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Changes in chemical composition, fatty acids and sensory quality of fried catfish fillets (*Clariars gariepinus*)

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Abstract

Modification is proximate composition fatty acids chemical quality as well as changes in organoleptic traits were study in raw Cat fish fillets (*Clarias gariepinus*), pan-fried fillets in sun flower oil for 4 minutes and reheated fried cat fish fillets (in conventional oven for 15 min. at 80°C) after storage for one week at 5±1°C and for one month at 20±2°C. after frying of cat fish fillets the moisture, Saturated Fatty Acids (SFA),Monounsaturated Fatty Acids (MUFA),Total Volatile Basis Nitrogen (TVBN) and Trymethylamin Nitrogen (TMAN) were reduced while, protein, fat, ash, polyunsaturated Fatty Acids (PUFA) Thiobarbeturic Acid (TBA) and Peroxide Value (PV) were increased due to chilling and frozen storage of fried catfish fillets, the gross chemical composition showed no significant changes (p> 0.05), whereas slow increase in SFA and slow decrease in (MUFA) and (PUFA) was found all chemical quality (TVBN,TMAN,TBA, and PV) of Cat fish fillet fried and stored at 5±1 °C and -20±2°C were higher (p>0.05), as compared with the samples after frying directly. Organoleptic evolution scores of colour, taste, flavor, juiciness, and overall acceptability were highest for samples after fried directly while it showed significant decrease (p>0.05) after storage at 5±1°C and at -20±2°C for one month respectively.

Keywords: Cat fish fillet; Fatty acids; Organoleptic; Peroxide value

1. Introduction

Precooked and frozen food that is reheated immediately before it is consumption is a major element in diets preparation although the subject is attracting a lot of attention from nutritionists there is little information about the effect that these consecutive process performed in the food, results indicated one 80 g. serving of fish to provide one third of the fish recommended daily intake for protein .regular consumption of fish, particularly marine fish due to its low fat content is recommended for the elderly and those with coronary heart disease and hypercholesterolemia [1]. Also Dalgaard et. al., [2] reported that .to extend the short shelf life of fish sea food and to provide products with desirable sensory properties, bringing smoking bio preservation, packaging and other simple preservation methods are recommended .lightly preserved seafood including cocked and brined fish products typically keeps the quality for 4 weeks or more at the recommended storage temperature of 5°C .

Chemically conventional cooking method (deep-fat –frying and baking) have an effect upon approximate composition mineral concentration and fatty acids profile [3, 4].that the fat composition of sardine and therapy having n-6/n-3 ratio could be deeply changed when sardines are fried effects of microwave heating deep fat frying and conventional oven baking on approximate composition and cholesterol concentration in channel catfish (*lactalurus punctatus*) fillets were examined by [5]. they declared that fillets that were deep fat fried showed the lowest moisture content with high fat content Organoleptically both fish fingers and fish fillets shows a decrease in color lightness and yellowness during drying redness decrease for fish fingers but increase for fish fillets during frying .fish type showed no significant effect

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on color of breaded product Schubring, R [6]. Also Raju, C. et. al., [7] demonstrated that, overall acceptability of fish collets prepared from pink perch (*Nemiptterus Japonicus*) fried at 160-170°C for 4-5 min in oil were acceptable and showed good texture and flavor throughout the period of frozen storage. The objective of this study was to determine the effects of deep fat frying followed by chilling or freezing storage on approximate composition, fatty acids profile, chemical quality characteristics and sensory properties of Catfish fillets.

2. Material and methods

2.1. Sample Preparation

Cat fish (*Clarias gariepinus*) was used in this study, an initial batch was directly obtained from farm of Central laboratory for aquaculture Research .all of the fish (8.0) kg were transported to the laboratory and immediately washed with tape water the, scales and all fins of the fish were removed using a sharp knife .thereafter the fish were washed again and soaked in tap water for one hour and dressed in a fillets Style weighing approximately 75g and divided in to four lots .the four deferent groups was treated as follow :one was kept fresh and raw and was so analyzed :three groups were pan –fried in sunflower oil for 4 min after thinly coated with enriched white corn flour, and then one of the three groups was immediately analyzed. the second group (of the three fried groups) was frozen to -20±2°C for one month, while the last group (of the fried group) was stored at 5±1°C for one week .on the anther hand the two groups of fried stored frozen and at chilled were reheated its reheated after packing of fillets with an aluminum wrapper in a conventional oven 15 min at 80°C.

2.2. Analytical Techniques

Protein was determine by Kjeldahl's producer using a 6.25 conversion factor according to the method AOAC [8].the moisture was determined by the oven drying at 105°C to constant weight as AOAC [8]., total fat was measured by extraction usig chloroform: methanol method (2:1v/v) [9]., ash was determined by heating at 550 °C using amuffel furnace according to the method AOAC (1990),Fatty acids were analyzed [10]. Total volatile bases nitrogen (TVBN), and trimethyamine nitrogen (TMAN) were determined according to the method recommended by the AMC [11]. Thiobarbiituric acid (TBA) was measured according to the method [12]. Peroxide value (PV) was determined according to the titration method AOAC [8].

2.3. Organoleptic Evolution

Samples were organoleptically evaluated for colour, taste, flavor, juiciness, and overall acceptability. A group of 10 staff members of processing and quality control department central laboratory for aquaculture Research as judges checked the organoleptic properties of the samples and grades ranged from zero to10 [13] as mentioned in table. Description of organoleptic properties scores.

Score	Description	Score	Description
10	Ideal	4	Fair
9	Excellent	3	Poorly fair
8	very good	2	poor
7	good	1	Very poor
6	Fairly good	0	Repulsive
5	acceptable		

2.4. Statistical Analysis

The replications of each trail were performed .moisture, protein fat, ash, Total Volatile Bases Nitrogen (TVBN),Trimethylamine nitrogen (TMAN),Thiobarbituric acid (TBA), peroxide value (PV) and sensory data were analyzed using ANOVA and means were separated [14] at probability level of $P < 0.05$ (SAS,2000).

3. Results and discussion

3.1. Chemical composition of raw and fried Catfish fillets

From table (1) it could be observed that due to frying of Catfish fillets, the moisture content was significantly reduced (P< 0.05) while protein, fat as well as ash were significantly increased (P < 0.05) frying increased fat content, possibly as result of both moisture content losses and absorption of some frying sun flower oil inside the tissues .the increase of other components may be due to loss of moisture.

It could observed that chilling and frozen storage of fried Catfish fillets resulted in significant changes (P < 0.05) of gross chemical composition compared with the fried Catfish fillets at zero time .in general by storage at chilling at 5±1°C and freezing at -20±2°C,the moisture, protein, fat and ash were slowly reduced. It might to assume that with drip separated during thawing of freezing samples, some losses of moisture, protein, fat and ash were occurred, as reported by Puwastien PK, AMC, Santerre CR, Sreelakshmi KR, [1, 11, 15, 16].

Table 1 Proximate composition of raw Catfish fillets, pan – fried fillets "A" and reheated fried catfish fillets after storage for one week at 5±1°C, "B" and for one month at -20±2°C, "C" (% on dry weight basis)

Constituent		Moisture %	Protein %	Fat %	Ash %
Raw catfish		77.80±1.5^{a}	16.95±0.7^{a}	3.49±0.3^{c}	1.34±0.05^{c}
Storage Period of fried fillets	A	62.00±0.9^{b}	28.44±0.5^{b}	7.60±0.5^{a}	2.10±0.07^{d}
	B	61.40±1.0^{b}	28.19±0.3^{c}	7.50±0.2^{ab}	2.00±0.03^{b}
	C	61.10±0.7^{bc}	28.10±0.9^{cd}	7.31±0.2^{b}	1.80±0.02^{a}

$^{a-d}$ Means withen a column with the same superscript signicantly different (P<0.05)

3.2. Fatty acids composition

Date presented in table (2) revealed that the oil fatty acids contents in raw Catfish fillets has high levels in C 18 :1, C 16:0, C 18:2, C16:1,and C 18:0 they were 26.3, 26.0,18.1, 9.1 and 8.6%, respectively.

Table 2 Fatty acids composition % of raw Catfish fillets, pan –fried fillets" A" and reheated fried Catfish fillets after storage for one week at 5±1 °C, " B" and for one month at -20±2°C, "C" (% on dry weight basis)

Samples	Raw Catfish	Storage period of fried fillets			Sun flower oil	
Carbon No		A	B	C	Unused	Used
C14	0.4	0.1	0.8	0.3	-------	-------
C16	26.00	18.9	18.7	18.4	7.6	8.1
C18	8.60	5.1	5.0	4.8	5.1	5.0
C20	2.0	1.1	1.8	2.5	------	-----
ΣSFA	37.0	25.2	26.3	26.0	12.7	13.1
C16	9.1	2.6	2.5	2.3	------	------
C18	26.3	29.0	27.8	27.3	30.3	31.2
C20	2.5	1.0	0.9	1.0	-------	--------
C22	0.8	0.50	1.6	2.1	-------	--------
Σ MUFA	38.7	33.1	32.8	32.7	30.3	31.2
C18	18.1	38.7	38.5	38.3	55.4	54.3
C18	3.1	1.2	1.2	1.1	-------	--------
Σ PUFA	21.2	39.9	39.7	39.4	55.4	54.3

After frying Catfish fillets, the results e showed an increase in C18:2 and C18:1 to reach 38.7% and 29.0% respectively. While there were decreases in C16:0, C18:0 and C16:1 which reached to18.9, 5.1 and 2.6%, respectively. these results may due to increased contents of sun flower oil which is used in frying processing (Table 2), especially from C18:1 and C18:2 that increased to reach to 30.3 and 55.44% respectively. Frying decreased the content from C16:1, C16:0 and C18:0 to 0.0, 7.6 and 5.1 % respectively.

One the other hand, in the fresh Catfish fillets percentages of monounsaturated fatty acids (MUFA) were higher than the percentages of saturated fatty acids (SFA) and double the percentage of polyunsaturated fatty acids (PUFA) frying in sun flower oil produced noteworthy change in fatty acids contents in fact the total SFA content decreased to 25.2% the (MUFA) content decreased to 33.1% while the (PUFA) content increased to reach 39.9%.

Storage in fried Catfish fillets at 5±1C and -20±2°C (Table 2) also slowly increased in (SFA) during storage for one week and one month respectively. while (MUFA) and(PUFA) decreased slowly during storage at 5±1°C and -20±2°C for one week and one month respectively. These results coincide with those given by Castrillon AMP, Aro TR [10, 17,].

3.3. Chemical quality

3.3.1. Changes in the Total Volatile Bases Nitrogen (TVBN) and trimethylamine nitrogen (TMAN)

Production total volatile bases nitrogen (TVBN) and increment in trimethylamine nitrogen (TMAN) in fish muscles during storage could be used as indicator of bacterial activity. (TVBN) and (TMAN) are considered available tool in the evolution of fish quality during storage because it is rapid accumulation in muscles under storage conditions.

Table 4 Chemical quality of fresh Catfish fillets, pan-fried "A " and reheated fried Catfish fillets after storage for one week at 5±1°C, "B" and for one month at -20±2°C, "C" (On wet weight basis)

Constituent		TVBN mg/100g	TMAN mg/100g	TBA mg/kg	PV mg/kg
Raw Catfish		13.40± 0.5^{C}	1.02±0.02^{c}	0.28±0.02^{c}	4.50±0.3^{c}
Storage Period of fried fillets	A	9.50±0.3^{d}	0.79±0.03^{c}	0.36±0.01^{bc}	5.90±0.2^{bc}
	B	17,80±0.4^{a}	5.60±0.04^{a}	1.06±0.03^{a}	7.80±0.4^{a}
	C	14.90±0.2^{b}	4.68±0.05^{b}	0.79±0.01^{b}	6.20±0.1^{b}

$^{a-c}$ Means within a column with the same superscript significantly different (P<0.05)

In this study (TVBN) and (TMAN) decreased (P<0.05) during frying (Table 4), initial average values were 14.1±05 and 1.05±0.02 mg/100g muscles for (TVBN) and (TMAN), respectively. The final values of (TVBN) and (TMAN) in Catfish fillets after frying were 10.2±3 and 0.81±0.03mg/100g muscles, respectively. Indicating a reduction in both measures is due to losses in (TVBN and TMAN) via volatilization during heating.

From results of (Table 3) it could noticed that the TVBN and TMAN of fried Catfish fillets stored at 5±1°C and -20±2°C were significant higher (p<0.05) as compared with the samples at zero time (after frying directly).these results agree with those reported by [18, 19].

3.4. Changes in Thiobarbituric acid (TBA) and Peroxide value (PV)

Thiobarbituric acid (TBA) and peroxide value (PV) index are the most used indicators for advanced lipid oxidation results presented in Table 3 indicated that the formation of (TBA) as malonaldhyde (mg/kg) and (PV) as mill equivalents peroxide /kg lipid were affected by frying of Catfish fillets. Results indicated significant increase (p<0.05) in (TBA) -value and PV-value during frying process. This indicates the occurrence of some oxidation in lipids by the thermal treatment .also significant increases (p<0.05) were observed in TBA and PV during storage period of fried Catfish fillets for one week at 5±1°C and one month at -20±2°C from the foregoing results, the increment in (TBA and PV) during storage could be resulted from lipid oxidation, these results are in harmony either those obtained by Raju, C. V, Darweash BM., El-Lahamy AA, Baryczka MJ, [18, 7, 20, 21].

3.5. Organoleptic evolution

Organoleptic evolution scores of colour, taste, flavor, juiciness and overall acceptability estimated for pan-fried Catfish fillets and reheated after storage for one week at 5±1°C and one month at -20±2°C are presented in table 4. Samples after frying directly showed the highest scores, which were 8.8 (very good) 8.5 (very good), 9.5 (excellent), 9.1(excellent) and 9.0 (excellent) for colour, taste, flavor, juiciness and overall acceptability, respectively, compared with the samples of Catfish fillets fried after storage period for one week and month at 5±1°C and -20±2°C, respectively .the scores of colour, taste, flavor juiciness and overall acceptability showed significant decrease ($p<0.05$) after storage period however Catfish fillets fried after storage period for one week at 5±1°C showed the lowest scores, having 7.2 (good), 6.1 (fairly good), 6.6 (fairly good), 6.1 (fairly good) and 6.5 (fairly good) for colour, taste, flavor, juiciness and overall acceptability, respectively.

Table 4 Average of Organoleptic scores of pan-fried "A" and reheated fried Catfish fillets after storage for one week at 5±1°C, "B" and for one month at -20±2 °C, "C" (% on dry weight basis)

Constituent		colour	Taste	flavour	Juiciness	Overall acceptability
Storage Period of fried fillets	A	9.0±0.2 (E)	8.7±0.1 (V.G)	9.5±0.3 (E)	9.1±0.1 (E)	9.0±0.1 (E)
	B	7.5±0.1 (G)	6.4±0.1 (F.G)	7.0±0.1 (G)	6.5±0.3 (F.G)	6.8±0.2 (F.G)
	C	8.0±0.1 (V.G)	7.5±0.2 (G)	7.8±0.3 (G)	8.0±0.2 (V.G)	7.8±0.2 (G)

[a-c] Means within column with the same superscript significantly different ($p<0.05$); E= Excellent. V.G= very good. G= good F.G= Fairly good

4. Conclusion

Therefore, it could be concluded that the gradual decrease in colour, taste, flavor, juiciness and overall acceptability scores throughout the storage period at deferent temperatures, could be attributed to the protein denaturation, hydrolysis and fat oxidation, which are the major factors of changes in Organoleptic properties during storage periods these results are agreement with those given by Schubring, Raju, C. V, Darweash BM., Okomoda VT [18, 6, 7, 23].

From the results obtained in the present study, it may be recommended that the best consumption of fried Catfish fillets is after processing directly, followed by storage at -20±2°C for one month and at 5±1°C for one week, respectively.

Compliance with ethical standards

Acknowledgments

This test was conducted at the Omer Al Mukhtar University.

References

[1] Puwastien PK, Judprasong E, Kettwan Y. Nakngamanong and L. Phattacharjee 1999 proximate composition of raw and cooked thai freshwater anf marine fish J.Food Composition and analysis. 1999; 12(1): 9-16.

[2] Dalgaard, Paw; Jørgensen, Lasse V. Cooked and brined shrimps packed in a modified atmosphere have a shelf-life of> 7 months at 0° C, but spoil in 4–6 days at 25° C. *International journal of food science & technology*, 2000, 35.4: 431-442.

[3] MUSTAFA, F. A.; Medeiros, D. M. Proximate composition, mineral content, and fatty acids of catfish (Ictalurus punctatus, Rafinesque) for different seasons and cooking methods. *Journal of Food Science*, 1985, 50.3: 585-588.

[4] Sanchez-Muniz, Francisco J.; Viejo, Jesus M.; Medina, Rafaela. Deep-frying of sardines in different culinary fats. Changes in the fatty acid composition of sardines and frying fats. *Journal of Agricultural and Food Chemistry*, 1992, 40.11: 2252-2256.

[5] Wu, Wen-Hsin; Lillard, D. A. Cholesterol and Proximate Composition of Channel Catfish (*Ictalurus punctatus*) Fillets–Chnges Following Cooking by Micowave Heating, Deep-fat frying, and oven baking. *Journal of food quality*, 1998, 21.1: 41-51.

[6] Schubring, R. Colour measurement on battered and breaded fish products. *Informationen fuer die Fischwirtschaft (Germany)*, 1996.

[7] Raju, C. V.; NAIK, AT Ramachandra; Ramesha, T. J. Development of ready-to-fry fish cutlet from pink perch, Nemipterus japonicus. *The Indian Journal of Nutrition and Dietetics*, 1999, 36.1: 23-28.

[8] AOAC. Official methods of analysis (18thed), Association of Official Analytical Chemists International, Washinton USA. 1990.

[9] Bligh EG, WJ Dyer. A rapid method of total lipid extraction and pacification. J. Biochem, Physical. 1959; 37: 911-917.

[10] Castrillon AMP, Navarro, EA Pontes. Changes in chemical composition and nutritional quality of fried sardine (Clupea pilchhardus) produced by frozen storage and microwave reheating J Sci food agric. 1997; 75: 125-132.

[11] AMC. Recommended method for examination of fish prouducts. Analyst. 1979; 104: 433.

[12] Tarladiges B, GBM Watts, MI Younathan, I Dugan. Distillation method for the quantitative determination of malonaldhyde in rancid foods .I.J. Amercan Oil Chemists Soc. 1960; 37: 44.

[13] Teeny FM, D Miyauchi. Preperation and utilization of frozen block fish muscle .J .Milk Food Technology. 1972; 35(7): 414-417.

[14] Duncan D B. Multiple range and multiple F tests. Biometrics 11:1-42, 1955

[15] Santerre CR, R Ingram, DH XU, GW Lewis, LG Lane. Chlordane and toxaphene residues following cooking of treated channel catfish fillets .J.Food Protection. 2000; 6396: 763-767.

[16] Sreelakshmi KR, Ninan G. Battered and breaded fish products. ICAR-Central Institute of Fisheries Technology, Cochin.2018 ;

[17] Aro TR, Tahvonen T, Mattila J, Nurmi TS, ivonen, H Kallio. Effects of season and processing on oil content and fatty acides of Baltic herring (Clupea harengus membras). j. Agric Food Chem. 2000; 48: 6085-6093.

[18] Darweash BM. Chemical composition of kobebah from carp and bolti fish .Egypt .J.Food Sci. 1996; 24(30): 345-358.

[19] DEWI, Eko Nurcahya; Nurbaiti, Aulleta Affri; Purnamayati, Lukita. Chemical Changes of Shredded Catfish (Clarias gariepinus) Added with Different Concentration of Sucrose during Storage at Room Temperature. In: *E3S Web of Conferences*. EDP Sciences, 2020. p. 03001.

[20] El-Lahamy AA, Khalil KI, El-Sherif SA, Ibrahim HR, Mahmud AA. Changes in fish during cooking methods (frying and grilling): A review. Journal of Public Health and Nutrition. 2019; 2(2): 1-4.

[21] Baryczka MJ, Chwastowska-Siwiecka I, Kondratowicz J. Evaluation of the quality of chilled and frozen African catfish (*Clarias gariepinus* Burchell, 1822) fillets. Czech Journal of Food Sciences. 2019; 37(3): 186-191.

[22] Schubring, R. Colour measurement on battered and breaded fish products. *Informationen fuer die Fischwirtschaft (Germany)*, 1996.

[23] Okomoda VT, Tiamiyu LO, Ricketts AO, Oladimeji SA, Agbara A, Ikhwanuddin M, Abol-Munafi AB. Hydrothermal Processing of *Clarias gariepinus* (Burchell, 1822) Filets: Insights on the Nutritive Value and Organoleptic Parameters. Veterinary Sciences. 2020; 7(3): 133.