

HEALTH HAZARD ASSOCIATED WITH SALTED FISH IN EGYPTIAN MARKET

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(Manuscript received 23 October 2004)

Abstract

Thirty random samples of salted fish (15 each of fesiekh and salted sardine) were collected from different markets in Cairo and Giza Governorates and subjected to physical, chemical and microbiological examination. The physical character of the examined samples did not show any significant abnormality. The chemical examination revealed PH values of 7 and 6.9 for fesiekh and salted sardine respectively, which exceed the permissible limit as recorded by Egyptian Organization for Standardization and Quality Control (EOSQC) (1996). The mean values of moisture % were 49.5 and 50.8 % for fesiekh and salted sardine, respectively, which were within the permissible limit as recommended by EOSQC (1996). Moreover, the maximum values of sodium chloride % were 23 and 25% for fesiekh and salted sardine, respectively. The maximum values of histamine level and Total Volatile Base-Nitrogen (TVB-N) were (35 and 30 mg/100g) and (45 and 40 mg/ 100g) for fesiekh and salted sardine respectively. The values of NaCl and histamine exceeded the permissible limit given by EOSQC (1996). The values of TVB-N exceeded the permissible limits of fresh fish (30 mg/100g) as recommended by EOSQC (2003). Microbiological examination revealed that the mean values of anaerobic count, *S. aureus* count, Enterobacteriaceae count and coliforms count were (3.1×10^4 and 1.7×10^3 cell/g), (2.2×10^4 and 1.5×10^3 cell/g), (7.4×10^2 and 1.6×10^2 cell/g) and (34.33 and 9.47) for fesiekh and salted sardine, respectively. These values exceeded the permissible limit recorded by EOSQC (1996).

Finally, it was concluded that the process of salting must be done under complete hygienic condition in order to minimize the risk of high bacterial load to become safe for consumer.

INTRODUCTION

Fish consumption has been increased in the recent years. In the future, fish are considered as one of the important sources of protein for human consumption. Fish like any other food, could be contaminated during handling and processing with many of the well known food poisoning organisms. Contamination of fish with organisms of public health significance remains primarily a problem of handling and processing (WHO, 1999).

It is evident that consumption of salt dried fish may increase the level of salt intake leading to cardiovascular problems (Santosa and Quantick, 1991).

Rodriguez-Jerez *et al.* (1994) studied the count evaluation of total aerobic mesophilic, psychotropic, Enterobacteriaceae, fecal coliform organisms in Spanish-preserved anchovies. They pointed out that the count of such organisms could be used as sanitary index of the product and may produce high concentration of histamine. Sodium chloride concentration was the main factor influencing the decreasing bacterial counts.

Staphylococcus food poisoning is considered as one of the major form of foodborne disease and its toxic symptoms usually appear within 0.5 to 7 or 8 hours after consumption of contaminated food by the Staphylococcal enterotoxins. The common reported symptoms include nausea, vomiting, retching and less frequently diarrhoea, headache, dizziness and weakness reported in minority of cases. There were few deaths recorded, especially in old or very young peoples (Varnam, 1990).

Reilly and Santos (1985) claimed that a high level of histamine indicates poor handling and processing of fish products. They added that delay in salting of fish resulted in higher histamine content. Enterobacteriaceae has important histamine producing activity. Moreover, they are sensitive to elevated sodium chloride concentrations. The isolated Staphylococcus could be considered as halotolerant bacteria. If this kind of microorganisms multiply in salted fish, histamine formation can appear with a risk for consumer's health. The authors concluded that the accumulation of high histamine concentration in salted fish could be due to poor quality of the raw material or to unhygienic handling as the histamine concentration is probably increased due to the presence of the halophilic or halotolerant microorganisms (Rodriguez-Jerez *et al.*, 1994).

MATERIALS AND METHODS

Samples

Thirty random samples of salted fish (15 each of fesiekh and salted sardine) were collected from different markets in Cairo and Giza Governorates. Each sample was wrapped separately in sterile polyethylene bag. The collected samples were transported to the laboratory, where they were subjected to physical, chemical and bacteriological examinations.

1. Physical examination (Borgstorm, 1965)

Attachment of scales, muscle texture, colour and odour of the flesh with examination of viscera and abdominal wall were carried out.

2. Chemical examination (AOAC, 1990)

2.1 Measurement of pH value (AOAC, 1990)

2.2 Determination of moisture % (AOAC, 1990)

The technique was carried out using ten grams of fish flesh, which were placed in a previously weighed porcelain dish, then, dried in hot air oven at 100 °C for four hours till two successive fixed weights were obtained. The moisture content was calculated.

2.3 Determination of sodium chloride % (AOAC, 1990)

It was carried out using silver nitrate (0.1N) precipitation technique.

2.4 Determination of histamine (AOAC, 1990)

The histamine analysis was carried out by thin layer chromatography (TLC). Ten grams of minced fish muscle was weighed and 70 ml methanol was added then, mixed thoroughly, homogenized and filtered. Twenty microliters of the filtrate was spotted with standard of histamine directly on the TLC plate, then solvent system (80 ml acetone: 20 ml ammonia) was used to separate the histamine from sample extract. The plates dried then, sprayed with ninhydrin. The quantitative concentration of histamine was calculated by comparing with the standard.

2.5 Determination of total volatile base nitrogen (TVB-N) (AOAC, 1990)

The Conway's microdiffusion technique was applied. The sample (25 g fish muscle) was extracted by using distilled water acidified by 2M HCl till pH 5.2, then, heat slowly to 70° C then, filter. The Conway's dish was covered and incubated at 36 °C for 2 hours after dispensing 2 ml extract (filtrate) with 1 ml

saturated potassium carbonate in outer ring and 2 ml 0.01 N HCl in inner ring. The titration was done (after incubation) with 0.01 N NaOH using methyl red as indicator till faint yellow colour end point. The TVB-N was calculated from the equation.

3. Bacteriological examination (APHA, 1992)

Preparation of fish homogenate

Ten grams from each sample were aseptically placed in a sterile blender with 90 ml of sterile peptone water and homogenized for two minutes, then, serial dilutions were prepared in sterile peptone water 2%, then, subjected to the following examinations:

a. Total bacterial count

The total bacterial count per cm^2 /g was done by using the plate count agar in duplicated plates and incubated at 30 ° C for 48 hours.

b. Anaerobic bacterial count

The plate media [reinforced Clostridium media (RCM)] were streaked with 0.1 ml of the first or second dilution, then, incubated anaerobically at 37 ° C for 48 hours.

c. *Staphylococcus aureus* count

The *S. aureus* was enumerated using Barid Parker media and incubated at 37 ° C for 24-48 hours.

d. Enterobacteriaceae count

The drop technique was applied using violet red bile glucose agar. Plates were incubated at 37 ° C for 24-48 hours. All purple colonies were counted.

e. Coliforms count [most probable number (MPN)]

Using the three tube methods of MacConky broth, tubes showing acid and gas production were considered positive. The MPN was estimated (MPN tables).

RESULTS AND DISCUSSION

1. Physical examination

Estimation of the organoleptic quality of the examined samples was illustrated in Table 1. The texture of muscles varied from firm to tender. The variation between the samples of fesiekh and salted sardine referred to the difference in the manufacture. The normal colour of the flesh was red (60% in fesiekh and 66.7% in salted sardine). The abnormal colour of flesh was greyish-yellow. This indicated that

the samples were salted for a long period and the greyish-yellow colour indicated fat oxidation. All the samples had salty odour and taste. Nearly similar results were recorded by Gehan (1996).

2. Chemical examination

The pH values of fesiekh and salted sardine were (7 and 6.9) as recorded in Table 2 which exceeded the permissible limit (6-6.5) as estimated by EOSQC (1996). The obtained results supported those recorded by Ahmed (1976).

The moisture % given in Table 2 revealed that the mean % of fesiekh and salted sardine were 49.5% and 50.8% within the permissible limit (50-55%) given by EOSQC (1996). The moisture of salted sardine was higher than the results obtained by Ahmed (1976), Morshdy (1980) and Gehan (1996). This difference may be due to the seasonal impact on fish composition or due to differences in manner of salting or both.

The values of NaCl% for fesiekh and salted sardine were 23% and 25% as recorded in Table 2. These values exceeded the permissible limit (15-22%) as given by EOSQC (1996).

The maximum values of histamine content of fesiekh and salted sardine were 35 and 30 mg/100g of sample, respectively, as given in Table 2. Such results indicated that histamine content in all samples exceeded the permissible limit (20 mg/100g of sample) given by EOSQC (1996). The high level of histamine in the investigated samples could be attributed to the bacterial decarboxylase activity due to poor quality of raw fish material, mishandling or other causes during their shelf life. Such data agreed with Rodriguez-Jerez *et al.* (1994).

From the results recorded in Table 2, the mean values of total volatile base nitrogen (TVB-N) for fesiekh and salted sardine were 39.5 and 32.2 mg/100g, respectively. The permissible limit of TVB-N was not recommended by EOSQC (1996), but the obtained results exceeded the permissible limits of fresh fish (30 mg/ 100g) as recommended by EOSQC (2003)

3. Bacteriological examination

From the results obtained in Table 3, the mean values of aerobic plate count (APC) in fesiekh and salted sardine were 3.7×10^5 and 1.1×10^5 cell/g. Nearly similar results were obtained by Ahmed (1976) and Rodriguez-Jerez *et al.* (1994).

The mean values of anaerobic bacterial count for fesiekh and salted sardine were 3.1×10^4 and 1.7×10^3 cell/g, respectively, as shown in Table 3. Nearly similar results were obtained by Elias (1968), and these might be assigned to the same storage-conditions after processing. These limits exceeded the permissible limit (10^2 cell/g) as recommended by EOSQC (1996)

The high *S. aureus* count was due to excessive contamination and handling during the processing. The mean *S. aureus* counts were 2.2×10^4 and 1.5×10^3 cell/g for fesiekh and salted sardine. Similar findings were recorded by Rashad (1986). *S. aureus* count was significantly correlated to anaerobic count and histamine content in the salted fish samples. These limits exceeded the permissible limit (10^2 cell/g) as recommended by EOSQC (1996)

The mean values of Enterobacteriaceae of fesiekh and salted sardine were 7.4×10^2 and 1.6×10^2 cell/g, respectively (Table 3). The relatively low count of Enterobacteriaceae may be attributed to the sensitivity of this family to high salt concentration, which agrees with the results reported by Gibsons and Roberts (1986).

The results of Coliforms count (MPN) recorded in Table 3 indicated that the mean coliforms count in fesiekh and salted sardine were 34.33 and 9.47 which exceeded the permissible limit as given in EOSQC (1996). These agree with the results obtained by De Man (1975).

Finally, to obtain high quality of salted fish, the following recommendations should be taken:

1. Minimize the contamination of raw material.
2. The salting process must be done under complete hygienic conditions (handling, processing).
3. Salting of fresh fish must be done without delay to inhibit bacterial growth and to control the histamine level in the final product.

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Table 1. Physical examination of the collected salted fishes (n=15).

Types of salted fish		Texture of muscles		Colour of flesh		Odour	Taste
		F	T	N	Ab	S	S
Fesiekh	No.	6	9	9	6	15	15
	%	40	60	60	40	100	100
Salted sardine	No.	6	9	10	5	15	15
	%	40	60	66.7	33.3	100	100

n= number of the examined samples
N= normal

Ab= abnormal

F= firm T= tender
S= salty

Table 2. Mean values of chemical analysis of muscles of examined salted fish (n=15).

Types of salted fish	pH value			Moisture %			NaCl %			Histamine content (mg/100g)			TVB-N (mg/100g)		
	Min.	Max.	Mean $\pm$ SE	Min.	Max.	Mean $\pm$ SE	Min.	Max.	Mean $\pm$ SE	Min.	Max.	Mean $\pm$ SE	Min.	Max.	Mean $\pm$ SE
Fesiekh	6	7	6.6 $\pm$ 0.1	45	55	49.5 $\pm$ 0.8	12	23	19.1 $\pm$ 0.9	10	35	23.3 $\pm$ 2.3	25	45	39.5 $\pm$ 1.3
Salted sardine	5.9	6.9	6.5 $\pm$ 0.1	47	54	50.8 $\pm$ 0.6	11	25	18.5 $\pm$ 1.2	15	30	22.1 $\pm$ 1.4	22	40	32.2 $\pm$ 1.5

n= number of the examined samples

Table 3. Bacterial count of muscles of examined salted fish (n=15).

Types of salted fish		Aerobic plate	Anaerobic bacteria	<i>S. aureus</i>	Enterobacteriaceae	Coliforms
Fesiekh	Min.	2.5×10^4	2.0×10^2	9.2×10^2	2.8×10^2	6.0
	Max.	9.3×10^5	8.0×10^4	8.2×10^4	1.2×10^3	85.0
	Mean ±SE	3.7×10^5 ± 8.4×10^4	3.1×10^4 ± 6.1×10^3	2.2×10^4 ± 6.1×10^3	7.4×10^2 ± 7.4×10	34.33 ± 7.13
Salted sardine	Min.	1.7×10^4	1.8×10^2	1.3×10^2	1.0×10^2	1.0
	Max.	4.7×10^5	6.1×10^3	6.2×10^3	3.3×10^2	22.0
	Mean ±SE	1.1×10^5 ± 3.4×10^4	1.7×10^3 ± 5.1×10^2	1.5×10^3 ± 4.9×10^2	1.6×10^2 ± 1.8×10	9.47 ± 1.74

n= number of the examined samples

REFERENCES

1. Ahmed, H. Y. 1976. Studies on the sanitary improvement of locally manufactured salted fish. Thesis, Ph. D. Assiut University.
2. APHA, 1992. Compendium of methods for the microbiological examination of foods 3rd ed., American Public Health Association, Washington, D.C.
3. Association of Official Analytical Chemists (AOAC). 1990. Official methods of analysis, 15th edition, USA.
4. Borgstrom, G. 1965. Fish as food. Volume III, processing part I. Academic Press Inc. (London) Ltd.
5. De Man, J. C. 1975. The probability of most probable number. Eur. J. Appl. Microbiol., 1: 67.
6. Elias, A. N. 1968. Studies on the microorganisms in salted mullet fish "fesiekh". Thesis, M.D. Fac. Agric., Cairo University.
7. EOSQC, 1996. Standard specification No. 1725.
8. EOSQC, 2003. Standard specification No. 889, part 1.
9. Gehan, M. A. K. 1996. Health hazard due to marketed salted fishes. Thesis, M. V. Sc. Fac. Vet. Med., Cairo University.
10. Gibson, A. M. and T. A. Roberts. 1986. The effect of pH, water activity, sodium nitrite and storage temperature on the growth of enteropathogenic *Escherichia coli* and *salmonellae* in laboratory medium. Int. J. Food. Mic., 3: 183.
11. Morshdy, A. 1980. Studies on the sanitary condition of salted fishes marketed in Sharkia. Thesis, M. D., Zagazig University.
12. Rashad, F. M. 1986. Bacteriological and chemical studies on salted mullet fish (fesiekh). A traditional fermented fish product in Egypt. Thesis, Ph.D., Cairo University.
13. Reilly, A. and R. G. Santos. 1985. Spoilage of tropical fish and fish product development. FAO fish. Rep. No. 317. Supp. 474.
14. Rodriguez-Jerez, J. J. M. T. Mora-Ventura E. I. Lopez-Sabatter and M. Hernandez-Herrero. 1994. Histidine, lysine, ornithin decarboxylase bacteria in Spanish salted semi preserved Anchovies. J. Food Prot., 57 (9): 784;
15. Santosa F. and P. Quantick. 1991. Use of food preservatives in salted dried fish. FAO fisheries report No. 470 sup. 218.
16. Varnam, A. H. 1990. Food-borne pathogens. 4th ed. Ch. 4, 5, 7 and 24. Wolf Publishing Ltd.
17. WHO 1999. food safety issues associated with products from aquaculture. Report of a joint. World Health Organ. Tech. rep., 883, i-vii: 1-55.

المخاطر الصحية المصاحبة للأسماك المملحة في السوق المصري

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أجريت هذه الدراسة على عدد ٣٠ عينة عشوائية من الأسماك المملحة (١٥ عينة فسيخ و ١٥ عينة سردين مملح)، تم تجميعها من عدة سوبر ماركت مختلفة في محافظتى القاهرة و الجيزة وذلك لاستبيان الحالة الصحية لهذه الأسماك وتأثيرها على صحة المستهلك. وقد خضعت العينات للفحوص الظاهرية، الكيميائية، البكتريولوجية وأظهرت النتائج ما يلى: العينات مقبولة ظاهريا ولم يظهر عليها علامات فساد.

بالفحص الكيميائى وجد ان الحد الاقصى لنسبة الاس الايدروجينى هو (٧ و ٦,٩) لعينات الفسيخ و السردين المملح على التوالى وانها أعلى من الحدود المسموح بها طبقا للمواصفة القياسية المصرية لسنة ١٩٩٦.

كان متوسط نسبة الرطوبة ٤٩,٥% و ٥٠,٨% للفسيخ و السردين المملح على التوالى وانها أعلى من الحدود المسموح بها طبقا للمواصفة القياسية المصرية لسنة ١٩٩٦. بالإضافة إلى ذلك كان الحد الاقصى لنسبة ملح الطعام ٢٣% و ٢٥% للفسيخ و السردين المملح على التوالى وللهمستامين والنيتروجين الكلى المتصاعد كانت النسبة (٣٠ و ٣٥% مجم / ١٠٠ جم) و (٤٥ و ٤٠ مجم / ١٠٠ جم) للفسيخ و السردين المملح على التوالى.

وجد ان قيم ملح الطعام والهمستامين كانت أعلى من الحدود المسموح بها طبقا للمواصفة القياسية المصرية لسنة ١٩٩٦. وكانت قيم النيتروجين الكلى المتصاعد أعلى من الحدود المسموح بها للأسماك الطازجة (٣٠ مجم/ ١٠٠ جم) طبقا للمواصفة القياسية المصرية لسنة ٢٠٠٣.

أوضحت الفحوص البكتريولوجية ان متوسط العد البكتيرى الكلى للميكروبات اللاهوائية، الميكروب العنقودى الذهبى و الميكروبات المعوية والقولونية هو (١٠×٣,١^٤، ١٠×١,٧^٣ خلية /جم) (١٠×٢,٢^٤، ١٠×١,٥^٣ خلية /جم)، (١٠×٧,٤^٢، ١٠×١,٦^٢ خلية /جم) و (٣٤,٣٣، ٩,٤٧) لعينات الفسيخ و السردين المملح على التوالى. وكانت القيم أعلى من الحدود المسموح بها طبقا للمواصفة القياسية المصرية لسنة ١٩٩٦. والخلاصة أن عملية التملح يجب أن تتم تحت ظروف صحية كاملة و ذلك حفاظا على صحة المستهلك.