP being one of them, are also able to increase the water retention of meat during cooking.

Table 3. Lightness of cured duck meat

Curcumin (%)	STPP (%)					Average(ns)
	0	0.1	0.15	0.2	0.25	
0,3	35,08	36,17	35,82	30,35	33,73	34,20
0,4	33,78	36,74	36,45	32,99	34,34	34,85
Average	34,43[a]	36,46[a]	36,14[a]	31,67[b]	34,04[a]	

Redness of cured duck meat

The colour of cured duck meat is not affected by the addition of curcumin, STPP or its interaction (Table 4). Redness value which is positive showed that duck has a reddish colour, while if the value is negative then the meat will be a greenish colour. In this study the positive value means that the cured duck meat in this research is reddish in colour. Red cured duck meat indicates normal meat.

Table 4. Redness of cured duck meat

Curcumin (%)	STPP (%)					Average (ns)
	0	0,1	0,15	0,2	0,25	
0,3	7,58	6,25	7,00	7,67	6,22	6,94
0,4	7,20	8,07	7,38	6,69	7,02	7,27
Average (ns)	7,39	7,16	7,19	7,18	7,52	

Yellowish color of cured duck meat

The result showed that the value of yellowness of cured duck meat was significantly influenced by the addition of curcumin, but was not influenced by the addition of STPP and there was no interaction (Table 5). In addition, curcumin added at 0.4% had a higher yellowness value, i.e. had a more yellow coloured flesh than the 0.3%.

Table 5. Yellowness of cured duck meat

Curcumin (%)	STPP (%)					Average
	0	0,1	0,15	0,2	02525	
0,3	20,17	21,40	24,05	21.26	21,76	21,73[a]
0,4	24,80	24,10	20,40	21,60	24,20	23,02[b]
Average (ns)	22,49	22,75	22,23	21,43	22,98	

Ali *et al.* (2007) stated that the color of the duck meat has a very high redness value, but it has a low brightness value. Dewi and Astuti (2014) stated that the addition of curcumin gave an improved flesh color. It is further mentioned that there is a relationship between the amount of curcumin and the length of time curing the duck meat on the colour. i.e. if lower levels of curcumin are used to get the desired yellow color, then curing time has to be longer.

Water Holding Capacity (WHC) Value of cured duck meat

The results of this study indicate that the WHC value of duck meat was significantly influenced by the addition of STPP, but that it was not affected by the addition of curcumin and its interaction (Table 6). The addition of STPP increased the WHC value, but at an addition of 0.25% (Table 6).

Table 6. WHC Value of cured duck meat

Curcumin (%)	STPP (%)					
	0	0,1	0,15	0,2	0,25	Average (ns)
0,3	30,28	41,01	43,00	43,22	38,82	39,27
0,4	23,33	41,25	50,13	50,32	41,28	41,26
Average	26,81[a]	41,13[b]	46,57[b]	46,77[b]	40,05[b]	

This is consistent with the statement of Thomas (1997) cit. Dewanti (2009) that STPP can absorb, bind and hold water, increase water holding capacity (WHC) and tenderness. Yuanita (2008) states that the STPP FG is able to break the bonds of the water in the meat, thus causing a decrease in the levels of WA (water activity) which is an essential component in inhibiting the growth of microbes. A high WHC value for meat shows that the meat can hold water, so the water level is higher. This is consistent with the research results of Pratiwi (2016), which state that higher the levels of STPP FG used, up to a level of 4% in broiler meat soaking, the lower the water content. An improvement in the FG STPP treatment levels is also accompanied by an increase in the elasticity of the meat and its water holding capacity. This means that a decrease in water content does not occur in the water-bound or immobilized free water, but is due to the evaporation of free water (Yuanita *et al.* 1997).

Sensory Test of Cured Duck Meat

The results of the study of sensory testing of cured raw duck meat show that the smell, texture are affected on the whole by the addition of curcumin and STPP (Table 7). The smell of the raw meat with curcumin added at 0.3% is less preferred than that at 0.4%;, with the highest score of unlikeability being 0.3% curcumin and 0.2% STPP giving a score of 4.60 or the most disliked. The colour test by sensory testing was not affected by either the curcumin treatment or the STPP. The texture of the raw duck meat was tested by pressing with a finger. The results of the tests of sensory texture of the meat turned out to be significantly different, with the least preferred texture coming from the addition of 0.4% curcumin and 0.25% STPP. But the most preferred overall by the panelists in a sensory test came from the addition of curcumin at 0.3% and 0.4% and STPP 0.25%.

In the sensory test of cured cooked duck meat the smell was not affected by treatment with curcumin and STPP. While colour, texture and taste were on the whole affected by treatment with curcumin and STPP, the addition of curcumin made no significant difference to the smell of the cooked meat , possibly because 0.3% and 0.4% additions of curcumin after cooking had a relatively similar smell.

Table 7. Sensory Test of Cured Duck Meat

		Smell	Color (ns)	Texture	Overall
	Basic Material	3,53^{ab}	3,47	4,27^{b}	3,73^{ab}
Curcumin (%)	STPP (%)				
0,30	0,00	4,53^{ab}	3,73	4,20^{ab}	4,33^{b}
	0,10	4,27^{ab}	3,21	3,33^{ab}	3,73^{b}
	0,15	3,80^{ab}	3,33	3,27^{ab}	3,47^{ab}
	0,20	4,60^{b}	4,00	3,87^{ab}	4,13^{ab}
	0,25	4,47^{ab}	3,40	3,33^{ab}	3,25^{ab}
0,4	0,00	3,30^{a}	3,67	3,47^{ab}	3,53^{ab}
	0,10	3,73^{ab}	3,40	3,93^{ab}	3,40^{a}
	0,15	3,33^{a}	3,47	3,93^{ab}	3,47^{ab}
	0,20	4,13^{ab}	3,60	3,67^{ab}	3,87^{ab}
	0,25	3,40^{ab}	3,53	3,07^{a}	3,20^{a}

Table 8. Sensory Test of Cured Duck Meat

		Smell (ns)	Color	Texture	Flavore	Whole
	Basic Material	3,67	4,40^{b}	3,13^{ab}	3,33^{ab}	3,53^{ab}
Curcumin (%)	STPP (%)					
0,30	0,00	3,20	3,80^{ab}	3,80^{ab}	4,33^{bcdef}	4,20^{abc}
	0,10	3,33	3,33^{ab}	3,19^{ab}	3,13^{a}	3,47^{a}
	0,15	3,93	3,60^{ab}	2,73^{a}	3,93^{abcde}	3,73^{ab}
	0,20	3,27	3,13^{a}	2,80^{a}	3,47^{abc}	3,30^{a}
	0,25	3,67	3,44^{ab}	3,47^{ab}	3,80^{abcd}	3,93^{abc}
0,4	0,00	3,13	3,27^{a}	4,20^{ab}	4,67^{def}	4,13^{abc}
	0,10	4,20	3,13^{a}	4,27^{b}	5,00^{ef}	5,00^{c}
	0,15	4,04	3,47^{ab}	4,33^{b}	5,13^{f}	4,67^{bc}
	0,20	4,07	3,07^{a}	3,53^{ab}	4,60^{cdef}	4,40^{abc}
	0,25	4,13	3,40^{ab}	3,20^{ab}	4,60^{cdef}	4,40^{abc}

While the most preferred colour of cooked cured meat was achieved by adding STPP at 0.2% and curcumin at 0.3% to 0.4%. Preferred texture of the cooked cured meat is achieved by addition of curcumin 0.3% and STPP at 0.1 to 0.2%, and curcumin at 0.4% with STPP at 0.2% to 0.25%. While the preferred taste of cooked cured meat is with curcumin added at 0.3% and STPP from 0.1% to 0.25%, and curcumin at 0.4% with STPP from 0.2% to 0.25%. On the whole the most preferred cooked cured duck meat is with an addition of curcumin at 0.3% with STPP from 0.1% to 0.2%, and curcumin added at 0.3% with STPP at 0.20% to 0.25%.

Conclusion

The results of this study concluded that raw duck meat texture was based on resistance to force and deformation, which were not significantly different. Resistance to force was between 545,91g and 597,76g and the deformation was between 70,47% and 73,03%. Water holding capacity of cured meat was between 40,05% and 46.77%, which is higher than fresh meat at 26,81%. However, the color of the cured duck meat was not as bright as fresh duck meat, as shown by the lightness (L) of between 34,04 and 36,46 against 34,43 for the fresh duck meat, and yellowness (b) of between 21,43 and 22,98 for cured meat and 22,49 for fresh meat. The research showed that the duck meat cured with curcumin extract at 0.3% and 0.4% concentrations and added with 0:10 to 0:20% STPP resulted in the most acceptable product, based on texture, color and water holding capacity, especially the brighter color and softer texture.

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