Effect of heat treatment on microbial contamination in marketed fish

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Abstract:

A total of 90 random samples of *Oreochromis niloticus (O. niloticus)* were collected from different markets and restaurants in daqahlya province to study the effect of heat treatment on microbial contamination. The bacteriological examination was practiced through examination of aerobic plate count, total staphylococcal count and total Enterobacteriaceae count in raw and treated samples. Results revealed that mean values of aerobic plate count are $3.5x10^5 \pm 2.15x10^5$, $3.3x10^3 \pm 0.905x10^3$ and $1.632x10^4 \pm 0.2899x10^4$. Mean values of total staphylococcal count are $2.15x10^5 \pm 1.29x10^5$, $1.8x10^4 \pm .2345x10^4$ and $3.7x10^4 \pm 0.442x10^4$. Mean values of total Enterobacteriaceae count are $2.05x10^5 \pm 1.23x10^5$, $2.64x10^4 \pm 0.6153x10^4$ and $5.28x10^4 \pm 0.8266x10^4$. In raw, fried and grilled O. niloticus respectively. It is very important to study hazards of improper cooking and treatment of fish on human health.

Keywords: staphylococcus, enterobacteriaceae, food poisoning.

1. Introduction:

Fish and fish products have great importance in human nutrition all over the world. In 1996, the catch was forming about 120 million tons in which 26% originated from aquaculture (1). Soil, water and fish handlers are considered the main sources of fish contamination (2). Staphylococcus, salmonella and E. coli are considered very important bacteria that responsible for food poisoning (3). Fish cooking for short time at very high temperature kills all of the vegetative bacteria except those that from heat resistant spores, however, when the conditions become suitable, the growth rate of germinating spores would be high (4). Consumption of poor-quality food which is contaminated by foodborne pathogens considered main cause of food poisoning (5).

2. Material and methods:

2.1. Sample collection:

A total of 90 samples of O. niloticus collected randomly from different restaurants around daqahlya province to be examined bacteriologically for aerobic plate count, total staphylococcal count and total Enterobacteriaceae count.

2.2.Sample preparation (6):

Exactly 25 grams of examined fish flesh added to 225 ml of 0.1% sterile buffered peptone water in a blender at 2000 rpm for 1-2 minutes to provide a homogenate of 1/10 dilution. One ml of the original dilution in sterile pipette was transferred to another sterile test tube containing 9ml of sterile peptone water (0.1%) then mixed well to form the next dilution, from which further decimal serial dilutions were prepared. The prepared dilutions were subjected to the following examinations:

2.3.Aerobic plate count (7):

Standard plate count agar was used and technique applied as following:

1 ml of each dilution was inoculated in 2 sterile Petri dishes having Standard plate count agar. Then inoculated plates were incubated in inverted position in incubator at 37°/24 hrs. The bacterial colonies on selected plates were counted.

2.4.Total staphylococcal count (8):

Baired-Parker agar was used and technique applied by inoculation of 0.1 ml of each dilution and surface spread on media surface then plated were incubated in inverted position in incubator at 37°/48 hrs. the bacterial colonies on selected plates were counted.

2.5.Total enterobacteriaceae count (9):

Violet Red Bile Glucose Agar used and technique applied by inoculation of 0.1 ml of each dilution and surface spread on media surface then plated were incubated in inverted position in incubator at 37o/24 hrs. the bacterial colonies on selected plates were counted.

3. Results:

Results recorded in the following table show that APC values range from $1x10^4$ to $6.9x10^5$ with a mean of $3.5x10^5 \pm 2.15x10^5$, from $1.7x10^3$ to $6.3x10^3$ with a mean of $3.3x10^3 \pm 0.905x10^3$ and from $6.8x10^3$ to $2.48x10^4$ with a mean of $1.632x10^4 \pm 0.2899x10^4$. Then total staphylococci count ranges from $1x10^4$ to $4.2x10^5$ with a mean of $2.15x10^5 \pm 1.29x10^5$, from $1.2x10^4$ to $2.5x10^4$ with a mean of $1.8x10^4 + .2345x10^4$ and from $2.7x10^4$ to $5.2x10^4$ with a mean of $3.7x10^4 + 0.442x10^4$. Also, total Enterobacteriaceae count ranges from $1x10^4$ to $4x10^5$ with a mean of $2.05x10^5 \pm 1.23x10^5$, from $8x10^3$ to $4.1x10^4$ with a mean of $2.64x10^4 + 0.6153x10^4$ and from $3.2x10^4$ to $7.8x10^4$ with a mean of $5.28x10^4 + 0.8266x10^4$ in raw, fried and grilled O. niloticus respectively.

Mean values of examined O. niloticus raw, fried and grilled samples:

Category	APC	Staphylococci count	Entero. Count
	Min Max Mean±SE	Min Max Mean±SE	Min Max Mean±SE
Raw O. niloticus	$1x10^4$ $6.9x10^5$ $3.5x10^5 \pm 2.15x10^5$	$1x10^4$ $4.2x10^5$ $2.15x10^5 \pm 1.29x10^5$	$1x10^4$ $4x10^5$ $2.05x10^5 \pm 1.23x10^5$
Fried O. niloticus	$1.7x10^3$ $6.3x10^3$ $3.3x10^3 \pm 0.905x10^3$	$1.2x10^4$ $2.5x10^4$ $1.8x10^4 \pm .2345x10^4$	$8x10^3$ $4.1x10^4$ $2.64x10^4 \pm 0.6153x10^4$
Grilled O. niloticus	$6.8x10^3$ $2.48x10^4$ $1.632x10^4 \pm 0.2899x10^4$	$2.7x10^4$ $5.2x10^4$ $3.7x10^4 \pm 0.442x10^4$	$3.2x10^4$ $7.8x10^4$ $5.28x10^4 \pm 0.8266x10^4$

4. Discussion:

Saad said that the aerobic plate count of food article is considered not only the representative parameter of its safety for human consumption yet, but also of importance in assessment of the hygienic conditions under which the food has been handled and processed (10). The data recorded in the previous table revealed that the mean value of aerobic plate count for raw, fried and O.

niloticus samples were $3.5x10^5 \pm 2.15x10^5$, $3.3x10^3 \pm 0.905x10^3$ and $1.632x10^4 \pm 0.2899x10^4$ respectively. These results agree with Soliman etal. and Surkiewicz who recorded a mean value of APC of grilled fish as log 3.90/g. (11, 12) While higher figure recorded by El-daly and Ibrahim who found that the APC was $7.2X10^6$/g, (13). The maximum permissible level of APC for good fish recorded by EOS should not be more than 5X105/g. (14). The mean value of Staphylococci counts for O. niloticus as shown in the previous table in raw, fried and grilled samples are $2.15x10^5 \pm 1.29x10^5$,$1.8x10^4 \pm .2345x10^4$ and $3.7x10^4 \pm 0.442x10^4$ respectively. These results are higher than those recorded by Abd El-Rahman et al. who found that the mean value of staphylococcal count was $3.8X10^3$ (15). Staphylococci spp. were part of natural flora in animal, so they are found in different raw foods. Staphylococcus food borne illness is mainly due to contamination of fish while handling in a fishing vessel or in a processing plant (16) and owing to food handlers mainly those suffering from infected wounds or sores on their hands or coughing and sneezing near food (17). The mean values of enterobacteriaceae count for O. niloticus as recorded in the previous table are $2.05x10^5 \pm 1.23x10^5$, $2.64x10^4 \pm 0.6153x10^4$ and $5.28x10^4 \pm 0.8266x10^4$ in raw, fried and grilled samples respectively. These results were lower than those recorded by Abd El-Rahman et al. who recorded $8.1X10^4$/g. and higher than values recorded by Hefnawy who found mean value of $20.1X10^2$/g (18). Enterobacteriaceae count also used as a main parameter in detecting the organisms which recontaminate the products after processing (19). This study proved that ready to eat fried and grilled fish are considered as a health hazard and bacterial counts are due to the post-cooking contamination through handling operation which fish were subjected during production (20,21). So, illness can be prevented by controlling the initial bacterial no., destroying bacteria through good cooking with high temp. and avoiding post-cooking contamination through controlling the handlers hygiene with health certificates and periodical medical examination and carriers of human pathogens must not be employed.

5. Conclusion:

Acc. to this study results, the contamination of heat-treated fish may be owing to unsatisfactory hygienic measures in fish handling and processing. So, it is important to control stages of handling, from time of fishing till consumption as they affect fish quality. The quality Assurance success depends on the selection, cleaning, disinfection and personal hygiene.

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الملخص العربي

تأثير المعاملة الحرارية للأسماك علي وجود الميكروبات

عادل إبراهيم العتباني - محمد عبدالله حسين – إيمان إبراهيم الدسوقي السيد
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تم تجميع عدد 90 عينة من سمك البلطي من أسواق و مطاعم مختلفة بواقع 30 عينة من البلطي النيئ ، 30 عينة من البلطي المقلي و 30 عينة من البلطي المشوي. و تم إجراء الفحص البكتريولوجي في اجزاء العد الكلي للبكتريا، العدد الكلي للميكروبات العنقودية و العد الكلي للميكروبات المعوية. و قد أوضحت النتائج ان متوسط العد الكلي للبكتريا الهوائية $3.5\times10^5\pm2.15\times10^5$ ، $3.3\times10^3\pm0.905\times10^3$ و $1.632\times10^4\pm0.2899\times10^4$. و أن متوسط العد الكلي للمكورات العنقودية $2.15\times10^5\pm1.29\times10^5$ في ، $1.8\times10^4\pm2345.\times10^4$ و $3.7\times10^4\pm0.442\times10^4$. و أن العد الكلي للبكتريا المعوية $2.05\times10^5\pm1.23\times10^5$ ، $2.64\times10^4\pm0.6153\times10^4$ و $5.28\times10^4\pm0.8266\times10^4$ في البلطي النيئ و المقلي و المشوي علي التوالي. وأكدت هذه الدراسة تأثير المعاملة الحرارية علي عدد الميكروبات بعينات الأسماك التي تم فحصها و أيضا تأثير المعاملة الحرارية بالقلي أنها تقلل عدد الميكروبات في العينات عن تلك التي تمت معاملتها بالشواء. هذا و قد تم مناقشة تأثير هذه البكتريا علي الصحة العامة و طرق تحسين جودة هذه الأسماك.