CHEMICAL AND PHYSICAL CHANGES OF SQUID CANNED IN OIL, TOMATO SAUCE AND VEGETABLES

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Abstract

Mantle and tentacles of squid were either steamed or fried. then canned in oil, in tomato sauce or with vegetables. Fried canned products had lowere moisture and higher protein than steamed samples. Higher protein (27.10%) was found for fried tentacles canned in tomato sauce, and higher fat was recorded for fried tentacles canned inoil (12.80%). All products contained adequate amounts of protein and fat. Thiobarbituric acid value varied according to the method of canning . WHC and plasticity were higher for steamed than fried squid, mantle than the tentacles, and canning with vegetables compared to canning in oil or tomato sauce Dry pack method of canning favoured the physical properties of the canned squied. When the nutritional value based on amino acid composition was considered (EAA % of wet sample), samples score was different from that found when protein quality (EAA as gm / 16 gm N) was concerned . But all had high nutritional value . Organoleptic evaluation revealed that based on overall acceptability, scores more than one of the tested products could be recommended for commercial production . This would increase the assortment of canned fish in local market increase the landing of such unpopular mollusc, and raise the available high quality protein required for man's diet.

INTRODUCTION

In developing countriesm, good quality protein is considerably expensive for

most of the social classes. Looking for the best and for complete utilization of animal protein sources is the main job of technologists. In Egypt, landing of squied is very limited due to its unpopularity . At the same time squid dishes are known at sea areas , and are offered as luxury and delicious food in big restaurants. Shenikova (1972) reported that rejection of squid might be based on its unpopular appearance and form, which could be easily overcome by processing through different methods such as canning . According to many authors (Lagunov and Nikolyaeva, 1966, Nemenova *et al.,* 1979 a,b and Nahwat A. Zahran 1982) the nutritional value of squid based on protein quality , mnineral and vitamin contents is considerable . Squid meat is recommended for old people , convalescents, and people who suffer from obesity, atherosclerosis and endemic goitre.

This work was conduted to prepare and evaluate the different methods of canned squid.

MATERIALS AND METHODS

Squid (Sepiotenthis loliginiformis), named locally as Sobbate or Sepia was obtained from Damietta city after landing and transported to the labortory in crushed ice, where it was eviscerated , skinned and washed. Mantle and tentacles treated with steam for 10 minutes or fried for 7 minutes in vegetable oil after covering with wheat flour. Two kinds of canned squid (mantle or tentacles) were prepared :

A - in vegtable oil.

B - in tomato sauce.

C - Fish (60%) and vegetables (40% pea, carrot, onion, spices).

according to the methods described by Zaitsev et al., (14969) samples were packed in double seamed tinned can at Ezbet El-Burg Fish Canning Factory, Edifina Co., and sterilized at 116oC for 75 minutes followed by rapid cooling . After 2 months of packing, sampels were analyzed. Moisture, protein (N x 6.25, Kjeldah method) , fat and ash contents were determined according to the methods described in the A.O.A.C. (1975). Thiobarituric acid value (T.B.A.) was determined colorimetrically using the methods described by Pearson (1970). Water holding capacity (WHC) as and plasticity were determined using the filter paper press methods described by

Solivev (1966), and values were expresad in cm^2

Organoleptic evaluation was carried out according to Molander (1960). A number of 10 Judges were asked to evaluate the colour, aroma, taste, textrue and overally acceptability of the different samples. Judging Scale was as follows:

Very good	8 - 9
Good	6 - 7
Fair	4 - 5
Poor	2 - 3
Very poor	0 - 1

Individual amino acids were estimated using paper chromatography method after HCl hydrolysis according to Block (1958). Tryptophan was determined colorimetrically after alkaline hydrolysis using the mehtod of Blauth *et al.* , (1963).

Essential amino acid index (E.A.A.I.) and biological value (B.V.) of protein were calculated by the method of Oser (1989) using concentration (gm 16 g N) of isoleucine, leucine , lysine, threonine, valine , tryptophan , methionine + cystine and phenylalanine + tyrosine. Amino acids scores (A.S.) were calculated for essential amino acids (EAA) using FAO reference protien (FAO/WHO, 1973) as follows:

$$A.S = \frac{\text{Concentration of essential amino acid in tested protein}}{\text{Concentration of essential amino acid in FAO pattern.}}$$

RESULTS AND DISCUSSION

1 - Chemical composition

Data presented in Table 1 and 2 show the steamed or fried canned squied mantle and tentacles . The fried sampes had less moisture content than the steamed squid. Mantle contained higher moisture than the tentacles , and the moisture content was high for the canned product in sauce , followed by vegetable then canned squid in oil.

Frying markedly decreased the moisture content and accordingly all nutrients of the canned products were higher than in steamed squid . This indicated the increase in nutritional value . In this concern , the highest protein content was recorded for fried squid canned in tomato sauce , which were 25.5 % and 27.10 % in case of mantle and tentacles respectively. High fat content was also found for fried smaples, especially when squid tenteacles (highest fat , 12.80 %) were cnned in oil. This show that the highest nutritional value (protein and fat) was found in fried , then canned squid tentacles in oil. All other analyzed samples were of adequate protein and fat contents regardless of the pre- canning thermal treatments, squid part or filler added in the cans. It should be noted that mantle showed higher protein content than tentacles for steamed squid, but for fried samples the reverse was found .

concerning to lipids oxidation, the T.B.A. Value was higher for tentacle compared to mantle , for fried than steamed squied, and for canned samples in tomato sauce , followed by canned squid with vegetable , and was lowest in canned mantle and tentacles in oil . The highest T.B.A. Value was found in fried tentavles canned in tomato sauce. It seems that the squid meat having tentacles of thinner pices than the mantle , with th possible presence of catalysts in fiiler , soaking in oil , and the possible presence of air while canning with vegetables might be involved in the level of lipids oxidation.

1 - Chemical composition

From the results in Table 1 and 2 it is evident that frying decreased both WHC and plasticity of squid meat . Tentacles were of lower WHC and plasticity than the mantle. The values were better in case of canning with vegetables as compared with conning in oil or sauce. Dry pack (canning withou liquids such as oil or sauce) seems to be convnient for bitter physical character istics.

3 - Amino acids composition (A.A)

Data presented in tables 3 and 4 show the A.A. composition of squid mantael and tentacles as influenced by the differnt treaments of canning. No deficiency was found in all products with regard to concentrations of EAA in relation to the FAO pattern (A.S.). The levels of A. A. however , were different in the analyzed products. The total summation of the different levels was reflected on the E.A.A.I. and B.V. values. Better protein quality (higher E.A.A.I. and B.V.) was found for steamed as compared with fried samples for mantle than tentacles, being highest for canned squied with vegetables , followed by canned samples in oil , and least for squid

Table 1. Chemical composition of steamed then canned Squid.

	Oil				Tomate Sauce				Vegetable			
	Mantle		Mantle		Mantle		Mantle		Mantle		Mantle	
	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight
Moisture (%)	72.49	----	72.33	----	74.01	----	73.32	----	72.96	----	72.87	----
Protein (%)	15.30	55.61	17.80	53.49	15.62	60.10	15.40	57.72	13.54	50.07	13.23	55.61
Fat (%)	852	30.97	8.33	30.11	6.01	23.12	6.13	22.98	3.75	13.87	3.68	30.97
Ash (%)	3.63	13.20	3.52	12.7	3.83	14.74	3.78	14.17	5.45	20.16	5.22	13.20
T.B.A.	0.022	---	0.100	---	0.040	---	0.150	---	0.035	---	0.110	---
W.H.C. (cm^2)	6.4	---	6.9	---	6.7	---	7.1	---	5.7	---	6.5	---
Plasticity (cm^2)	3.4	---	2.8	---	3.4	---	2.8	---	3.6	---	2.8	---

Table 2. Chemical composition of fried then canned Squid.

	Oil				Tomate Sauce				Vegetable			
	Mantle		Mantle		Mantle		Mantle		Mantle		Mantle	
	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight	wt/wt	dry weight
Moisture (%)	58.62	----	54.86	----	61.08	----	57.63	----	62.12	----	59.61	----
Protein (%)	23.86	57.66	25.51	56.51	25.59	65.75	27.10	63.69	20.82	54.96	21.02	52.04
Fat (%)	11.98	28.95	12.80	28.35	7.32	18.81	7.87	18.57	6.98	18.43	7.38	18.27
Ash (%)	5.22	12.61	5.80	12.85	5.09	13.08	5.72	13.50	6.43	16.97	7.90	19.55
T.B.A.	0.065	---	0.125	---	0.140	---	0.160	---	0.065	---	0.130	---
W.H.C. (cm^2)	6.6	---	7.3	---	6.8	---	7.6	---	6.2	---	7.0	---
Plasticity (cm^2)	3.2	---	2.4	---	3.2	---	2.4	---	3.3	---	2.7	---

Table 3. Amino acids composition of canned squid (Mantle or Tantacles) treated with steam.

Amino acid	F A O reference Protein g/16 N	Oil				Tomate Sauce				Vegetable			
		Mantle		Mantle		Mantle		Mantle		Mantle		Mantle	
		g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s
:eicone+Isoleucine	11.00	12.03	1.09	11.83	1.08	11.77	1.07	11.59	1.05	12.45	1.13	11.95	1.09
Lysine	5.50	8.05	1.46	9.75	1.74	7.90	1.43	9.63	1.75	7.95	1.45	9.76	1.78
Valine	5.0	5.00	1.00	5.00	1.0	4.99	1.00	5.09	1.02	5.20	1.04	5.02	1.00
Methionine		2.65		2.61		2.52		4.47		2.85		3.79	
Theronine		4.68		4.50		4.38		4.10		6.82		5.45	
Phenylalanine		3.92		3.55		4.24		3.86		4.53		4.12	
Tryptophan	4.00	2.39	1.17	1.60	1.13	2.25	1.09	1.51	1.03	2.74	1.71	1.91	1.36
Arginine		3.62		3.99		3.18		3.48		4.08		3.69	
Histidine		3.50		3.86		3.30		3.65		2.55		2.76	
Tyrosine	1.00	4.02	2.39	3.83	1.60	3.75	2.25	3.50	1.51	3.21	2.74	3.18	1.91
Cystine		3.52		4.05		3.49		4.01		3.58		4.63	
Alanine+glutamic		16.01		14.58		16.15		14.73		15.28		13.87	
Glycine+aspartic		11.70		12.30		11.81		12.42		11.89		12.08	
Proline		1.08		2.21		1.05		2.18		1.72		2.85	
Serine		3.15		2.26		3.24		2.35		3.76		4.26	
Methionine+cystine	3.50	6.17	1.76	6.66	1.90	6.01	1.72	6.48	1.85	3.76	1.84	8.42	2.41
Phenylalanine+tyrosine	6.00	7.94	1.32	7.38	1.23	7.99	1.33	6.36	1.06	7.74	1.29	7.30	1.22
E.A.A.I.		96.96		93.15		93.55		88.94		105.49		101.86	
B. V. %		93.96		89.80		90.24		85.22		103.25		99.30	

Table 4. Amino acids composition of canned fried squid (Mantle or Tantacles).

Amino acid	F A O reference Protein g/16 N	Squid in oil				Squid in tomate				Squid in Vegetable			
		Mantle		Mantle		Mantle		Mantle		Mantle		Mantle	
		g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s	g/16 N	A.s
:eicone+Isoleucine	11.00	11.85	1.08	11.35	1.03	11.00	1.00	11.11	1.01	12.03	1.09	11.55	1.05
Lysine	5.50	7.25	1.32	9.62	1.75	7.10	1.29	9.43	1.71	7.04	1.28	8.64	1.57
Valine	5.0	5.00	1.00	5.12	1.02	5.00	1.00	5.00	1.00	5.10	1.02	5.23	1.05
Methionine		3.98		3.76		3.85		3.63		4.24		5.09	1.33
Theronine		4.40		4.43		4.10		4.00		6.50		5.30	
Phenylalanine		3.60		3.22		3.91		3.52		4.25		3.78	
Tryptophan	4.00	2.33	1.10	1.54	1.11	2.10	1.03	1.30	1.00	2.62	1.63	1.75	1.33
Arginine		3.36		3.95		2.82		3.40		3.83		3.65	
Histidine		4.20	2.33	4.99	1.54	4.00	2.20	4.78	1.49	3.26	2.62	3.83	1.75
Tyrosine	1.00	4.08		3.88		3.81		3.61		3.27		3.24	
Cystine		3.84		3.54		3.80		3.49		3.89		4.24	
Alanine+glutamic		14.20		13.27		14.36		13.52		13.89		12.58	
Glycine+aspartic		11.57		11.78		11.68		11.90		11.45		11.77	
Proline		1.23		2.40		1.29		2.36		1.96		2.09	
Serine		3.48		3.02		3.27		3.14		3.99		5.02	
Methionine+cystine	3.50	7.82	2.23	7.30	2.09	7.65	2.19	7.12	2.03	8.13	2.32	9.33	2.67
Phenylalanine+tyrosine	6.00	7.68	1.28	7.10	1.18	7.72	1.29	7.14	1.19	7.52	1.25	7.11	1.19
E.A.A.I.		96.92		92.61		93.03		88.36		104.55		99.64	
B. V. %		93.91		86.61		89.67		84.58		102.23		69.88	

canned in tomato sauce . It was previously reorted that the loss in EAA was higher for mantle than tentacles of squid and for freid than boiled samples (Nahwat A. Zahran, 1982) .

Morevover , according to Hafiz (1982) dry packin of dophin meat caused less hydrolysis and breakedown of EAA when compared with meat canned with liquids "bone soup". In the second case, more T.V.N., T.M.A.M.N., NH_3. N as percent of T.N. were recorded indiction gmore hydrolsis of protein followed by breakdown of nitrogen fraction. Hydrolysis of free amino acids was accompained by the separation of NH2, and sH groups to form ammonia and sulphur dioxide. Therefore, canning with vegetables (dry pack method) protected more the squid protein from breakdown during canning, in comparis on with canning in oil or in tomato sauce.

From the results in Table 5 it is evident that the concertrations of EAA were parallel to the protein levle of given sample. In this connection , fried mantle showed higher EAA contents than with steaming , for steamed mantle had mostly higher EAA than tentacles The reverse was mostly found for mantle and tentacles of fried squid. Moreover highest EAA were mostly found for canned squid in tomato sauce foolowed by cnned amsple in oil, while vegetables. This was in accordance with the levels of protein in smaples. Therefore, ranking products based on the nutritonal valueof wet sample (gm/100gm samples) , contradicts with ranking based on protein (gm/16gm N.). In general, all samples were of high nutritional and biological values.

4 - Organloptic evaluation

Data presented in Table 6 show the average scores given fo rthe steamed or fried squid mantle and tentacles canned in oil , in tomato sauce or with vegetables. It seems that sometimes the textrue did not coincide with the results of plasticity (Tables 1 and 2). This might be due to the fact that plasticity reflects one, and not all tenderness parameters .Thexture as evaluated organoleptically reflects the preferecne judged by panelists, and they may not prefer the very tender samples . In general , overall acceptabily migh reflect the total summation of panelists preference . In this concern steamed and fried mantle and tenactles canned with vagetables, and steamed tenatcles canned in tomato sauce were rated very good (8scores) , while steamed mantle canned in ioil was fair (6 scqures); all other samples were ranked good (7 scores).

Finally one or more of the different canned squid products could be distribted commercially to increase the assortment of canned fish in the market , to increase

Table 5. Amino acids composition of canned fried squid with different methods (g/100g) sample

	Steamed						Steamed					
	Oil		Tomato sauce		Vegetables		Oil		Tomato sauce		Vegetables	
	Mantle	Tentac-les	Mantle	Tentac-les	Mantle	Tentac-les	Mantle	Tentac-les	Mantle	Tentac-les	Mantle	Tentac-les
Leucine+isoleucine	1.84	1.75	1.84	1.79	1.69	1.58	2.83	2.80	2.82	3.01	2.51	2.43
Lysine	1.23	1.42	1.23	1.48	1.08	1.29	1.73	2.45	1.82	2.56	1.47	1.82
Valine	0.77	0.74	0.78	0.78	0.70	0.66	1.19	1.31	1.28	1.36	1.06	1.10
Threonine	0.72	0.67	0.68	0.63	0.92	0.72	1.05	1.13	1.05	1.08	1.35	1.11
Tryptophan	0.37	0.24	0.35	0.23	0.37	0.25	0.56	0.39	0.54	0.35	0.55	0.37
Methionine+cystine	0.94	0.99	0.94	1.00	0.87	1.11	1.87	1.86	1.69	1.93	1.69	1.96
Phenylolanine+tyrosine	10.12	1.09	1.25	0.98	1.04	0.97	1.83	1.81	1.98	1.94	1.57	1.50

Table 6. Organoleptic evaluation of canned squid products by different methods (average score).

	Fried Squid						Treated with steam					
	Tentacles			Mantle			Tentacles			Mantle		
	in vegetable	In tomato sauce	In oil	in vegetable	In tomato sauce	In oil	in vegetable	In tomato sauce	In oil	in vegetable	In tomato sauce	In oil
Aroma	8	7	7	9	8	7	7	9	6	8	8	6
Taste	7	6	7	8	7	6	7	8	7	7	7	6
Texture	8	7	7	8	8	7	8	9	8	8	7	6
Colour	8	7	7	8	7	7	8	8	7	8	8	6
Overall acceptability	8	7	7	8	7	7	8	8	7	8	7	6

the landing of this unpopular mollusc, and to raise the level of available dietary high quality protein.

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بعض التغيرات الكيماوية والطبيعية للحبار المعلب في الزيت وصلصة الطماطم ومع الخضروات

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لحم وزوائد السبيط عوملت اما بالبخار او القلي ثم علبت في الزيت او في صلصة الطماطم او مع الخضروات – وقد كانت المنتجات المعرضه للقلي أقل في الرطوبة واعلي في محتوي البروتين من المعاملة بالبخار . واعلي نسبه بروتين (٢٧,١٪) وجدت في زوائد السبيط المقليه المعلبه في صلصة الطماطم كما أن اعلي نسبه دهن وجدت في زوائد السبيط المقلي المعلبة في الزيت (١٢,٨٠٪).

وقد احتوت كافه المنتجات عل نسب معقوله من البروتين والدهن وقد لوحظ أن قيمة حامض الثيوباربيتوريك تختلف حسب طريقة التعليب. وعلاوة علي ذلك لوحظ زن القدره عل إمساك الماد والبلاستيكية أعلي في عينات السبيط المعامله بالخبار عن المقليه ، وأعلي في لحم السبيط عن زوائده واعلي عند التعليب مع الخضر بالمقارنة بالتعليب في الزيت أو في صلصة الطماطم. وعلي ذلك فلقد أدي التعليب ال تحسن الخواص الطبيعية للسبيط المعلب.

وقد وجد أن ترتيب العينات علي اساس القيمة الغذائية بناء علي محتوي الاحماض الامينية الاساسية بالجرام لكل ١٠٠ جرام عينه رطبة يختلف عن ترتيب نفس العينات وفقا لجودة البروتين (محتوي الاحماض الأمينية بالجرام لكل ١٠٠ جرام بروتين) ، غير أن جميع العينات كانت تتميز بالقيمه الغذائية العاليه ، وعل اساس التقييم الحسي للتقبل العام إتضح انه يمكن النصح بانتاج أكثر من نوع من المعلبات المجهزة في البحث عن نطاق تجاري وذلك لزيادة كمية الممكن صيده من هذا النوع المألوف من الرخويات وكذلك لزيادة البروتين العالي الجودة اللازم لغذاء الإنسان .