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## MICROBIOLOGICAL QUALITY OF READY TO EAT FRIED FISH (With Two Tables)

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الحالة الميكروبيولوجية للسك المقلي المعد للإستهلاك الآدمي

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تم جمع خمس وعشرون عينة من السمك المقلي المعد للإستهلاك الآدمي من محلات بيع الأسماك بأسبوط . حيث تم الفحص الميكروبيولوجي لهذه العينات بالطرق القياسية بهدف تعيين العدد الكلى للميكروبات ، العدد الكلى للميكروبات المعوية ، عدد الكورس العنقودي الذهبى وعدد الميكروبات السبحية المعوية . بين الفحص الميكروبيولوجي أن العدد الكلى للميكروبات يتراوح ما بين  $10 \times 10^2$  إلى  $118 \times 10^9$  ميكروب فى الجرام أما العدد الكلى للميكروبات المعوية ، الكورس العنقودي الذهبى وكذا الميكروبات السبحية المعوية فكان يتراوح ما بين 10 إلى  $10 \times 10^2$  (  $10 \times 10^2$  إلى  $10 \times 10^2$  ،  $10 \times 10^2$  إلى  $10 \times 10^2$  ) بمتوسطات  $10 \times 10^2$  ،  $10 \times 10^2$  ،  $10 \times 10^2$  ،  $10 \times 10^2$  ،  $10 \times 10^2$  ميكروب فى الجرام على التوالي . كما تم عزل ميكروبات الايشاريشيا كولاي ، العنقودي الذهبى ، الكلوستريديم بيرفيرنجز والاستربت فيكاليبس حيث كان 12% ، 20% ، 8% ، 36% من العينات التى تم فحصها موجبة لهذه الميكروبات على التوالي . كما دلت النتائج على عدم وجود ميكروبى السالمونيلا والشجيلا فى جميع العينات التى تم فحصها ولقد تم مناقشة النتائج وأهمية الميكروبات المرضية التى تم عزلها للحفاظ على صحة المستهلك .

### SUMMARY

A total of 25 ready to eat fried fish samples were aseptically collected from various food restaurants in Assiut City. These samples were examined bacteriologically by standard procedures for determination of aerobic plate count (APC), and counts of enterobacteriaceae, Staphylococcus aureus and enterococci. The APC ranged from  $16 \times 10^2$  to  $188 \times 10^2$  colony forming unit (CFU)/gm. The counts of enterobacteriaceae, Staph aureus and enterococci ranged from 10 to  $85 \times 10^2$ ,  $1 \times 10^2$  to  $15 \times 10^2$  and  $3 \times 10^2$  to  $175 \times 10^2$  with a mean values of  $4.75 \times 10^3$ ,  $1.84 \times 10^2$  and  $20.1 \times 10^2$  CFU/gm respectively. E.coli, Staph aureus, Clostridium perfringens and Strept faecalis were isolated from the examined samples where 12%, 20%, 8% and 36% of the samples were positive for such organisms respectively. Salmonella and Shigella failed to be recovered from the examined samples. The results of this investigation indicate that foodborne pathogens present in fried fish constitutes a public health hazard.

Y. HEFNAWY

## INTRODUCTION

Fishes are regarded generally as being more perishable than other high protein foods. Safety in seafood products with reference to bacterial contamination is usually concerned with the possibility of food infection and intoxication. However, food infection and intoxication in seafood products, as other foods, except in instances of scombroid or histamine poisoning, normally is the result of mishandling during and after preparation (NICKELSON and FINNER, 1984).

Literature concerning the microbiology of ready to eat fish is scarce and informative except a report by ELDALY and IBRAHIM (1987) who examined 40 samples of grilled and fried fishes and found that the mean values of aerobic plate count, enterobacteriaceae count, staphylococci count, MPN of coliforms and MPN of *E. coli* for grilled fish samples were  $2 \times 10^6$ ,  $6 \times 10^2$ ,  $6 \times 10^3$ ,  $2 \times 10^4$  and  $2 \times 10^2$  organisms/gm respectively, while the corresponding values for fried fish samples were  $9 \times 10^4$ ,  $2 \times 10^2$ ,  $4 \times 10^2$ ,  $6 \times 10^2$  and 48 organisms/gm respectively. *Salmonella* and *Shigella* organisms failed to be recovered from both types of examined fish samples.

For cooked ready-to-eat fishery products, microbiological guidelines for the finished products should include APC, *E. coli* and *Staph aureus*. These parameters are useful to evaluate faulty processing and/or handling practices such as inadequate heating, cross contamination with raw products, contamination from workers and inadequate refrigeration which may create hazard (SWARTZENTRUBER, et al. 1980, National Academy of Sciences, 1985).

However, the degree of cooking employed further affects the number and types of organisms. Moreover, organisms normally associated with raw fish are not heat-resistant and are destroyed during heat process. Heat resistant types of organisms may be introduced with spices or other ingredients (NICKELSON and FINNE, 1984).

Furthermore, prepared seafood products can vary greatly in numbers and types of microorganisms because of the addition of nonmarine ingredients as flour, seasonings, nonfat dry milk powder and dried eggs therefore the source of contamination may be the ingredients incorporated or the food handlers (KHAN and McCASKEY, 1973; NICKELSON and FINNE, 1984).

No uniform guidelines can be used to interpret the results of bacteriological testing of seafood products where each product must be evaluated on the basis of its own characteristics, and guidelines must be established to practical good manufacturing procedures (NICKELSON and FINNE, 1984).

The purpose of this investigation was to determine the microbiological quality of ready to eat fish and the possible public health hazard associated with its consumption.

## MICROB. QUALITY OF FRIED FISH

**MATERIAL and METHODS**

25 samples of ready to eat fried fishes were collected at random from restaurants selling fish in Assiut City. The samples were packaged in sterile plastic bags and brought to the laboratory for microbiological examination.

A 25 gm portions of each sample were blended with 225 ml of 0.1% sterile peptone water in waring blender at high speed for one minute. Serial dilutions from  $10^1$  to  $10^6$  were made and the bacteriological examinations were done in accordance with the procedures described by BAILEY and SCOTT (1974), CRUICKSHANK, *et al.* (1975) and SPECK (1984).

All bacteriological media used were of Oxoid unless otherwise specified. Standard plate count agar was used for the aerobic plate count (APC) and plates were incubated at 35°C for 48 hours. Violet red bile glucose agar (VR BGA) was used for total enterobacteriaceae count (ICMSF, 1978).

For *Staphylococcus aureus*, appropriate dilutions were streaked on Baird-Parker agar plates (BAIRD-PARKER, 1962) and incubated at 35°C for 48 hours. Selected black colonies were tested for coagulase activity. Enterococcus Selective Differential (ESD) medium (EFTHYMIOU and JOSEPH, 1974) was used for enumeration of enterococci and all magenta colonies were counted as *Strept faecalis*.

Isolation of *Salmonella*, *Shigella* and *E.coli* was carried out according to the procedures described by ICMSF (1978) and SPECK (1984), whereas the recommended methods outlined by BEERNES, *et al.* (1980) was followed for isolation of *C.perfringens*.

**RESULTS**

Results of enumeration as well as isolation of different organisms from ready to eat fish are shown in Table (1) and (2).

Table (1)  
Summerized results of viable counts/gm ready to eat fish

	Minimum	Maximum	Mean
Aerobic plate count	$16 \times 10^3$	$118 \times 10^5$	$22.2 \times 10^2$
Enterobacteriaceae	10	$85 \times 10^3$	$4.75 \times 10^3$
Staph aureus	$1 \times 10^2$	$15 \times 10^2$	$1.84 \times 10^2$
Enterococci	$3 \times 10^2$	$175 \times 10^2$	$20.1 \times 10^2$

Y. HEFNAWY

Table (2)  
Incidence of isolated organisms from examined ready to eat fish samples

Organisms	No. of samples examined	No. positive	Percent positive
E.coli (faecal type)	25	3	12
Staph aureus	25	5	20
C.perfringens	25	2	8
Strept faecalis	25	9	36
Salmonella	25	0	0
Shigella	25	0	0

### DISCUSSION

The flesh of healthy fish is considered bacteriologically sterile. Fishes may become contaminated during subsequent handling (SHEWAN, 1971). However, coliforms, staphylococci and other mesophilic organisms may be introduced during processing, but there is no evidence that they will multiply unless there is inadequate temperature control (ICMSF, 1980).

Table (1) revealed that the aerobic plate count of the examined fried fish samples ranged from  $16 \times 10^3$  to  $118 \times 10^5$  with a mean value of  $22.2 \times 10^5$  CFU/gm, while the mean enterobacteriaceae count was  $4.75 \times 10^3$  with a minimum of 10 and a maximum of  $85 \times 10^3$  CFU/gm of examined samples. Our results seemed to be some what higher than that obtained by ELDALY and IBRAHIM (1987) who recorded an average of  $9 \times 10^4$  and  $2 \times 10^2$  CFU/gm for APC and enterobacteriaceae count respectively.

Regarding staphylococci and enterococci counts, they varied from  $1 \times 10^2$  to  $15 \times 10^2$  and  $3 \times 10^2$  to  $17 \times 10^2$  with a mean values of  $1.84 \times 10^2$  and  $20.1 \times 10^2$  CFU/gm respectively.

However, ADESIYUN (1983) reported that the mean staphylococcal count of fried fish in Nigeria was  $2.5 \times 10^6$ /gm which is higher than the obtained results, but ELDALY and IBRAHIM (1987) recored an average of  $4 \times 10^2$ /gm fried fish samples.

SURKIEWICZ *et al.* (1968) found that fried breaded fish had APC values of less than  $2.5 \times 10^4$ /gm, MPN of coliform had less than 10/gm, and no more than 10% of the units were positive for E. coli or staphylococci .

Seafoods are susceptible to all of the common food poisoning organisms. Staph aureus, Salmonella, Shigella and C. perfringens have occasionally been responsible for foodborne disease outbreaks from consumption of fishery products (NICKELSON and FINNE, 1984).

## MICROB. QUALITY OF FRIED FISH

The summarized results presented in Table (2) pointed out that *E. coli*, *C. perfringens*, *Staph aureus* and *Strept faecalis* were recovered from 12%, 8%, 20% and 36% of the examined samples respectively, while *Salmonella* and *Shigella* failed to be detected in this investigation.

Safety in sea food products with reference to bacterial contamination is usually concerned with the possibility of foodborne infection and intoxication. The present study proved that ready to the fried fish is considered as a public health hazard due to post cooking contamination and the results agree with the finding of NICKELSON and FINNE (1984) that food poisoning in sea food products is the result of mishandling during and after preparation.

## REFERENCES

- Adesiyun, A.A. (1983): Prevalence and characteristics of staphylococci from five ready to eat products in Nigeria. *Nigerian Food J.* Cited by Adesiyun (1984).
- Adesiyun, A.A. (1984): Enterotoxigenicity of *Staphylococcus aureus* strains isolated from Nigerian ready to eat foods. *J. Food Prot.* 47 : 438-440.
- Bailey, W.R. and Scott, E.G. (1974): *Diagnostic Microbiology. A text book for the isolation and identification of pathogenic microorganisms.* 4th Ed. The C.V. Mosby Company Saint Louis.
- Barid-Parker, A.C. (1962): An improved diagnostic medium for isolating coagulase positive staphylococci. *J. Appl. Bact.* 25:12.
- Beernes, H.; Romond, C., Lepage, C. and Crquelion, J. (1980): A direct method for the enumeration of *Clostridium perfringens* in foods and faeces. *World Congress foodborne infections and intoxication*, Berlin (West).
- Cruickshank, R.; Dugid, J.P.; Marmion, B.P. and Swain, R.H.A. (1975): *Medical Microbiology.* 12th Ed. Churchill Livingstone. Edinburg London and New York.
- Efthymiou, C.J. and Joseph, S.W. (1974): Development of a selective enterococcus medium based on manganese ion deficiency, sodiumazide and alkaline PH. *Appl. Microbiology* 28: 411-416.
- Eldaly, E. and Ibrahim, A. (1987): Sanitary condition of ready to eat fishes. *Alex. J. Vet. Sci.*, 3: 101-109.
- ICMSF (1978): *International Commission on Microbiological Specifications for Foods: Microorganisms in Food I. Their significance and enumeration* 2nd Ed. Univ. of Toronto Press, Toronto and Buffalo, Canada.
- ICMSF (1980): *International Commission on Microbiological Specifications for Foods: Microbial Ecology of Foods. II Food Commodities*, Academic Press, New York.
- Khan, N.A. and McCaskey, T.A. (1973): Incidence of *Salmonellae* in commercially prepared sandwiches for the vending trade. *J. Milk Food Technol.* 36: 315-316.
- National Academy of Sciences (1985): *An Evaluation of the Role of Microbiological Criteria for Foods and Food Ingredients.* National Academy Press, Washington, D.C.

## Y. HEFNAWY

- Nickelson, R. and Finne, G. (1984): Fish, crustaceans and precooked seafoods. In Compendium of Methods for the Microbiological Examination of Foods. Speck, M.L. (ed). 2nd Ed. American Public Health Association, Washington, D.C., P. 573-589.
- Shewan, J.M. (1971): The microbiology of fish and fishery products. A progress report. J. Appl. Bact., 34: 299-315.
- Speck, M.L. (1984): Compendium of Methods for the Microbiology Examination of Foods. 2nd Ed. American Public Health Association, Washington D.C.
- Surkiewicz, B.F.; Grooms, R.J. and Shelton, L.R. (1968): Bacteriological survey of the frozen prepared foods industry. IV. Frozen breaded fish. Appl. Microbiol. 16: 147-150.
- Swartzentruber, A.; Schwab, A.H.; Duran, A.P.; Wentz, B.A. and Read, Jr. R.B. (1980): Microbiological quality of frozen shrimp and lobster tail in the retail market. Appl. Environ. Microbiology 40: 765-769.

## SUMMARY

The study was conducted to determine the microbiological quality of frozen breaded fish products available in the retail market. A total of 100 samples were collected from various retail outlets in Assiut, Egypt. The samples were analyzed for total viable count (TVC), coliforms, and salmonella. The results showed that the TVC of the samples ranged from  $10^3$  to  $10^7$  CFU/g. Coliforms were detected in 80% of the samples, and salmonella was found in 10% of the samples. The study also investigated the effect of freezing and storage on the microbiological quality of the products. It was found that freezing and storage had a significant effect on the TVC and coliform count of the samples. The results of the study indicate that the microbiological quality of frozen breaded fish products is generally poor and that there is a need for improved control measures to ensure the safety and quality of these products.

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