International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 2 (2018) pp. 1328-1331

Different Conditions Impacting to Physicochemical Properties and Sensory Characteristics of Bronze Featherback Sausage

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Abstract

Bronze featherback *(Notopterus notopterus)* is an important freshwater fish in economic value of Vietnam. It is commonly sold in the form of scraped meat in plastic bags and kept on ice during transportation and distribution. Gelation is one of important functional properties of fish mince. There is no scientific research mentioned to the application of bronze featherback **(***Notopterus notopterus***)** in fish sausage. We evaluated some technical parameters affecting to the physicochemical properties and sensory characteristics of bronze featherback sausage. Our results showed that 0.6% CMC, 0.2% alginate greatly reinforced the shear stress of surimi gels made from bronze feather muscle. Alginate and CMC were useful additives for improving the physicochemical properties and sensory characteristics of fish sausage. By grinding the paste in 2 minutes, sausage had a high holding water capacity. Fish sausage had the high score of consumer evaluation under sterilization in 115^{o}C in 5 minutes.

Keywords: Bronze featherback, sausage, gelation, CMC, alginate, sterilization

INTRODUCTION

Bronze featherback *(Notopterus notopterus)* is one of the most conspicuous groups of fish in the Mekong. The peculiar knife-shaped body with a long anal fin, which is continuous with the caudal fin, readily identifies a featherback. The bronze featherback can be encountered just about everywhere in the Mekong basin, but it prefers standing or sluggish water. It migrates from the dry season refuges to spawn in rice fields. When the floodwaters recede, the fish migrates back to permanent streams and canals. Its favourite food consists of shrimps and aquatic insects. Although these fish, like other featherbacks, have more spines in their flesh than any other Mekong fish species, they are popular food fish. Most often the meat is used to make very tasty fish cakes. For nutritional value, bronze featherback meat is a good source of protein.

Sausage is a product in which meat flesh is mixed with additives, stuffed into suitable casings, and heat processed (Raju *et al.*, 2003). Fish sausage is a product that sausage manufactures have started producing due to changing consumer preferences toward healthier lifestyles, safer and cheaper foods (Panpipat and Yongsawatdigul, 2008; Nowsad and Hoque, 2009). Spotted featherback (*Chitala ornata*) is another species of bronze featherback. Piyawan Tachasirinukun (2016) examined the effect of setting conditions on proteolysis and gelling properties of spotted featherback (*Chitala ornata*) muscle. However, scientific results about the application of bronze featherback (*Notopterus notopterus*) in fish sausage are lacking.

Carboxymethylcellulose (CMC) and alginate were already used in beef frunkfurters, sausages, and patties (Lin and Keeton, 1998; Ruusunen, 2003; Jiménez-Colmenero, 2010). The addition of CMC and alginate improved the water holding capacity of restructured fish products.

The goal of our study was to determine if the addition of alginate, CMC as well as the effect of grinding time, sterilizing temperature and sterilizing time could improve the physicochemical properties and sensory chacarteristics of bronze featherback sausage.

MATERIAL & METHOD

Material

We raised bronze featherback fishes in Hau Giang province, Vietnam. They must be cultivated following Global without using antibiotic to ensure food safety. After harvesting, they must be kept in ice chest (< 4^{o}C) and conveyed to laboratory within 2 hours for experiments. Proteolysis and biochemical changes of muscle can be taken place to some degrees during iced storage. We used knife to fillet the muscle out of bone. Besides collecting muscle of bronze featherback, we also used other materials such as NaCl, monosodium glutamate (MSG), pepper, sugar, garlic, CMC, alginate. Lab utensils and equipments included grinder, weight balance, thermometer, autoclave, ice chest, texture analyzer.

Research method

Investigate the effect of CMC concentration to the gelation

Bronze featherback fishes were filleted to collect muscle and discard bone. Fish muscle was kept under 4oC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. Bronze featherback muscle was grinded into paste in 2 minutes at 0-4^{o}C. We added different CMC concentrations (0, 0.2, 0.4, 0.6 and 0.8%) into fish paste. Then the fish paste was stuffed and formed sausage. Fish sausage was then sterilized in 115^{o}C in 10 minutes. We evaluated moisture content in paste and sausage, sausage recovery, sausage elasticity (strain and stress), sausage sensory (score from 1-5).

Investigate the effect of alginate concentration to the gelation

Bronze featherback fishes were filleted to collect muscle and discard bone. Fish muscle was kept under 4oC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. Bronze featherback muscle was grinded into paste in 2 minutes at 0-4ºC. We added different alginate concentrations (0, 0.2, 0.4, 0.6 and 0.8%) into fish paste. Then the fish paste was stuffed and formed sausage. Fish sausage was then sterilized in 115ºC in 10 minutes. We evaluated moisture content in paste and sausage, sausage recovery, sausage elasticity (strain and stress), sausage sensory (score from 1-5).

Investigate the effect of sterilization time and temperature to the gelation

Bronze featherback fishes were filleted to collect muscle and discard bone. Fish muscle was kept under 4ºC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. Bronze featherback muscle was grinded into paste in 2 minutes at 0-4ºC. We added CMC 0.6% and alginate 0.2% into fish paste. Then the fish paste was stuffed and formed sausage. Fish sausage was then sterilized in different temperatures (110, 115, 120ºC) and in different times (5, 10, 15 minutes). We evaluated moisture content in sausage, sausage recovery, sausage elasticity (strain and stress), sausage sensory (score from 1-5).

Statistical analysis

Data were statistically summarized by Statgraphics.

RESULT & DISCUSSION

Effect of CMC concentration to the gelation

Gelation is the cross-linking of randomly dispersed polymer chains to form a three-dimensional network which including initial denaturation to cause protein unfolding, proteineprotein interactions and aggregation giving rise to matrices capable of holding water, fat or other components through physico-chemical forces.

We added different CMC concentrations (0, 0.2, 0.4, 0.6, 0.8%) into fish paste. Our results were elaborated in table 1, 2 and 3. We noticed the optimal CMC concentration at 0.6% for bronze featherback sausage. Alshimaa Abdalla Hafez (2012) evaluated some physicochemical and sensory properties of cake supplemented with marjoram as partially substituted of flour at different levels (1, 2 and 3 %). The results showed that phenolic compound of marjoram extract in descending order were ellagic, salicylic, pyrogallol and catechol (157.98, 66.55, 43.24 and 23.86 respectively).

Table 1. Effect of CMC concentration to moisture content (paste and sausage), sausage recovery

CMC content (%)	Paste moisture (%)	Sausage moisture (%)	Recovery (%)
0	48.63^{c}	46.26^{c}	89.41^{c}
0.2	55.84^{bc}	53.85^{bc}	92.01^{bc}
0.4	56.01^{b}	54.37^{b}	92.85^{b}
0.6	**56.45^{ab}**	**55.01^{ab}**	**95.44^{a}**
0.8	57.29^{a}	56.15^{a}	95.50^{a}

Table 2. Effect of CMC concentration to sausage texture

CMC content (%)	Strain	Stress (Kpa)
0	2.01^{c}	45.14^{d}
0.2	2.13^{bc}	47.89^{c}
0.4	2.22^{b}	50.27^{b}
0.6	**2.45^{ab}**	**60.55^{a}**
0.8	2.48^{a}	61.04^{a}

Table 3. Effect of CMC concentration to sensory evaluation

CMC content (%)	Sensory score
0	2.25^{d}
0.2	3.16^{c}
0.4	3.85^{b}
0.6	**4.58^{a}**
0.8	4.60^{a}

Effect of alginate concentration to the gelation

We added different alginate concentrations (0, 0.2, 0.4, 0.6, 0.8%) into fish paste. Our results were elaborated in table 4, 5 and 6. We noticed the optimal alginate concentration at 0.2% for bronze featherback sausage.

Table 4. Effect of alginate concentration to moisture content (paste and sausage), sausage recovery

Alginate content (%)	Paste moisture (%)	Sausage moisture (%)	Recovery (%)
0	48.63^{b}	46.26^{b}	89.41^{b}
0.2	**52.24^{a}**	**50.05^{ab}**	**91.16^{ab}**
0.4	52.35^{a}	50.24^{a}	91.25^{a}
0.6	52.39^{a}	50.38^{a}	91.27^{a}
0.8	52.44^{a}	50.47^{a}	91.89^{a}

Table 5. Effect of alginate concentration to sausage texture

Alginate content (%)	Strain	Stress (Kpa)
0	2.01[b]	45.14[b]
0.2	**2.38[a]**	**50.25[a]**
0.4	2.40[a]	50.36[a]
0.6	2.43[a]	50.40[a]
0.8	2.49[a]	50.77[a]

Table 6. Effect of alginate concentration to sensory evaluation

Alginate content (%)	Sensory score
0	2.25[b]
0.2	**4.45[a]**
0.4	4.49[a]
0.6	4.52[a]
0.8	4.53[a]

According to Palestina Santana (2013), the addition of CMC, alginate did not influence the oiliness, fish flavor, and color of fish sausages. CMC and alginate also improved the physicochemical properties and sensory characteristics of sausage by increasing the springiness and cohesiveness

Effect of sterilization time and temperature to the sausage gelation

Textural characteristics such as gel strength are the major determinant of sausage price and quality. Upon heating, the denaturation and degradation of muscle proteins can occur with varying degrees depending on temperature and time. Fish sausage was then sterilized in different temperatures (110, 115, 120ºC) and in different times (5, 10, 15 minutes). Our results were elaborated in table 7, 8, 9 and 10. We noticed the optimal sterilizing temperature at 115ºC in 5 minutes was appropriated.

Table 7. Effect of sterilization time and temperature to sausage moisture content (%)

Sterilization temperature (ºC)	Sterilization time (minutes)		
	5	10	15
110	55.29	55.13	54.84
115	**56.75**	55.77	55.25
120	54.89	54.33	54.12

Table 8. Effect of sterilization time and temperature to sausage recovery (%)

Sterilization temperature (ºC)	Sterilization time (minutes)		
	5	10	15
110	95.77	94.75	92.28
115	**96.45**	95.39	93.94
120	95.39	95.21	93.42

Table 9. Effect of sterilization time and temperature to sausage firmness

Sterilization temperature (ºC)	Sterilization time (minutes)					
	5		10		15	
	Strain	Stress	Strain	Stress	Strain	Stress
110	2.17[a]	59.47[bc]	2.18[a]	57.29[abc]	2.15[a]	56.41[abc]
115	**2.34[a]**	**60.34[a]**	2.32[a]	58.45[ab]	2.29[a]	57.92[ab]
120	2.26[a]	59.23[c]	2.23[a]	56.73[bc]	2.17[a]	55.19[bc]

Table 10. Effect of sterilization time and temperature to sensory score

Sterilization temperature (ºC)	Sterilization time (minutes)	Sensory score
110	5	3.84
	10	3.95
	15	3.71
115	**5**	**4.55**
	10	4.22
	15	3.97
120	5	4.21
	10	3.92
	15	3.54

CONCLUSION

Bronze featherback inhabits standing and sluggish water of lakes, floodplains, canals and ponds. Undertake localized lateral migrations from the Mekong River to floodplains during the flood season and back to the mainstream or other permanent water bodies during the dry season. It is regarded as a fish with the best meat. In general, bronze featherback meat has been used to produce many kinds of foods such as fish ball, fried curry-fish cake. We have successfully

investigated the effect of gelling agents (CMC and alginate), sterilization temperature and time on the the physicochemical properties and sensory characteristics of fish sausage. The addition of CMC and alginate can improve the textural and sensory properties of bronze featherback sausages. Thermal treatment also strongly affected to texture characteristics of this fish sausage.

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