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NUTRITIVE VALUE OF SOME FAST PRODUCTS MADE FROM SILVER CARP FISH, IN LAKE WADI EL-RAYAN, EL-FAYOUM, EGYPT

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ABSTRACT

This study evaluates the nutritive value of some fast products made from silver carp fish (*Hypophthalmichthys molitrix*), in Lake Wadi El-Rayan, El-Fayoum, Egypt. The average weight (M± SD) of three fish samples during February, 2012 was 17.5 ± 0.300 kg and the edible part was 53%. Fast silver fish products such as fish fingers, patties, kofta and chips were nutritionally and sensory evaluated. The obtained results indicated that protein level in fish fingers was higher than other ones, fish patties had a high fat content and energy value و while, kofta and chips had a high content of carbohydrates. Essential amino acids (EAA) content (g/16gN) of all products was much higher than FAO/WHO (1985) reference protein pattern. Also, amino acids score (AAS) for all EAA was higher than 100. Therefore, the best nutritional protein quality was found in fish fingers followed by patties, kofta and chips products respectively. However, fish patties had been obtained high scores of sensory evaluation followed by fish fingers, kofta and fish chips respectively. The mean scores of odor and acceptability were significantly higher (P≤0.05) in all products. In conclusion, silver carp fish in Lake Wadi El-Rayan can be reaching to unacceptable sizes for fresh marketing, so, it could be utilized to produce some fast products. The nutritional protein quality of studied products varied markedly as affected by fish mince percent in formula used for each product.
Keywords: Silver carp fish, fast products, nutritive value, sensory properties.

INTRODUCTION

Fish and fish products are known to be of great source of protein have good digestibility, high nutritional quality and biological value and as adequate source of the essential unsaturated fatty acids, some vitamins and minerals especially phosphorus, magnesium, calcium, iron and selenium (Gomma, 2005). Also, fish products are one of the most acceptable food products in the world and commonly used as ready-to-eat or precooked products. Concern cooking process, heat is applied to food to enhance its flavor, inactivate pathogenic micro-organism and increase shelf life (Bognar, 1998). Carp as a freshwater fish species has been one of the most widely cultured species all over the world due to its fast growth rate, easy cultivation and high feed efficiency ratio. Silver carp fish is produced largely and is unacceptable to the popular in the fresh form. In addition, the preference of the consumers was directed towards the fast food consumption since there has been a rapid urbanization and an increase in working women population. There have been many studies about the production and quality stability of the fishery fast food products including fish cake, fish crackers, fish balls and

fish burgers (Lazos, 1996). Fish patties and fingers made from carp have been suggested as convenience products and they were preferred to traditional preparations of this fish (Sehgal and Sehgal, 2002). Therefore, the current work is to investigate the utilizing of unaccepted big size silver carp fish (*Hypophthalmichthys molitrix*), in Lake Wadi El-Rayan, El-Fayoum, for production of fast fishery products such as fingers, patties, kofta and chips had a high nutritional quality as well as good acceptability.

MATERIALS AND METHODS

Fish samples: they were obtained from Wadi El-Rayan Lake, El-Fayoum Governorate, Egypt, during February, 2012. The average weight (M±SD) of three silver carp (*Hypophthalmichthys molitrix*) samples was 17.5 ± 0.300 kg. They were transported to the laboratory in Shakshouk Fish Research Station, National Institute of Oceanography and Fisheries in ice.

Ingredients: powdered spices, edible salts, starch, vegetable oil, sunflower oil, flour and food additives were obtained from the local market.

Technological process: The fish samples were beheaded, gutted and washed gently with tap water, then filleted and skinned by hand. The yield of flesh was 53 %. The fillets were dipped in 1% chilled brine solution contained 0.5% acetic acid for 5 min. The prepared fillets were cut and minced by a kitchen meat mincer using a 3 mm diameter holes plate. Minced fish were divided into four batches to obtain different silver carp products, i.e. fish fingers, patties, kofta and chips as follows:

Fish fingers: The first batch of minced fish was minced again with other ingredients (Table, 1) and shaped into fingers (10×2×1 cm), frozen at -18^{o}C for 2 hr before battering. Frozen fish fingers were rapidly coated with batter solution (3 parts of water plus 2 parts contained 94 % maize flour, 2 % skim milk, 2 % egg yolk and 2 % sodium chloride), and then rubbing with finally ground crumbs (Ibrahim *et al.,* 2002).

Table (1): Recipe of silver carp fingers.

Ingredients	%	Ingredients	%
Fish mince	93.5	Onion	0.24
Salt	1.5	Garlic powder	0.24
Sugar	1.0	Black pepper	0.24
Wheat flour	3.0	Thyme	0.02
Cumin	0.24		

Fish patties: The second batch of minced fish and other additives were incorporated (Table, 2) as mentioned by Chandrasckhar and Mohite (1978). All ingredients were mixed using the Varimix kitchen machine, divided into equals pieces (50 gm weight) and formed patties (1cm thickness and 8.5 cm diameter) by manually operated forming machine (NOAW-Affetacrane, Italy).

Table (2): Recipe of silver carp patties.

Ingredients	%	*Spices mix.	%
Fish mince	75.0	Black pepper	42.0
Vegetable oil	9.0	Cumin	23.0
Starch	8.0	All spices	18.0
Salt	2.3	Clove	2.0
Sod.bicarbonate	0.4	Coriander	5.0
Onion	2.5	Cubeb	2.0
Garlic	0.5	Cardamon	2.0
Polyphosphate	0.3	Red pepper	1.0
*Spices mix	2.0	Ginger	5.0

Fish kofta: The third batch of fish mince, boiled potato and other ingredients were good mixed (Table, 3), and then rusk was added to the minced mixture (Hassan *et al.,* 1999).

Table (3): Recipe of silver carp fish Kofta .

Ingredients	%	*Spices mix.	Percent
Fish mince	72.0	Black pepper	1.0
Boild potato	18.0	Cinnamon	1.0
Rusk	2.5	Cumin	1.0
Salt	2.0	Laurel leavas	0.50
Sugar	2.5	Cardamon	0.50
Garlic and onion	1.5	Thyme	0.50
*Spices mix.	1.5	Cloves	0.50
		Cubeb	0.50
		Rosemary	0.50

Fish chips: The fourth batch of fish mince and other ingredients (Table, 4) were mixed. After that, this mixture was divided into small pieces and formed 5 cm long and 1 cm thick (Levent *et al.,* 2011).

Table (4): Recipe of silver carp chips

Ingredients	%	Ingredients	%
Fish mince	60.00	Potato flour	5.50
Starch	11.00	Salt	1.85
Cold water	21.00	Monosodium glutamate	0.65

Cooking method: The prepared fish patties, fingers, Kofta and fish chips were deep fried in sunflower oil heated at 170 ºC for 5-8 minutes using electrical fryer pan (Moulinex brand). The fried fish were placed in the frying basket to drain out the excess amounts of cooking oil, cooled and kept for analysis.

Analytical methods

Moisture, protein (N×6.25), fat and ash contents were determined (AOAC, 2002). Amino acids composition was determined (Millipore Co-operative, 1987). Values of amino acids were expressed as g/16gN and

g/100g sample. Amino acids score (AAS) calculated for essential amino acid in relation to FAO/WHO reference protein (1985) according to Bhanu *et al.* (1991). In addition, essential amino acid index (EAAI) was calculated (Hidvegi and Bekes, 1983) and biological value (BV %) calculated (Oser, 1959) as follows: BV= 1.09 (EAAI) -11.73. Grams consumed of studied carp products to cover the daily requirements of essential amino acids (GDR g) and percent satisfaction when consumed 150 grams (P.S/150 g %) were calculated (Anon, 1989). Protein efficiency ratio (PER) was calculated by the following equation, PER= - 0.468 + 0.454 (Leu) – 0.105 (Tyr) as described by Alsmeyer *et al.* (1974) as adapted by Adeyeye (2009).

Sensory evaluation: the color, taste, odor, texture and general acceptability of fried silver carp fish fingers, patties, kofta and chips products were evaluated according to Hemedia and Salama (1992). Results were analyzed statistical using the least significant difference test (LSD) ($P \leq 0.05$) as outlined by Steel and Torri (1980).

RESULTS AND DISCUSSION

Chemical composition

Chemical composition (wet weight) of fast fishery products; fingers, patties, kofta and chips were 59.35, 57.24, 58.64 and 61.02% moisture, 16.50, 14.66, 13.25 and 11.95 % protein, 10.40, 12.72, 8.85 and 9.22% fat, 2.95, 3.45, 3.30 and 2.90% ash content, respectively (table 5). Meanwhile, the energy values were 202.80, 222.64,196,49 and 189.22 Kcal./100g for fish fingers, patties, kofta and chips, respectively. A high value of protein was found in fish fingers; lipid was found in fish patties and carbohydrate was found in kofta and chips, respectively. This increment is due to ingredients percent in each product. Similar results are reported by Mostafa *et al.* (2002), Levent *et al.* (2011) and Levent *et al.* (2011).

Table (5): Chemical composition (wet wt) of fast processed carp products.

Fast Products	Constituents (%)					Energy value Kcal. /100g
	Moisture	Protein	Fat	Ash	Carbohydrate	
Fingers	59.35	16.50	10.40	2.95	10.80	202.80
Patties	57.24	14.66	12.72	3.45	11.93	222.64
Kofta	58.64	13.25	8.85	3.30	15.96	196.49
Chips	61.02	11.95	9.22	2.90	14.61	189.22

Results were expressed as mean (n=3).

Nutritional protein quality

Table (6) shows the nutritive value of fast fishery products. All carp fish products had much higher content (g/16gN) of all essential amino acids (EAA) than those of (FAO/WHO, 1985) reference protein pattern. Thereby, amino acids score (AAS) for all EAA was higher than (100) and confirmed that no deficient in any EAA in the investigated fish products. On the other

hand, the restricting (RA) of EAA (the lowest AAS) was found in amino acids containing sulpher (methionine and cystine) for all fast products.

Table (6): Essential amino acids (EAA) composition and amino acid score (AAS) of fast processed carp products.

Amino acids	FAW/WHO (1985) g/16gN	Fast processed carp products;							
		Fingers		Patties		Kofta		Chips	
		g/16gN	AAS	g/16gN	AAS	g/16gN	AAS	g/16gN	AAS
Isoleucine	1.3	5.60	431	5.28	406	4.82	371	4.15	319
Leucine	1.9	7.21	379	6.90	363	5.12	269	6.85	360
Lysine	1.6	6.15	384	6.18	386	6.75	422	6.38	375
Threonine	0.9	3.80	422	3.35	372	3.35	372	3.24	360
Valine	1.3	6.04	465	5.30	408	5.10	392	5.02	386
Histidine	1.6	5.60	350	5.18	324	4.85	303	4.41	276
Meth + Cyst.*	1.7	3.25	191	2.95	174	2.66	156	2.48	146
Phenyl.+Tyr.	1.9	6.15	324	5.88	309	5.82	306	5.09	237

Tryptophan was not determined AAS: Amino acid score.
***R.A.: Restricted essential amino acid**

Nutritional value, protein quality with regards the total essential amino acid (TEAA), essential amino acid index (EAAI), biological value (BV %) and protein efficiency ratio (PER) of all fast products are presented in Table (7). It could be noticed that all fast fishery products had better protein quality as indicated by higher of TEAA, EAAI, and BV% and PER. Therefore, the high quality of protein was found in fingers followed by patties and kofta, while the lowest values of the same parameters were recorded for chips. These results are based mainly on the percent of minced fish in formula for each product as reported by (Ramadan, 1999).

Table (7): Nutritional Protein quality of fast processed carp products.

Fast products	Responded parameters			
	TEAA	EAAI	BV(%)	PER
Fingers	43.80	87.18	83.30	2.56
Patties	41.02	81.04	76.60	2.41
Kofta	38.47	77.40	72.69	2.38
Chips	37.62	73.92	68.84	2.34

TEAA: Total essential amino acids B.V.: Biological value
EAAI: Essential amino acids index PER: Protein efficiency ratio

From table (8), the obtained data shows grams consumed of processed fast products to cover the daily requirements (GDR g) of EAA for adult man and satisfaction percentage of the daily requirements from all EAA when consuming 150g of the products (PS/150g %) in relation to the (USRDA,1989) reference protein pattern. The results proved that there were variations between GDR and PS values in all products as a result of the variations in protein content, where's the product which low of GDR, high of PS values consider a high of nutritional value. Also, it was noticed that

restricting (RA) EAA in all fish products was methionine + cystine amino acids (highest GDR and lowest PS/150g %). Therefore, it could be concluded that all processed silver carp fish products had high nutritional quality of protein. Furthermore, fish fingers product was the better nutritional protein quality followed by patties, kofta and chips as indicated by higher values of TEAA, EAAI, BV %, PER and PS/150g % with lower the GDR g. In general, the nutritive value of the products investigated was based on percent of minced fish in formula.

Table (8): Essential amino acid composition (g/100g sample), GDR, g and P.S. /150 g % of fast processed fishery products.

Essential amino acids	USRDA (1989)	Fast processed carp products;											
		Fingers			Patties			kofta			Chips		
		g/100g sample	GDR (g)	ps/150g %	g/100g sample	GDR (g)	ps/150g %	g/100g sample	GDR (g)	ps/150g %	g/100g sample	GDR (g)	ps/150g %
Isoleucine	0.819	0.92	89	169	0.77	106	142	0.64	128	117	0.50	164	91
Leucine	1.197	**1.19**	101	149	1.01	119	126	0.68	176	85	0.82	146	103
Lysine	1.008	**1.01**	100	150	0.91	111	135	0.89	113	133	0.76	133	113
Threonine	0.567	0.63	90	167	0.49	116	129	0.44	129	116	0.39	145	103
Valine	0.819	1.00	82	183	0.78	105	142	0.68	120	125	0.60	137	109
Histidine	1.008	0.92	110	136	0.76	133	113	0.64	158	95	0.53	190	79
Meth* Cyst+	1.071	0.54	198	76	0.43	249	106	0.35	306	142	0.30	357	42
Phenyl.+Tyr	1.197	1.01	119	126	0.86	139	108	0.77	155	97	0.61	196	77

Tryptophan is not determined **G.D.R: the grams consumed to cover the daily requirements for adult man.**

***R.A.: Restricted essential amino acid** **P.S %. / 150g: the percentage satisfaction of the grams daily requirements for adult man.**

Sensory evaluation of processed fast fishery products

The mean scores of sensory properties (color, taste, odor, texture and general acceptability) of fast processed carp products are shown in table (9). Fish patties had high scores of all tests followed by fingers, kofta and chips, respectively. Therefore, fish patties was actually evaluated as best as "excellent" followed by fish fingers as also "excellent", while, fish kofta evaluated as "very good" and fish chips as "good". This indicated that fast fishery products made from big sizes silver carp fish were high acceptability for panelists. Besides, there were significant values in color between patties and chips (P≤0.05) and the higher significant differences in taste of chips and other ones. The mean scores of odor and acceptability were significantly higher (P≤0.05) between all products as well as in texture between kofta and patties products.

Table (9): The mean scores of sensory evaluation of fast processed carp products.

Property	Fast carp products;				LSD*(P≤0.05)
	Fingers	Patties	Kofta	Chips	
Color	8.5	9.0	8.5	8.0	0.632
Taste	9.5	9.5	9.0	7.5	0.316
Odor	9.0	8.5	8.0	7.0	0.017
Texture	8.0	8.6	7.5	8.0	0.548
General acceptability	8.7	9.2	8.2	7.5	0.182

0.0- 3.9 very poor, 4 - 4.9 poor, 5 - 6.5 accepted, 6.6 - 7.5 good, 7.6 - 8.5 very good and 8.6 - 10 excellent. LSD*: least significant differences.

CONCLUSION

The obtained results in the current study showed that it could be utilized of unaccepted big size silver carp fish for the production of fast fishery products such as fingers, patties, kofta and chips. These products had a high nutritional quality as well as good acceptability. In addition, the nutritive value of the investigated products was based on percent of minced fish formula.

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القيمة الغذائية لبعض المنتجات السريعة المصنعة من أسماك المبروك الفضي بحيرة وادي الريان- محافظة الفيوم- مصر

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أجرى هذا البحث بهدف دراسة القيمة الغذائية لبعض المنتجات السريعة المصنعة من أسماك المبروك الفضي كبيرة الحجم والمرتفعة في نسبة التصافي (53%) المتواجدة ببحيرة وادي الريان – محافظة الفيوم خلال شهر فبراير 2012. في هذه الدراسة تم عمل التقييم الغذائي والحسي لتلك المنتجات المصنعة والتى شملت أصابع السمك والباتيه والكوفته والشيبسى.

ويمكن تلخيص أهم النتائج التي تم الحصول عليها فيما يلي:- وجد أن مستوى البروتين في أصابع السمك أعلى من باقي المنتجات الأخرى ونسبة الدهن والطاقة كانت أعلى في منتج الباتيه بينما الكربوهيدرات كانت أعلى فى منتج الكوفته والشيبسى. أيضا وجد أن الأحماض الامينية الاساسيه (EAA) (جرام/16جرام نيتروجين) في كل المنتجات أعلى من النموذج المرجعي FAO/WHO والأحماض الامينية المحددة (AAS) لكل الأحماض الامينية الاساسيه أعلى من 100. كذلك أعلى جودة بروتين غذائية وجدت فى أصابع السمك يتبعها الباتيه ثم الكوفته والشيبسى ولكن كان الباتيه أعلى في التقييم الحسي يتبعه أصابع السمك ثم الكوفته والشيبسى ومتوسط قيم الرائحة والقبول العام كان مرتفع في كل المنتجات. وعى ذلك أمكن استنتاج أن اسماك المبروك الفضي فى بحيرة وادي الريان تصل إلى أحجام كبيرة غير مقبولة لدى المستهلك في الصورة الطازجة لذلك أمكن الاستفادة منها في أنتاج منتجات سريعة ذات جودة غذائية عالية. كذلك وجد أن نسبة البروتين في المنتجات موضع الدراسة تتأثر بوضوح بنسبة مفروم السمك فى خلطة تجهيز كل منتج من المنتجات.

قام بتحكيم البحث

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