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EFFECT OF PRECOOKING PROCESS OF TUNA-LIKE FISH (*Scombromorous* sp.) CAKE ON CHEMICAL, MICRO-BIOLOGICAL AND SENSORY PROPERTIES

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ABSTRACT

The aim of this study was to investigate the effect of precooking process on chemical, microbiological and sensory changes of fish cake made from Tuna- like fish (*Scombromorous* sp.) as well as to improve characteristics and economic value of final product. Results indicated that after precooking, moisture and ash contents were slightly decreased. Ether extract and carbohydrate were not affected by the process. Protein content was slightly increased. Mixing samples with 15% wheat flour increased ash and carbohydrate contents. Moreover, frying increased the ether extract and carbohydrate contents while, protein and ash contents were decreased. All samples were rich in iron and suitable for adults. Furthermore, after frying, precooking process decreased mineral content (Zn, K and P), on the same time leaching of Na and Ca was relatively low. Precooked process and mixing the samples with 15% wheat flour increase Ca/P ratio but frying decreased it. The calculated K/Na ratio was decreased after precooking but it was slightly decreased after frying. Total soluble salts decreased slightly as a result of precooking and frying processes. Lysine and glutamic acids were the highest indispensable and dispensable amino acids of fish cake, respectively. However, precooking decreased the levels of amino acids content. Adding 15% of wheat flour decreases the amino acids content of fish cakes, frying causes more reducing of amino acids levels. Molds and yeast were detected only in fresh cake, and microbial contamination were in permissible range, however precooking process reduce its microbial contamination. Precooking process was accepted organolepticly and had more acceptability than rate of non-precooked fish. On the other hand, precooking reduce the period time of cake frying process. Therefore, the present study recommended to use of precooking process in large scale also since use of wheat flour will reduce the cost of final product.

Keywords: Tuna-like fish (*Scombromorous* sp.), fish cake, precooking process, frying methods.

INTRODUCTION

Fish is consumed as food at allover the world, it provides the world's prime source of high quality protein (14-16 %) of animal protein consumed world-wide. It also contains vitamins and minerals. Tuna-like fish (*Scombromorous* sp.) constituent about 8-10 % of the total marine fish catching in Egypt (Abu-Tor, 2002a). This fish genus is not appreciated among Egyptians because of its bloody dark-flesh and presence of many blood vessels. Therefore, it is susceptible to rapid spoilage, consequently large amounts of raw materials are wasted year. So, this fish must be utilized in for production of commercial fish product (Abu-Tor, 2002b). Furthermore, Korish *et.al.*, (2008) noticed that the flesh of Tuna-like fish (*Scombromorous* sp.) represented about 59.80% w/w of whole weight.

Precooked foods are an important process in the world of commercial food production over the last decade. They are intended for feeding large groups of people, such as children in schools, the elderly either in old peoples homes or by means of "meals on wheels", patients in nursing homes and hospitals, persons in prisons, schools and similar institutions. The nutritive value of fish can be affected by processing or cooking method (Kilinc *et.al.*, 2006). Salama *et.al*., (2005) noticed that, after cooking methods (roasting, frying and wet cooking) the amino acids contents were decrease in all samples. Also, they found that frying methods cause slight decrease in total amino acids composition compared with other cooking methods. From this point of view the present study was aimed to prepare precooked fish cake from Tuna-like fish (*Scombromorous* sp.), to improve its economic value and as a preservation method overcome the fish spoilage. So the effect of precooking process on the quality of prepared cake was studied.

MATERIALS AND METHODS

Materials:

Tuna–like fish (*Scombromorous* sp.) was purchased from the fish local market of Kafr El-Sheikh City, Egypt (weight ranged from 900 to 1000 gm), during the summer season of 2007. Fishes were transported in ice box to the laboratory. Wheat flour 72% extraction with 14% moisture content, salt (sodium chloride), sodium glutamate and spices (black pepper) were purchased from Kafr El-Sheikh local market. The used chemicals were in analytical grade.

Methods:

Preparation of fish cake:

Fishes were washed with tap water to remove any impurities then beheaded, eviscerated and skinned, then the flesh was isolated from the bones. The obtained flesh was minced by passing twice through an electric meat-mincer type Moulinex, France made. The minced flesh was used to prepare cakes (83% fish flesh, 15% wheat flour and 2% salt and spices) according to the method described by Korish *et.al.*, (2008). Part of minced flesh and fresh cake were stored in sealed plastic pouches at -18˚C until required for analysis.

Pre-cooking of fish cake:

Fresh and mixed fish flesh with 15% wheat flour were steamed for 20 minutes, then kept in polyethylene bags till analysis as reported by Ghazi *et al*., (1993)

Fish cakes frying:

Fish cakes were fried in corn oil at 180˚C according to the conditions mentioned by Abd El-Aal *et al*., (2000) and served hot to the panelists.

Chemical analysis:

Fresh cake, precooked cake and fried cakes were subjected to chemical analysis, moisture, ash, ether extract and nitrogen contents were determined according to the standard methods of the AOAC, (2000). Nitrogen content was converted to crude protein by a factor of 6.25, while the crude carbohydrate was determined by the difference.

Minerals analysis:

Calcium, sodium and potassium were determined by using flame emission spectrometry (Sherwood, flame photometer,410) according to the method described by Black (1983). Total phosphorus was determined calorimetrically according to method of Carter (1993) using (Spectrophotometer Jenway, 6100). Available micro elements and heavy metals (Fe, Pb and Zn) were determined by using atomic absorption spectrophotometer technique using unit GBC (mode Avanta) as given by Chapman and Pratt (1961).

Total soluble salts, were determined in samples water extract (1:5) according to Page, (1982).

Amino acids analysis:

Protein hydrolysate was prepared according to the method of Moore and Stein, (1958). Amino acid composition of Tuna – like fish (*Scombromorous* sp.) was carried out in the central laboratory Alex. Univ. A.R.E. The amino acid analyzer BECKMAN model 118 / 199 CL was used.

Microbiological analysis:

Samples (10g) were taken aseptically from the fish cake and homogenates in 90 ml of NaCl solution(9g/l). Serial dilutions of homogenates were made and total viable counts were determined by the pour plate method, using Plate Count Agar (Difco, 0479-17) as a medium. Plates were incubated at 30ºC for 24-48 hr. Oxytetracycline Yeast Extract Agar (LABMX89) was used for moulds-yeast count. Plates were incubated at 30ºC for 3-5 days. Staphylococci, Coliform bacteria, Salmonella, Shigella and Psycrophilic bacteria counts were carried out according to the methods given by Kiss, (1984).

Sensory evaluation:

To evaluate the prepared precooked fish cake, sensory evalution was carried out by a group of 10 staff members of the food technology department, faculty of agriculture, Kafrelsheikh university. The sensory test was conducted at six items, color, odor, texture, taste, appearance and overall acceptability as described by Rangana (1977), using a 9-point scale for grading the quality of samples.

RESULTS AND DISCUSSION

1. Effect of precooking of prepared cake on proximate composition:

The prepared cake was divided into two portions, the first one was fresh, while the second was precooked as shown in Table (1). The results indicate that the moisture content of all precooked samples were slightly decreased compared with fresh cake. This means that the precooking increases the water holding capacity of the precooked cake, consequently the cake tenderness. Adding wheat flour decreased moisture contents as well as increased the ash content. Furthermore, ash content of all precooked samples were slightly lower than that of fresh ones, this means that the precooking process can be cause to lose of minerals content of cake. These results were in accordance with those of Garcı´a-Arias *et. al.*,(2003) and

Weber *et. al.*, (2008). The results also indicate that there were no appreciable difference was observed in ether extract content in both precooked and fresh cake. Regarding to the protein content, it can be notice that there was decrement in protein content after frying precooked samples. With respect to the carbohydrate content the results indicated that the precooked samples contain higher carbohydrate compared with the fresh samples. It can be say that the precooking process prevent the loss of carbohydrate. Also it can be seams that frying decreased moisture, ash and protein as affected by heat treatment. At the same times, the ether extract content was increased, because it carried out by using oil. Similar results were reported by (Zhang *et. al*., 2002)**.**

Table (1): Effect of precooking and fried cakes prepared from Tuna-like fish on gross chemical composition (on dry weight bases).

Treatments / Parameter(%)	Control		Fish cake treated with wheat flour			
	Fresh fish cake	Precooked fish cake	With 15% wheat flour		After deep fat fried cakes	
			fresh	Pre cooked	fresh	Pre cooked
Moisture	69.83	69.50	63.20	64.91	56.88	60.51
Ash	3.90	3.50	4.24	4.03	4.20	3.97
Ether extract	15.36	15.36	15.01	15.00	16.20	16.50
Protein	76.35	76.74	67.58	66.38	63.96	63.47
Carbohydrates*	4.39	4.39	13.17	14.59	15.64	16.06

Carbohydrates* were determined by differences = 100-(protein + ether extract + ash).

2. Effect of precooking of prepared cakes on minerals content

Mineral contents of both fresh and precooked cake were presented in Table (2) The results show that, the mineral levels in fresh cake were higher than those of precooked except for Na and Ca which they appeared to be higher in precooked samples. This may be due to the leaching of minerals from cake at different rates during precooking process, while the leaching in Na and Ca were seemingly low. Ersoy and Özeren, (2009) reported similar results. Adeyeye and Otokiti, (1999) stated that, iron is an essential trace element for hemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, proteins and fats. It was recommended that one mg/day of iron is suitable for adults to maintain the daily balance of intake and excretion (Ishida *et al.,* 2000). The results indicate that, all fish cake treatments contain high levels of iron.

Shills and Young (1988) brought the concept of Ca/P ratio, because modern diets which are rich in animal proteins and phosphorus tend to promote the loss of calcium in urine. If Ca/P ratio is lower than 0.5, high amount of calcium may be loss in urine, resulting a decrease in the calcium levels of bones. In this relation, Ca/P ratio of tested fish is more than one which is a good source of minerals required for bone formation while, the highest ratio were found after frying fresh cake.

Whereas high levels of potassium in diets are beneficial for those suffering from hypertension and those who suffer excessive excretion of

potassium through the body fluids (Siddhuraju *et al.*, 2001), thus frying precooked fish cake treated with wheat flour are beneficial for good health. A K/Na ratio in diet is an important factor in prevention of hypertension and arteriosclerosis, since K depresses and Na enhances blood pressure (Yoshimura *et al.,* 1991). Total soluble salts seemed to be decreased slightly as a result of frying process. The decrease after frying can be due to the loss with moisture content leading to a decrease of solid matters.

In general, Tuna like fish were rich in iron, zinc, calcium and phosphorus. Precooking process increased the Ca/P ratio, while K/Na ratio was decreased.

Table (2): Effect of precooking and frying on mineral contents of fish cake (mg/100g on wet weight basses).

Treatments / Mineral contents	Control without wheat flour		With 15% wheat flour			
	Fresh fish cake	Precook-ed fish cake	Fresh fish cakes		Pre-cooked fish cakes	
			Before frying	After frying	Before frying	After frying
*T.S.S	272.64	229.12	206.08	198.40	241.92	234.24
Fe	129.00	97.35	82.5	69.5	51.5	48.25
Pb	0.00	0.00	0.00	0.00	0.00	0.00
Zn	37.50	32.00	17.75	3.75	4.50	3.25
K	12.60	11.80	10.9	9.8	11.7	11.4
Na	20.70	25.40	23.1	21.5	24.6	23.8
Ca	36.92	40.38	38.08	34.62	36.92	35.77
P	19.90	18.40	47.9	8.1	27.2	25.8
Ca/P ratio	1.86	2.19	3.49	4.27	1.34	1.39
K/Na ratio	0.61	0.46	0.47	0.46	0.48	0.48

T.S.S : Total soluble salts.

3. Effect of precooking and frying processes on amino acids composition of prepared fish cake:

The effect of precooking and frying processes on amino acids composition of fresh Tuna like-fish cake and treated with 15% wheat flour was listed in Table (3). Data indicate that, the levels of lysine and glutamic acids were the highest compared with other amino acids. However, precooking process decreased the levels of amino acids this may be related to the denaturation that occurred on protein content as a result of steam treatment (Ghazi *et.al*., 1993). Adding 15% of wheat flour cause to change amino acids composition depending on the content of amino acids of flour. Also, it could noticed that lysine and glutamic acid were slightly increased as affected by flour treatment. Data show that frying cause more decrement of amino acids contents.

The possible escape of some inter and intro muscular protein including amino acids and coagulatation of protein was also accrued quickly during frying. (Salama, *et.al*., 2005).

Table (3): Effect of precooking and frying processes on amino acid composition of fish cake.

Treatments / Mineral contents	Control without wheat flour		With 15% wheat flour			
	Fresh fish cake	Precook-ed fish cake	Fresh fish cakes		Precooked fish cakes	
			Before frying	After frying	Before frying	After frying
Lysine	6.17	4.05	6.20	6.00	4.01	3.78
Threonine	3.31	3.30	2.84	2.05	2.95	2.16
Methionine	ND*	ND*	ND*	ND*	ND*	ND*
Valine	3.35	2.55	3.03	2.90	2.36	2.23
Phenylalanine	3.01	2.59	2.75	2.47	2.33	2.05
Isoleucine	2.99	2.28	2.23	1.14	3.04	1.95
Leucine	5.71	3.20	4.82	4.72	3.91	3.78
Tryptophane	ND*	ND*	ND*	ND*	ND*	ND*
**Total Indis. A.A	**54.54**	**17.97**	**21.87**	**19.28**	**18.60**	**15.95**
Aspartic acid	7.45	5.01	7.45	7.40	5.05	5.02
Serine	2.84	2.39	2.92	2.4	2.46	1.94
Glutamic acid	10.21	8.85	11.05	10.00	9.29	7.62
Alanine	3.90	3.52	4.27	3.73	3.52	2.61
Histadine	4.25	3.40	4.03	3.81	3.35	2.88
Arginine	4.24	2.86	3.62	2.96	3.48	2.82
Cystine	ND*	ND*	ND*	ND*	ND*	ND*
Tyrosine	2.65	2.36	2.05	2.01	1.76	1.74
Glycine	3.30	2.99	3.29	2.80	2.97	2.37
Proline	2.51	2.51	2.56	2.09	2.54	1.98
***Total dis. A.A.	**41.35**	**33.89**	**41.24**	**37.12**	**34.42**	**28.98**

***ND = Not Determined**
****Total Indis. A.A.= Total Indispensable amino acids**
****Total dis. A.A.= Total dispensable amino acids**

4. Microbial examination of fresh and precooked cakes:

The microbial flora of fresh fish and precooked cake were shown in Table (4) It was found that the total viable count of all samples were seemed to be similar while molds and yeast were detected only in fresh cake with a little numbers while they not detected in precooked cake. This may be due to that the temperature used for precooking process can be reduce the microbial flora. These results were in agreement with those of Kilinc *et al*, (2006).

On the other hand, the psycrophilic bacteria was found only in fresh cake, while coliform group, salmonella and shigilla were not detected in all samples. It is clear that the precooking process was effective on reducing the number of microbial count.

Table (4): Microbial count in fresh and precooked cakes prepared from Tuna- like fish (*Scombromorous sp*.)

Treatments	Control without wheat flour		With 15% wheat flour	
Microbial count × 10^2	Fresh fish cake	Precooked fish cake	Fresh fish cake	Precooked fish cake
Total viable count	2.80	2.31	2.81	2.46
Molds and Yeast	0.59	Nil	0.71	Nil
Psycrophilic bacteria	1.20	Nil	1.50	Nil
Coliform group	Nil	Nil	Nil	Nil
Salmonella and Shigilla	Nil	Nil	Nil	Nil

*** Mean value of three replicates .**

5. Effect of precooking process on sensory evaluation:

Data in Table (5) show means of panel test scores for appearance, color, odor, texture, taste and overall acceptability of fresh and precooked fish cakes after frying. It was indicated that precooked samples (control and those treated with 15% wheat flour) gained higher scores for all tested parameters compared to fresh cake samples.

Table (5): Sensory evaluation of fresh and precooked of Tuna – like fish cakes after deep fat frying prepared without and with adding 15% of wheat flour.

Material	Adding ratio of wheat flour	Organoleptic score*					
		Appearance	Color	Odor	Texture	Taste	Overall acceptability**
Fresh fish cakes	(Control 0.0%)	7.88	7.56	7.56	7.89	7.56	7.69
	With 15% wheat flour	7.50	7.89	8.44	7.56	7.56	7.79
Precooking fish cakes	(Control 0.0%)	8.13	7.78	7.78	8.33	8.44	8.09
	With 15% wheat flour	8.38	8.11	8.11	8.22	8.44	8.25

***Mean value obtained by 10 panelists.**
****Overall acceptability = (Appearance + Texture + Color + Odor + Taste) divided by 5.**
Score sheet: Dislike extremely =1; dislike very much = 2; dislike moderately = 3; dislike slightly = 4; neither like nor dislike = 5; like slightly = 6; like moderately = 7; like very much = 8 and like extremely = 9.

On the other hand, there was slightly appreciable differences between precooked control and cake treated with 15% wheat flour in all tested parameters scores. Fresh cake (control and with 15% wheat flour) behaved similarly . However precooking process had more acceptability than fresh cake. These results are in agreement with the those of Dreeling , (2000) and Biswas *et al.*, (2004)

From Figures (1-3) show the differences in color can be noticed that, the appearance of precooked samples was better as show in figures (1-3) and table (5). After adding 15% of wheat flour the appearance of cake were more good as preferred by consumers (table (5) and figures 1-3).

Precooked fish cake *Non-precooked fish cake*

Figure (1): Fresh and Precooked fish cake.

Precooked fish cake *Non-precooked fish cake*

Figure (2): Fresh and Precooked fish cake treated with 15% wheat flour.

Precooked fish cake *Non-precooked fish cake*

Figure (3): Fresh and Precooked fish cake treated with 15% wheat flour after deep frying.

6. Effect of precooking process on frying period:

As shown in Table (6) the precooking process strongly reduced frying the period of fish cake compared with the fresh one by 33.33% of cooking time. It could be attributed to the primarily cooking (precooking) which reduce the period of frying time. The results were in agreement with those of Njintanga and Mbofungb, (2006).

Table (6): Effect of Precooking process on frying period of fish cake .

Type of treatment	Period of deep fat frying (minuets)	Percentage of cooking period (%)
Fresh cake with 15% wheat flour	6	100
Precooked cake with 15% wheat flour	2	33.33

CONCLUSION

According to the obtained results, it could be concluded that precooking of fish cake, improves the consumption acceptability of Tuna-like fish (*Scombromorous sp*.). Moreover, precooking reduced the period of frying process and help to improve their chemical, physical and microbiological properties. However, it could be recommended to produce precooked fish cakes in large scale.

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تأثير عملية الطبخ المبدئي على الخواص الكيماوية والميكروبيولوجية والعضوية الحسية لأقراص سمك السكمبرومورس (الشبيه بالتونة)

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أجرى هذا البحث بهدف دراسة تأثير بعض عمليات الطبخ المبدئي على لحم أقراص سمك السكومبروموس (الشبيه بالتونة) وذلك لتحسين القابلية للاستهلاك والقيمة الاقتصادية له . وتم دراسة التركيب الكيماوي والمحتوى الميكروبي والخواص العضوية الحسية لأقراص السمك ، وقد أوضحت النتائج أن المحتوى من الرطوبة والرماد يقل بعد إجراء الطبخ المبدئي بينما يزداد قليلا المحتوى من البروتين ولم يتأثر كلا من المستخلص الايثيري والكربوهيدرات . وعند خلط العينات بدقيق القمح بنسبة ١٥% أظهرت النتائج زيادة نسب الرماد والكربوهيدرات وعند القلي ازداد محتوى المستخلص الايثيري والكربوهيدرات بينما انخفضت نسب البروتين والرماد و كانت كل العينات غنية في محتواها من عنصر الحديد . بعد إجراء القلي لأقراص السمك المعاملة بالطبخ المبدئي لوحظ حدوث انخفاض في المحتوى من المعادن (الزنك والبوتاسيوم والفسفور) وكان الانخفاض في عنصري الصوديوم والكالسيوم قليل . وأدت عملية الطبخ المبدئي والخلط بدقيق القمح إلى زيادة نسبة Ca/P ولكن القلي احدث انخفاض لهذه النسبة وبصفة عامة كانت نسب Ca/P مناسبة لتكوين العظام . بعد إجراء الطبخ المبدئي حدث نقص في نسب K/Na ولكن لوحظ زيادة قليلة في هذه النسب بعد القلي . كما حدث نقص في الأملاح الذائبة الكلية بعد عملية الطبخ المبدئي وبعد القلي . وقد وجد أن كلا من الحامض الأميني الليسين والجلوتاميك هما الأعلى في حالة الأحماض الأمينية الغير أساسية والأساسية على الترتيب ، وقد احدث الطبخ المبدئي انخفاض في نسب الأحماض الأمينية أما إضافة الدقيق أدى إلى انخفاض في محتوى أقراص السمك من الأحماض الأمينية وأحدث القلي انخفاض أكثر لمستويات الأحماض الأمينية . وبالنسبة للمحتوى الميكروبي كانت الفطريات والخمائر موجودة فقط في العينات الطازجة بنسب قليلة وأظهرت الاختبارات الميكروبية التي أجريت على المنتج عدم احتوائه على أي من الميكروبات الممرضة كما أن الطبخ المبدئي قلل من المحتوى الميكروبي للمنتج . وكانت العينات التي تم تحميرها والمعاملة بالطبخ المبدئي مقبولة للمستهلك وأكثر قبولا من العينات الطازجة كما كان الزمن اللازم لإجراء القلي في حالة الطبخ المبدئي اقل من العينات الغير مطبوخة . وبناء على ما سبق فان تصنيع سمك السكومبروموس وتقديمه للمستهلك في صورة أقراص أدى إلى تحسين القابلية للاستهلاك وأدى الطبخ المبدئي إلى زيادة قابلية المستهلك لهذا المنتج كما أن إضافة الدقيق للمنتج حسن من خواصه الاستهلاكية ويقلل من تكلفة المنتج وتوصي هذه الدراسة باستخدام طريقة الطبخ المبدئي عند تصنيع أقراص سمك سكمبروموس (الشبيه بالتونة).