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Boulti (*Tilapia nilotica* Linn.) fish paste 2. Bacteriological studies of the raw fish and the produced paste

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With 1 table

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Although the flesh and body fluids of newly healthy fish are generally considered to be sterile, it is well known that the slime, gills and intestines carry heavy bacterial loads. Soil, air and water, fresh or salt represents the main sources for the aerobic fish flora (*Shewan,* 1949). The importance of environment on the flora is evidenced by the fact that fish caught in polluted waters may carry human pathogens, particularly food-poisoning types (*Tsuchiya* et al., 1959). This is especially important in river and lake fisheries. Thus cases of salmonellosis, resulting from the ingestion of fish, have been recorded from the Nile Valley, South America and the great lakes in Central Africa (*Shewan,* 1962).

Boulti fish (*Tilapia nilotica* Linn.), used in the first part of this work to prepare fish paste, was examined bacteriologically. The produced paste was also subjected to the same methods to follow the effect of handling and preparation method on the microbial contamination of the product.

Materials and methods

Boulti fish (*Tilapia nilotica* Linn.) was caught from Naser's lake (Aswan) and transported to Cairo under refrigeration by the Egyptian General Organization for Food Stuffs. Samples of fish flesh before and after preparation of fish paste were immediately subjected to the bacteriological tests.

Sampling

Two samples, 20 g of each, were transferred to a sterilized waring blender. After the addition of 180 ml of sterilized phosphate buffer solution (0.013 M, pH 7.0), the mixture was blended for 5 minutes. Samples of the produced fish paste were tested immediately after preparation and at weekly intervals for a period extending to 5 weeks of storage at 2–4 °C in both aluminium tubes and polyethylene bags. About 1 g sample was used to make 1 : 10 dilutions in the sterilized buffer solution. Samples in all cases were shaked vigourously and tested for total viable bacterial counts. Total viable bacterial counts: Poured plate method using 1 ml inocula of diluted samples has been adopted to follow up the count possible to attain. In all cases two poured plates from each sample were made using plate count agar (Difco) as a medium. Incubation was carried out for duplicate plates at 37 °C (24 hrs) and for

the other duplicates at 22 °C (48 hrs). The main figure of count obtained within each duplicate was recorded to represent the total bacterial count/ml at the specific defined time. Calculations were carried out to change the results as log bacterial count/gram.

Results and discussion

Table 1 summarizes the results of total viable bacterial count test for raw fish flesh samples and the produced fish paste. Fish flesh tends to show total viable bacterial counts with a mean value of 10^9 cells per gram. The count at 37 °C was somewhat higher than the other plates incubated at 22 °C. The results support the idea that fish flesh during the filleting comes

Table 1. Total viable bacterial counts of Boulti *(Tilapia nilotica* linn.) fish flesh and fish paste.

Samples	Time in weeks	log bacterial counts/gram					
		Plates incubated at 22 °C			Plates incubated at 37 °C		
		A	B	Mean	A	B	Mean
Fish flesh	0	8.90	9.60	9.75	9.76	9.80	9.78
		9.20	9.80	9.50	9.98	9.60	9.79
a.t. paste[1])	0	6.80	5.90	6.35	7.40	7.80	7.60
		6.60	6.40	6.50	6.00	7.30	7.15
p.b. paste[2])	0	7.80	7.60	7.70	7.28	7.30	7.29
		7.72	7.40	7.65	7.40	7.60	7.50
a.t. paste	1	8.48	8.00	8.24	8.04	8.30	8.17
		7.20	7.30	7.25	7.47	7.30	7.39
p.b. paste	1	8.75	9.25	9.07	8.09	8.08	8.08
		8.61	9.00	8.85	8.36	8.84	8.67
a.t. paste	2	6.90	6.90	6.90	8.20	8.86	8.65
		6.58	6.48	6.53	7.86	8.34	8.16
p.b. paste	2	8.68	9.11	8.95	8.00	9.70	9.48
		8.30	8.48	8.40	8.51	8.76	8.65
a.t. paste	3	8.78	8.96	8.88	7.34	7.70	7.56
		7.76	8.64	8.40	6.78	7.00	6.90
p.b. paste	3	9.12	9.90	9.67	9.64	9.99	9.85
		9.12	9.12	9.12	9.56	9.98	9.36
a.t. paste	4	7.73	8.26	8.07	7.86	9.99	7.93
		8.18	8.86	8.64	8.54	8.11	8.38
p.b. paste	4	8.60	9.91	9.63	8.90	9.60	9.37
		9.76	10.83	10.58	9.61	10.20	9.99
a.t. paste	5	9.01	9.90	9.65	8.15	8.78	8.57
		9.00	9.99	9.74	7.30	8.18	7.93
p.b. paste	5	8.00	8.70	8.48	8.48	9.23	9.37
		8.60	9.00	8.85	9.00	9.70	9.48

[1]) Boulti fish paste packaged in alluminium tubes
[2]) Boulti fish paste packaged in polyethylene bags

in contact with a variety of surfaces, many of which are normally heavily contaminated. The filleting bench, the knife incision, however, introduce large numbers of bacteria, and these are considerably increased as a result of subsequent contact with the filleting board (*Georgala,* 1957).

Fish paste showed a total viable bacterial count of 10^8 cells per gram, after 2 weeks of storage at 2–4 °C, the count increased again to 10^9 cells per gram and became stable during the next three weeks. It was noticed that the count for fish paste packaged in polyethylene bags was higher than the count when packaged in aluminium tubes. Fish paste seems to be not a good growth medium for bacteria. *Shewan* (1949) reported that the slime, gills and intestines carry heavy bacterial loads. The figures recorded previously are of the order of 10^2 to 10^6/cm^2 of skin and from 10^3 to 10^8/ml of intestinal fluid (*Liston,* 1965). However, these highly bacterial loads represent the main source for contamination of the flesh and often the produced paste. According to *Silliker* (1963), high counts of this order at 20 °C in fresh fish are normally associated with undesirable organoleptic changes. He also indicated that it is not always safe to assume that a product with low counts at 35 or 37 °C is otherwise safe.

It is clear from this study that bacterial examination of the other ingredients added to the paste may disclose a source of contamination. Sampling before and after each step of paste production often verifies observed insanitation.

Summary

Total viable bacterial count reached 10^9 per gram of raw fish. It was decreased to 10^7 in fish paste and increased to 10^8-10^9 after storage at 2–4 °C for 5 weeks. It was observed that fish paste showed higher counts when preserved in polyethylene bags than in alimunium tubes.

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