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Fatty Acid Composition of Microwave Cooked Pangasius Meat Studied by Gas Chromatography

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***Abstract*: Pangasius catfish culture is widely practiced in India. It has low cost of production, fast growth rate and disease resistance, more freshness, Good market potential in interior areas, especially in restaurants and hotels but it has more fat and hence has an unusual odour, when consumed in processed form affects the marketability and further value addition Also the nutritional value of catfish lipids is low because of a small amount of n-3 family PUFA and high amount of MUFA and SFA. The SFA and Trans C18:1 MUFA can increase risk of chronic cardiovascular diseases that affects the heart, blood vessels, and brain. Effective processing method can get rid of the fat content in Pangasius catfish fillet and provide a good protein food for consumers. The present project is therefore proposed to develop a suitable preprocessing method for removal of fat from catfish fillets. Heat treatment such as microwave methods were used to reduce in the SFA and MUFA content of fish fillets. The present research is proposed to standardize the different time and temperature of cooking process of defatted fillets. This research proposed on study of saturated and mono-unsaturated fatty acid from different heat treatment meats.**

***Keywords*: Heat treatment, fatty acids composition, gas chromatography.**

1. Introduction

Pangasius genus includes the catfish varieties that are commonly found in the south-east Asian region. It belongs to the family Pangasiidae. The most common variety of cultured fish is Pangasianodon hypophthalmus. This fish species is also called, Sutchi catfish, striped catfish, or Tra fish. Among all the freshwater species, Pangasius catfish is the world's fastest-growing species in aquaculture. Pangasius is now traded worldwide as skinless and boneless fillets popularly along with portions, steaks, fillets, and also as value-added products Jeyakumari et al., 2016; Thi et al., 2013). The fish attains a bodyweight of 1.2 to 1.3 kg rapidly within six months but usually harvested after eight months of culture. Pangasius fillets are a good substitute for white-fleshed fishes in the market due to their increasing acceptability and popularity; Pangasius is usually served in the European market as skinned and boneless frozen fillets (Noseda et al., 2012), currently, these fillets exported to over 100 countries worldwide. Fillets were characterized by high moisture levels of 80% and low crude protein of 15.8% and lipid of 3.0% contents. Total lipids were characterized by low cholesterol levels of 40 mg/100 g, high percentages of saturated fatty acids (47.5%) of total fatty acid. Low percentages of polyunsaturated fatty acids (20%) are present in total fatty acids mainly represented by linoleic acid (60% of total polyunsaturated fatty acids). Heat treatment were used to removal or reduced the fat content from Pangasius fillets. Different parts of meat was heated by microwave method were used. It is held by different time and same temperature to remove fat content from the fillets. Best time and temperature is best for analysis and standardized time and temperature for removal of SFA and MUFA and retain PUFA content.

2. Materials and Methods

A. Materials

Pangasius hypophthalmus were collected from Madurai AM fish farm and fish markets. The collected fishes were kept in insulated iceboxes. Insulated icebox prevents dehydration, and temperature fluctuation thus delays the spoilage of fish. Further, it is easy to handle. Flake ice produced by flake ice machine was used during fish transportation and processing purpose. Size of the ice for 2-3 cm level were produced to kept into the box and fish were spread on ice layer then carried out further steps.

1) Preparation of dressed meat

The raw pangasius sp was collected from the market and washed with water. If any foreign material adhered to the outer surface, it was removed. Weight of the cleaned fish sp. was noted down. Removal of fins, head, evisceration was carried out and further washed in clean water. The weight of dressed meat was noted down.

2) Cooking of pagasius fillets and pasta preparation

- Raw meat (pangasius sp)
- Dressed meat
- Washed with water
- Microwave oven cooking (110℃ for 6 minutes)
- Reduced content of SFA and MUFA
- Retention of PUFA after heat treatments

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3) Sampling procedure

Randomly samples were chosen and study of different time and temperature was used to remove fat from the fillets. The time and temperature which gave better removal of fat is suitable for standardization of time and temperature. Samples were collected from microwave cooked meat and their analysis of fatty acid composition. Mainly focus on study of saturated and mono-unsaturated fatty acid from defatted fish meats.

4) Standardization time and temperature for defattening of Pangasius fillets

There are different methods of heat treatment used to remove or defatted of Pangasius fillets. The selected 50 gram of meat was done a heat treatment for three times by the same method. The microwave heat treatment method were followed. The microwave cooked method was done by domesticated micro oven instrument with the temperature of 110℃ for 4 minutes the fillet was not completely free from fat. I have done the same experiment again with the temperature of 110℃ for 5 minutes and the meat was not completely free from fat content. Again I have done the same experiment with the temperature of 110℃ for 6minutes and the meat was completely free from fat. So, this finalized the standard temperature and time for the defattening of pangasius fillets. The microwave experiment standardized temperature is at 110℃ for 6minutes. it is suitable for further study purpose.

5) Microwave oven cooking

The domestic microwave oven was used for cooking of Pangasius fillets. Fillets were kept in the oven to reach the core temperature of 110℃ for 6minutes.

6) Fatty acid composition analysed by Gas chromatography

Fatty acid is very important components of lipids content. GC is most common method it is used for analysis of fatty acid composition. The fatty acid is a complex structure it is contain more components of fatty acid such as acylglycerols, cholesterol esters, waxes and glycosphingolipds. It is extracted by use of saponification hydrolysis it is done by alkaline medium AOAC, 1990. The FAMEs are extracted by use of the methanol and boron trifluoride. Extraction and methylation it is done by folch method are used to obtain the lipid components from the ten gram of fish samples. Esterification was done, take 250g lipid fraction it is dissolved in to toluene in the round bottom flask. Then, added 4ml sodium hydroxide and reflux for 5-10minutes until droplets of fat disappears. Added 5ml of methanol and reflux for another 1min. cool the content and add 15ml of saturated sodium chloride solution. Then, add 5ml of hexane, shake well and then remove the upper layer hexane layer. Repeat the extraction with hexane twice. It is combine hexane layer and evaporate to dryness in a rotary flask evaporator set at 55-60℃. The methyl esters in 1ml of HPLC grade hexane for injection in GC. The column at 210℃ for 30minutes. Then, inject 0.5ml of standard FAMEs mixture onto the GC. Then, it is start to separation of FAMEs takes 45min. Next, inject 0.5ml of sample FAMEs. Identify the individual fatty acid in the sample by comparing the retention time of the individual fatty acid in the standard mixture. Calculated area unit value expressed to percentage of the fatty acid of total lipids.

7) Statistical analysis

The SPPS 19 (IBM, 2O10) statistical package was used for analysis of experimental results. The results were produced in the mean standard deviation.

3. Result and Discussion

A. Fatty acid composition of defatted Pangasius meat

1) Fatty acid composition of raw Pangasius meat

Raw Pangasius meat contains head portion of saturated fatty acid-53.04%, mono-unsaturated fatty acid-40.7% and poly-unsaturated fatty acid-7.06%. Body portion of saturated fatty acid-51.77%, mono-unsaturated fatty acid-40.44% and poly-unsaturated fatty acid-7.06%. Ventral portion of saturated fatty acid-50.37%, mono-unsaturated fatty acid-40.47% and poly-unsaturated fatty acid-7.07%. Tail portion of saturated fatty acid-46.79%, mono-unsaturated fatty acid-39.83% and poly-unsaturated fatty acid-6.94%. Microwave heat treatment was used to reduce saturated and mono-unsaturated fatty acids and retention of poly-unsaturated fats after defatted meats.

2) Microwave heat treatment

Microwave cooking instruments able to scorching a material to be cooked. This apparatus was maintained under hygienic condition and operated in safe manner. It cooks the material without excessive heating of interior portion of the materials. These were used as home appliance. The recent investigation replaced that the microwave cooking apparatus replace conventionally processing technology such as pasteurizing (or) sterilizing food products (Ahmed & Ramaswamy 2007). Application of microwave heat into food products was invented by (Fito, P et., al 2005, Decareau 1985). In general, fish muscle protein was highly sensitive to microwave oven and texture of meat become it very dry, hard and rubbery appearance due to heated with elevated temperature (Mizrahi 2012). Microwave cooking of meat in higher temperature results in loss of nutrition from fish fillets (Shimi 1992). Cook-chilled products it can be vary in wide range of 6 – 42 days it is depending upon the heat treatment (Ahmed & Ramaswamy 2007). The raw fish fillets contain high fat content, but after heat treatment fat content reduced due to production of primary and secondary oxidative products in during microwave heat treatment (Regulska-Iiow & Iiow 2002). Mineral composition was very important for health life. The present research proposed to the microwave cooked method was done by domesticated micro oven instrument with the temperature of 110℃ for 6minutes and the meat was completely free from fat. This method was reduced the saturated and mono-unsaturated fatty acids from the fillets. Raw Pangasius meat contains head portion of saturated fatty acid-53.04%, mono-unsaturated fatty acid-40.7% and poly-unsaturated fatty acid-7.06%. Body portion of saturated fatty acid-51.77%, mono-unsaturated fatty acid-40.44% and poly-unsaturated fatty acid-7.06%. Ventral portion of saturated fatty acid-50.37%, mono-unsaturated fatty acid-40.47% and poly-unsaturated fatty acid-7.07%. Tail portion of saturated fatty acid-46.79%, mono-unsaturated fatty acid-39.83% and poly-unsaturated fatty acid-6.94%. Microwave heat treatment was used to reduce saturated and mono-

unsaturated fatty acids and retention of poly-unsaturated fats after defatted meats. PUFA was increased after heat treatment. The proximate composition has increase the protein and ash content while decrease the moisture and fat contents. Mineral composition was increase after heat treatment.

the amount of up to 2.19%, 1.7%, 1.78% and 1.75%. PUFA content is increased after heat treatment such as the steam method and it established good result from 7.06 to 8.18% representing the samples. The heat treated samples showed the change in the composition and it constituted the increased in the concentration of the PUFA of the fillets and is found to be in the range of up to 1.12%.

Table 1
Fatty acid composition of Pangasius fillets

Compounds	Fatty acids	Head	Body portion	Ventral portion Micro.	Tail portion
C 4:0	Butyric acid	0.03	0.01	0.04	0.01
C 12:0	Lauric acid	0.02	0.04	0.06	0.03
C 14:0	Myristic acid	4.23	4.15	4.28	4.08
C 14:1	Myristoleic acid	0.09	0.06	0.07	0.04
C 15:0	Pentadecanoic acid	0.21	0.19	0.25	0.20
C 15:1	Cis-10 Pentadecanoic acid	0.02	0.03	0.03	0.01
C 16:0	Palmitic acid	23.19	23.48	24.19	23.61
C 16:1	Palmitoleic acid	2.08	2.03	2.07	2.04
C 17:0	Heptadecanoic acid	0.25	0.32	0.39	0.33
C 17:1	Cis-10 Heptadecanoic acid	0.18	0.16	0.19	0.12
C 18:0	Stearic acid	6.43	6.66	6.69	6.18
C 18:1t	Vaccenic acid	34.12	34.43	34.28	34.14
C 18:2t	Linolelaidic acid	5.13	5.51	5.67	5.27
C 18: 2 n6c	Linoleic acid	0.17	0.14	0.19	0.13
C 18:3n3	α-Linolenic acid	0.58	0.54	0.57	0.51
C 13:3 n6	Ɣ-Linolenic acid	0.25	0.21	0.27	0.28
C 20:1	Cis-11 Eicosenoic acid	1.15	1.17	1.16	1.12
C 20:2	Eicosadienoic acid	0.52	0.56	0.62	0.57
C 20:4n6	Arachidonic acid	0.47	0.44	0.46	0.42
C 20:3	Dihomo-γ-linolenic acid	0.08	0.06	0.07	0.05
C 21:0	Henicosanoic acid	0.7	0.6	0.9	0.5
C 22:0	Behenic acid	0.52	0.56	0.58	0.54
C 22:1n9	Erucic acid	0.24	0.21	0.25	0.23
C 22:2	Docosadienoic acid	0.02	0.04	0.07	0.01
C 22:6n3	Docosahexanoic acid	0.25	0.27	0.26	0.23
C 23:0	Tricosanoic acid	0.04	0.03	0.06	0.02
C 24:0	Lignoceric acid	0.4	0.41	0.32	0.28
C 24:1	Nervonic acid	0.63	0.65	0.64	0.61
Unknown		18	17.04	15.37	18.44
Total		100	100	100	100

Table 2
Samples

Samples	Cooked meat of head portion	Cooked meat of body portion	Ventral region	Tail portion
Saturated fatty acids	36.02	36.77	37.76	35.78
Mono-unsaturated fatty acids	38.51	38.74	38.69	38.08
Poly-unsaturated fatty acids	7.39	7.73r	8.18	7.47

4. Conclusion

There are three different heat treatment such as microwave, grilled and steam method used to remove saturated and mono-unsaturated fatty acid from the Pangasius fillets. PUFA was retain the cooked fillets. Standardized of time and temperature of microwave cooked fillets held by IFB 25L convection microwave oven. Meat characteristics of well completed drop out fat content from cooked fillets at standard time 6 minutes and temperature 110°c. 5 g of fat was collected from 50g meat. Microwave cooked head, body, ventral and tail portion samples has given percentage of up to 53.04%, 51.77%, 50.37% and 46.79% after heat treatment there is a loss 17.02%, 15%, 12.61% and 11.01% of the saturated fatty acid. The MUFA content of the raw head, body, ventral and tail fillets constitutes the amount of up to 40.7%, 40.44%, 40.47 and 39.83% after heat treatment of the microwave cooked samples has given compatible result of the amount of the 38.51%, 38,74%,38.69% and 38.08%. After heat treatment there could be change in content and lost composition of the fatty acid which represents

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