Assiut Vet. Med. J. Vol. 47 No. 94, July 2002

Dept. Food Hygiene
Fac. Vet. Med. Assiut Univ., Assiut, Egypt

QUALITY OF FISH KOFTA AND SAUSAGE PROCESSED FROM BOLTI AND CARP FISHES IN EGYPT

(With 9 Tables)

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(Received at 27/6/2002)

جوده كفته وسجق السمك المصنع من سمك البلطي والمبروك في مصر

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يحتل سمك البلطي والمبروك أعلى إنتاج في مصر لذلك كان الهدف من هذا البحث هو تصنيع كفته وسجق منهما. تم الحصول على هذه الاسماك من الأسواق المحلية في أسيوط . في المعمل تم إزالة القشور و غسلها وإزالة الرأس والأحشاء الداخلية ثم قطعت إلي فيليه ثم فرمت لحوم الأسماك جيدا . صنعت الكفتة و السجق لكل من النوعين. فحصت الأسماك المفرومة والكفتة و السجق لتقدير البروتين والدهون والرطوبة والرماد والكربوهيدرات . كانت كفته و سجق البلطي أعلى نسبيا في البروتين و اقل منها في المبروك. تم تقدير الأحماض الأمينية و كذلك الأحماض الدهنية. كانت الأحماض الدهنية الغير المشبعة تمثل ٤٥,٣١ و ٤٥,٠٩ % بينما مثلت الأحماض المشبعة ٥٤ و ٣٦,٨٦% في كل من البلطي و المبروك على التوالي . كان هناك اختلاف طفيفا في الأحماض الأمينية بين النوعين . الكفتة المصنعة خزنت عند درجه ٤م بينما السجق المصنع خزن عند درجه – ٢٠م . تم الفحص البكتريولوجي في البداية ثم بعد يومين ثم بعد أربعة أيام بينما تم فحص السجق في البداية ثم بعد أسبوعين ثم بعد أربعة أسابيع . العد البكتريولوجي تناقص تدريجيا حتى نهاية التجربة. لم يتم عزل ميكروبي السالمونيلا او الكلوستريديوم بيرفرنجنز . تم تقييم المنتج من حيث اللون والطعم والرائحة والتقبل العام .اتفقت نتائج هذا التقييم مع T V B N, T BA. كل النتائج في البحث برهنت على نجاح تصنيع الكفتة والسجق من سمكي البلطي والمبروك.

SUMMARY

The aim of the present study was to process kofta and sausage from Bolti and Carp fishes. The fishes were obtained from the local fish market in Assiut, scaled, washed, eviscerated and washed with tap water. The meat only was minced thoroughly. The minced samples, processed

kofta and sausage were examined for protein, fat, moisture, ash and carbohydrate. Bolti kofta and sausage were relatively higher protein content and lower fat content than that of Carp. Fatty acids and amino acids were estimated in minced Bolti and Carp. The total unsaturated fatty acids represented 54.00 and 45.09% while total saturated ones were 31.45 and 36.86% in Carp and Bolti fish respectively. Slight difference in amino acids content of the two kinds was recorded. The prepared kofta samples were stored at 4±1°C and examined bacteriologically at 0, 2 and 4 days interval while the prepared sausage samples were stored at –20 °C and examined at 0, 2 and 4 weeks interval. In fish kofta or sausage, the bacterial count slowely decreased till the end of storage. Neither *C. perfringenes* nor *Salmonella* could be detected in fish products. The kofta and sausage samples were sensorily evaluated by panel members. The sensory evaluation was correlated with TBA and TVBN findings. The all data confirmed the success of processing kofta and sausage from Carp and Bolti fishes.

Key words: *Bolti, Carp, Kofta, Sausage, Processing, Quality.*

INTRODUCTION

Fish-based products are very popular foods in many countries, as they are very nutritious and healthy (Metin *et al.*, 2000). Carp fish is one of the most important fresh water fish in Egypt, which amounted to 36077 metric tons during year 1992 (Darweash, 1996). Carp fish did not find acceptance by consumers in the fresh state because of spines that penetrates its flesh in addition to unpleasent characteristic and the rapid development of rancidity (Shalaby, 1992). The composition of Carp fish seems to be variable according to species, age, sex, physiological state, season of catch and region of catch (Stolle *et al.*, 1994). Bolti fishes are also fresh water fish, which have been studied by many authors (Badawy, 1979, Foda *et al.*, 1986 and Ramadan, 1989). The manufacture of sausage and kofta from red meat is well established technology since many years. This technology is also extended to the production of sausage from poultry meat (Raccach and Baker, 1979). Several workers reported the feasibility of partial or complete replacement of red meat in frankfurters and other sausage by a fish (Lee and Toledo 1976,

Kolakowski 1977, Angel and Weinberg 1979, Arocha and Toledo, 1982). However, Darweash (1996) prepared kobebah from Carp and Bolti fish and the final products showed good nutritional value, organoleptic quality and lower production costs accordingly. Fish-based products are more perishable than meat-based products. The main causes of fish deterioration are autolytic, bacterial and oxidative activities. The microbiological quality is a most important criteria. Microbilogical investigations are conducted to check good manufacturing practice, shelf life and as an accept/reject control. The microbiological quality is based on the estimation of indicator, pathogenic as well as food poisoning microorganisms (Nassar, 1993).

The aims of present work were to a) obtain information about the chemical composition, fatty acid profile and amino acid content of minced meat of Carp and Bolti fishes, b)Manufacture of sausage and kofta from Carp and Bolti fishes and evaluate the proximate composition, bacteriological quality and sensory quality of these products.

MATERIALS and METHODS

Materials:

Twenty fishes (14 kg) of each of Bolti fish *(Tilapia nilotica)* and Carp fish *(Cyprinus carpio)* were brought from the local fish market in Assiut City in October 2000. The samples were scaled, eviscerated, washed with tap water to remove blood and the black lining in the gut cavity. Afterward, head, skin and bones were removed with hand then the fish flesh was minced using meat mincer and used as an ingredient for two types of fish products.

1- Manufacture of fish kofta:

Kofta of Bolti and Carp fish was prepared according to the following formula: 500g minced fish, 12g sodium chloride, 10g spices (black pepper, red pepper, ginger, allspice and coriander), 5g sodium glutamate and 5 g ascorbic acid. All ingredients were mixed throughly together and formed in a kofta–like manner pieces. Six trials were done for fish kofta processing

2- Manufacture of fish sausage:

Both of Bolti and Carp minced fish were used for preparing of sausage according to the following formula: 500g minced fish, 75g iced water, 30g corn starch, 15g nitrite curing salt ($NaNo_2$ 0.4-0.5%, Na Cl 99.5%),), 4g sodium glutamate, 1.5g potassium sorbate, 0.3g sodium nitrite, 7.5g spices (black pepper, red pepper, ginger, cumin and all spice), 3.5g garlic. The recipe for this mix is bases on the formula of meat sausage with some mdification. The ingredients were mixed throughly and stuffed into prepared lamb casing using a handy stuffer. Six trials were done for fish sausage processing. After that, both of the prepared kofta and sausage were examined for estimation the nutritive value, microbiological quality and organoleptic examination.

Analytical methods:

All samples were analyzed in duplicate either chemically or bacteriologically.

1- Proximate composition:

Moisture, crude protein, crude fat and ash were determined in minced fish and prepared kofta and sausage as the methods described in A. O. A. C. (1995). The carbohydrate content in sausage fish was calculated by difference.

2- Amino acid content:

Amino acid content in minced Bolti and Carp fish was determined after hydrolysis by 6 N Hcl according to the method of Pellett and Young (1980) using Beckmen Amino Acid Analyzer model 119 CL.

3- Fatty acid composition:

The lipids of minced Bolti and Carp fisher were extracted according the method of Folch *et al.* (1957). The methyl ester of fatty acids was prepared as the method of Rossell *et al.* (1983). The fatty acids were separated using PYE Unicam pro- GC gas liquid chromatography with a dual flame ionization were carried out on (105mx 4m) SP-2310 column, packed with 55% cyanopropyl phenyl silicone dimensions. The column's temperature at first was programmed

by increasing the temperature from 70-190C at the rate of 8°C minute and then isothermal for 10 minute at 190°C the injector and detector temperature were 250 and 300°C, respectively the flow rate of carrier ganen were 30, 33 and 330 ml/minute for nitrogen, hydrogen and air, respectively. The chart speed was 0.4 cm/minute. Peak identifications were establishes by comparing the retention times obtained with standard methyl esters.

Estimation of Thiobarbituric acid (TBA):

This was done according to the method of Vyncke (1975).

Estimation of Total volatile bases nitrogen (TVBN)

This was carried out according to the method of Antonacopoulos and Vyncke (1989).

4- Microbiological quality:

Kofta samples were stored at 4± 1°C in domestic refrigerator and examined at 0, 2 and 4 days, while sausage samples were stored at -20°C at deep freezer and examined at 0 time then after 2 and 4 weeks storage for:

1- Total colony count (Baumgart *et al.*, 1990).
2- Halophile count (Müller, 1986).
3- *Enterobactriaceae* count (Mercuri and Cox, 1979).
4- Coliforms count (Mercuri and Cox, 1979).
5-*Staph. aureus* (Baird-Parker, 1962).
6- Isolation of *Salmonellae* (APHA, 1992)
7- Isolation of *C. perfringens* (Beerns *et al.*, 1986)

5- Sensory evaluation:

The sensory quality of the manufactured products was done after frying in corn oil at 180°C for 5 minutes by 9 panel members with the comparison of chicken kofta and sausage obtained from the local market in Assiut City. The evaluation criteria were colour, consistency, juiceness, flavour and the general preference using 5 point scale according to method cited in Gelman and Benjamin (1989). The obtained data were statistically analysis using Duncan's test as described by Snedecor and Cochran (1982).

RESULTS and DISCUSSION

Table 1 showed the chemical composition of minced Bolti and Carp fishes. The data revealed that, Carp fish had high fat and low moisture content compared with Bbolti fish. On the other hand, Bolti fish had slight high content of protein. Nearly similar results for Carp were reported by Zaitsev *et al.* (1969) and Stolle *et al.* (1994) .For Bolti, the present findings were agree with that reported by Ramadan (1989).

Chemical composition of raw and fried kofta and sausage prepared from Carp and Bolti fishes are presented in Table 2. The moisture contents in Bolti kofta and sausage were higher than that of the same products of Carp and that may be due to the relatively higher content of protein and lower content of fat in Bolti compared with Carp meat. As a result of frying, the moisture content decreased, while the contents of protein, fat, ash and carbohydrate were incresed in both of kofta and sausage products as shown in Table 2. However the loss of moisture in fried kofta was higher than that of fried sausage and that may be due to present of casing in the case of sausage.

Fatty acid composition of Carp and Bolti fish are presented in Table 3. The data showed that the total unsaturated fatty acids represented 54.00 and 45.09% of the total fatty acids in carp and Bolti fish respectively, While the total saturated fatty acids recorded 31.45 and 36.86% for the same species respectively. The major fatty acids in both Carp and Bolti fish lipids were oleic (38.75, 34.11%), palmitic (20.25, 22.50%), palmitoleic (11.83, 8.72%) and stearic (6.35, 7.32%), respectively. The fatty acids C 16:0, C 18:1 and C 22:6 were the dominants and this comply with Body (1983). Table 4 revealed the amino acids contents in Carp and Bolti fishes. Data showed that, there are slight differences between the two kinds used in amino acid composition. However, Bolti fish had slightly higher content of isoleucine, methionine, phenylalanine, threonine, alanine, arginine, histidine, serine and cystine than Carp fish. In the same time, the Carp fish had somewhat higher content of leucine, lysine, valine, aspartic acid, glutamic acid, prolin, glycine and tyrosine. Ramadan (1989) found that bolti fish muscle contained tryptophan 1.66, therionine 3.00, valine 3.65, methionine 1.85, phenylalanine 4.40, lysine 5.52, histidine 3.60, arginine 9.20 and leucine+isoleucine mixture 8.6 g/100 protein.

The low finding of TBA (Table 5) correlated with organoleptic evaluation. Rancid odour or flavour did not appear in this study and this may be due to antioxidants used. In contrary, Dawson *et al.* (1978) reported increase in TBA and peroxide value in mince from fresh water fish. The results of TVBN were low and may be due to the use of fresh water fishes in study.

The initial bacterial population of Bolti kofta, Carp kofta, Bolti sausage and Carp sausage were tabulated in Tables 6 and 7 respectively. The initial total colony count was slightly higher than that in kofta and this may be due to the ingredients used and the processing difference. The combination of salt, nitrite, spices in the manufacture formulation proved to be selective for the growth of these bacteria. The low bacterial count obtained during the present work could be attributed to the use of fresh fish and good sanitary handling, washing of fish before processing and low temperature preservation. Nearly similar results of low bacterial count in Carp were reported by Gelman and Benjamin, (1987), Nassar, (1993). In fish kofta either from Bolti or Carp, the bacterial count slowely decreased till the fourth day of storage at 4°C (Table 6). In Bolti or Carp sausage, the indicator bacterial counts were decreased at the second or fourth week of storage at –20 °C. *Staph. aureus* count was low in Bolti kofta while the organism was not detected in Carp kofta, Bolti and Carp sausages. Neither *C. perfringens* nor *Salmonellae* could be detected in fish kofta or sausage and this may be due to hygienic status of used fish, good manufacture practice and the use of preservatives especially nitrite in processing.

Colour, odour, taste, jucinse were used as organoleptic evaluation factors for fish kofta or sausage and to be comparable with those of chicken product. Fish sausage had somewhat pale colour although the use of additives such as sodium nitrite, due to the low myoglobin content in fish meat. The adding of red pepper may intensify the colour. The product were lighter. The soft texture is the critical sensory factor in the acceptability of fish sausage. There are other factors such as fat content and processing conditions. The mean results and the statistical analysis of sensory evaluation for both kofta and sausage either from Carp or from Bolti and in comparing with chicken products were done in (Tables 8& 9). Gelman and Benjamin (1989) reported

slightly softer texture of fish sausage in comparison with red meat sausages.

The bacteriological quality comply with the sensory evaluation of fish kofta and sausage of both Bolti and Carp. The manufacture of kofta from Bolti and Carp had a resonable storage stability and that its shelf life was 4 day at 4°C. The Bolti and Carp sausages were stable for 4 weeks at –20°C. The relatively low TBA values for fish kofta and sausage agree with the absence of rancid odour. The all data confirmed the success of processing kofta and sausage from Carp and Bolti fishes. The method is a cheap and can provide a technology for utilization of fish with special to unpopular or under utilized species.

AKNOWLEDGEMENTS

The author sincerely thanks all members of Food Science and Technology, Assiut Agric. Faculty for sensory evaluation and also Dr. A. Hamed and Dr R. El Dengawy for their help in fatty and amino acids estimation.

REFERENCES

Angel, S. and Weinberg, Z.G. (1979): Development of an emultion based-product from minced silver carp in Israel. J. Food Teechnology 14, 4, 405-419.

Antonacopoulos, N. and Vyncke, W. (1989): Determination of volatile basic nitrogen in fish: A calloborative study by the West European Fisch Technologists Association (WEFTA). Z Lebens Unters Forsch, 189, 309-316.

AOAC (1995): Official Methods of Analysis 16th Ed Association of Official Analytical Chemists, Virgina, USA.

APHA (1992): Compendium Methods for Microbiological Examination of Food. 3 rd Ed brothers, Ann, Arb.

Arocha, P.M and Toledo, R.T (1982): Descriptors for texture profile analysis for frankfurter –type products from minced fish. J. food Sci. 47, 3, 695-697.

Badawy, R.M. (1979): Chemical and technological studies on lipids of some local smoked fish. M.Sc. Thesis, Fac. Agric. Assiut University. Egypt.

Baird-Parker, A.C. (1962): An improved diagnostic medium for isolating coagulase positive *staphylococci*. J. Appl. Bact., 25, 12-19.

Baumgart, J.; Firnharper, *J.; Spicher, G.; Timm, F. and Zschaler, R. (1990):* Mikrobiologische Untersuchung von Lebensmitteln. Behr's Velag, Hamburg, Germany.

Beerens, Hremond, C.; Lebage, C. and Criguelion, G. (1986): A direct method for enumeration *Clostridium perfringens* in food and feces. 2 nd World Congress on Foodborne Infection and Intoxication. Berlin, Germany.

Body, D.R. (1983): The nature and fatty acids composition of the oil from deep-sea fish species from Newzealand waters. J. Sci. Food Agric., 34, 388-392.

Darweach, B.M. (1996): Chemical composition of Kobebach from Carp and Bolti fish. Egypt J. Food Sci. 24, 3, 345-358.

Dawson, L.E , Uebersax, K.L and Uebersax, M.A. (1978): Stability of fresh water suker (Catostomus spp.) flesh during storage. J Fish Res. Bd Can 35, 2, 253-257.

Foda, Y.H., Abu-Salem, F.M., El-dashloty, S., Rasmy, N.M. and Sorore, A.(1986): Chemical constituents of Bolti fish. Annals Agric. Culture Sci., Fac. Agric. Ain. Shams Univ., Cairo, Egypt. 31,1, 499-518.

Folch, J.; Lees, M. and Stoane-Stanleg, G.H. (1957): A simple method for isolation and purification of total lipids from animal tissues. J. Biological Chemistry, 266, 497-510.

Gelman, A. and Benjamin, E. (1989): Charactersics of mince from bond-bred silver carp *(Hypophthal michthys molitrix)* and preliminary studies on its use in sausages. J. Sci. Food Agric., 47, 225-241.

Kolakowski, E. (1977): Studies on fish sausage technology. Optimal condition for comminuting process. Nahrung 21, 7, 583-589.

Lee, C.M. and Toledo, R.T. (1976): Factors affecting textural characterstics of cooked comminuted fish muscle. J. Food Sci. 41,2, 391-397.

Metin, S., Erkan, N., Varlik, C., Ozden, C.Baygar, T., Kalafatoglu, H. and Gun, H. (2000): Influence of modified atmosphere packaging on shelf life of fish-salami. Fleisch wirtschaft Int.4, 49-51.

Mercuri, A.J. and Cox, N.A. (1979): Coliforms and Enterobacteriaceae isolates from selected foods. J. Food Protec. 42, 712-714, 711.

Műller, G. (1986): Grundlagen der lebensmittel mikrobiologie. Dietrich Verlag, Darmstadt, Germany.

Nassar, A.M. (1993): The better utilization of fish for human consumption and creation of uncooled distribution for its products in Egypt. Ph.D Thesis, Assiut Univ., Egypt.

Pellet, P. I and Yong, V.R (1980): Nutritional evaluation of protein foods. Food and Nutritional Bulletin Supplmental, Published by the United Nations University.

Raccach, M. and Baker, R. (1978): Microbial properties of mechanically deboned fish flesh. J. Food Sci. 43, 6, 1675-1677.

Ramadan, E.A. (1989): Chemical and technological studies on some frozen Egyptian fish. M.Sc., Thesis, Fac. Agric. Assiut Univ. Egypt.

Rossel, J. B., King, B., and Downs, M.J. (1983): Detection of adultration. J. Am. Oil Chemistry 60, 333.

Shalaby, A.O (1992): Chemical, physical and technological studies on fish sausage. M.Sci. Food Technol. El Mansoura Univ. Egypt.

Snedecor, G. and Chochran, W. (1982): Statstical Methods 6 th ed, Iowa State Univ. Press Ames, Iowa, USA.

Stolle, A., Sedlmeier, H., Nassar, A.; Eisgruber, H.; Youssef, H. and Lotfi, A. (1994): Über den Nährwert von karpfen *(Cyprinus carpio)* . Tierärzl Prax, 24, 512-514

Vyncke, W. (1975): Evaluation of the direct thiobarbituric acid extraction method for determining oxidative rancidity in mackerel *(Scomber scombrous L.).* Fette, Seifen, Anstrichmittel 77, 239-240.

Zaitsev, V.;Kizevtter, I.;Lagunov,L.; Mokarova, T.; Minder, L. and Podsevalov, v. (1969): Fish curing and processing, MIR Publishers, Moscow.

Table 1: Chemical composition of the examined minced fishes. *

Species	Moisture	Protein	Fat	Ash	Calories
Carp	58.90	14.69	23.88	0.83	105.18
Bolti	79.65	17.84	1.41	0.61	84.0

weight bases.

Table 2: Chemical composition of raw and fried kofta and sausage prepared from Bolti and Carp fishes.

	Carp				Bolti			
	Kofta		Sausage		Kofta		Sausage	
	Raw	Fried	Raw	Fried	Raw	Fried	Raw	Fried
Moisture	73.50	60.73	72.25	68.60	74.48	63.65	73.75	70.35
Protein	18.15	25.08	17.09	14.74	19.38	26.17	18.10	19.65
Fat	4.20	6.67	3.98	4.75	2.05	3.10	1.87	2.76
Ash	1.05	2.35	0.91	1.06	0.85	1.86	1.40	1.50
carboh	3.10	5.05	4.96	5.85	3.29	5.22	5.10	5.74

Table 3: Fatty acids content in the examined Bolti and Carp (as % of total fatty acids).

Fatty acid	Carbon chain	Carp	Bolti
Capric	C 10:0	ND	0.25
Louric	C 12:0	ND	0.92
Myristic	C 14:0	4.85	5.96
Palmitic	C 16:0	20.25	22.50
Palmitoleic	C16:1	11.83	8.72
Stearic	C 18:0	6.35	7.23
Oleic	C 18:1	38.75	34.11
Linoleic	C 18:2	3.42	2.26
Others	Unknown	14.55	18.05
Total saturated		31.45	36.86
Total unsaturated		54.00	45.00

ND: not detected

Table 4: Amino acids content in the examined samples g/100 g protein

Amino acid	Carp	Bolti
Essential amino acids		
Leucine	9.34	9.19
Isoleucine	6.85	7.72
Lysine	7.50	6.61
Methionine	3.25	3.53
Phenylalanine	4.17	4.93
Valine	6.90	5.69
Threonine	4.03	5.98
Tryptophane	n.d	n.d
Non essential amino acids		
Alanine	5.17	5.61
Histidine	2.52	3.07
Arginine	8.09	8.96
Aspartic acid	8.15	7.17
Serine	3.60	3.79
Glutamic acid	10.94	10.90
Proline	4.86	4.66
Glycine	5.06	4.95
Cystine	1.11	1.18
Tyrosine	3.65	3.16

Table 5: Results of TVBN (mg/100 g) and TBA (mg/ kg)in fish kofta and sausage.

Time	Carp				Bolti			
	Kofta		Sausage		Kofta		Sausage	
	TVBN	TBA	TVBN	TBA	TVBN	TBA	TVBN	TBA
0	11.4	0.0	11.8	0.0	12.2	0.0	12.2	0.0
2	12.2	0.0	12.7	1.9	13.0	0.0	14.5	2.0
4	13.3	0.0	14.7	2.6	14.1	0.0	16.0	2.8

Table 6: Microbial quality of fish kofta at 4 °C

Time day	PCA		Enterobact.		Coilforms		Halophils		S.aureus	
	Bolti	Carp	Bolti	Carp	Bolti	Carp	Bolti	Carp	Bolti	Carp
0	$2x10^4$	$8x10^4$	$2x10^2$	$4x10^4$	1x10	$4x10^4$	$2x10^4$	$6x10^2$	$6x10^2$	<10
2	$3x10^4$	$6x10^4$	$1x10^2$	$2x10^3$	<10	$1x10^3$	$1x10^4$	1x10	$1x10^2$	<10
4	$5x10^4$	$5x10^3$	1x10	$1x10^3$	<10	$8X10^2$	$1x10^4$	1x10	1x10	<10

Table 7: Microbial quality of fish sausage at – 20 °C.

Time	PCA		Enterobact.		Coilforms		Halophils		S.aureus	
	Bolti	Carp	Bolti	Carp	Bolti	Carp	Bolti	Carp	Bolti	Carp
0	2x105	$3x10^5$	$1x10^3$	$2x10^3$	$4x10^2$	$4x10^3$	$3x10^3$	$2x10^4$	<10	<10
2 w	$4x10^4$	$8x10^4$	$1x10^3$	$1x10^3$	$2x10^2$	$1x10^3$	$1x10^3$	$1x10^3$	<10	<10
4 w	$8x10^3$	$1x10^3$	$2x10^2$	$1x10^2$	1x10	$4X10^2$	$2x10^2$	$1x10^2$	<10	<10

Table 8: Mean organoleptic evaluation of fish kofta*

Type	Colour	Consistency	Juiciness	Flavour	General Acceptable
Carp	4.188 ^{ab}	4.063 ^{b}	4.125 ^{a}	4.125 ^{a}	4.188 ^{b}
Bolti	4.500 ^{a}	4.063 ^{b}	4.313 ^{a}	4.188 ^{a}	4.625 ^{a}
Control	3.875 ^{b}	4.125 ^{b}	4.000 ^{a}	4.375 ^{a}	4.000 ^{b}

*: Mean of scored according to 5-point scale (5=best quality, 1=worst quality) by 9 panel members.

^{abc}: means bearing different supercripts differ significant ($p<0.05$) at the same column.

Table 9: Mean organoleptic evaluation of fish sausage*

Type	Colour	consistency	juiciness	flavour	General Acceptable
Carp	3.875^{b}	4.125^{a}	3.750^{b}	4.250^{a}	3.875^{a}
Bolti	4.500^{a}	4.125^{a}	4.250^{a}	4.125^{a}	4.000^{a}
Control	4.375^{ab}	3.625^{b}	3.750^{b}	3.625^{a}	3.750

* as below table 8.