



Aerobic spore formers in battered and breaded fish products.

Hemmat M. Ibrahim¹, Reham A. Amin¹, Nahla A. Shawky², Suzan, H. Sheir²

¹Department of Food Hygiene, Faculty of Veterinary Medicine, Benha University. ²Animal Health Research Institute, Shebin El-Koom Branch.

ABSTRACT

A total of 90 random samples of half cooked battered breaded fish products represented by fish pane, fish fingers and fish nuggets (30 of each) were collected from different supermarkets in Kalyoubia governorate. The samples were examined for sensory evaluation and detection of aerobic spore formers to assure their quality. The obtained results indicated that the mean sensory panel scores for color, adhesion, texture and overall acceptability were 2.96, 2.93, 2.88 and 2.92 for fish pane, 2.90, 3.13, 2.67 and 2.90 for fish fingers and 2.93, 3.16, 2.56 and 2.89 for fish nuggets, respectively. Mean count values of APC and aerobic spore former count (cfu/g) were $1.07 \times 10^4 \pm 0.35 \times 10^5$ and 2.084×10^3 for fish pane, $8.33 \times 10^4 \pm 1.04 \times 10^4$ and 6.54×10^2 for fish finger and $2.61 \times 10^5 \pm 1.73 \times 10^4$ and 2.44×10^3 for fish nuggets, respectively. The public health significance of the isolated bacteria was discussed.

Keywords: Battered and breaded fish products, Sensory evaluation, Aerobic spore former.

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1. INTRODUCTION

Fish and fish products are very important for human nutrition because they are rich of animal protein and other elements for the maintenance of healthy body (Andrew, 2001). The processes of battering and breading provide special functions in food products including improving the appearance of the products, increasing the texture, reducing the oil uptake during the frying process and increasing the shelf life of the coated products (Varela and Fiszman, 2011). Battered and breaded fish products can undergo undesirable changes during frozen storage time due to microbial contamination from various sources and rapid spoilage as a result of protein denaturation (Benjackul et al., 2005) and lipid oxidation (Richard., 2002) leading to loss of quality. Sensory evaluation was used to assess the degree of freshness based on organoleptic characteristics such as color, odor and texture of the product.

(Haqet al., 2013). Bacteriological examination is applied to evaluate the possible presence of microorganisms of public health significance and to give an impression about the hygienic quality of the fish. This includes temperature abuse and hygiene during handling and processing (Huss, 1995). Estimation of APC is used as an index in standards, guidelines and specifications and considered more useful to estimate spoilage and the remaining shelf life of fish and fishery products (Ólafsdóttir et al., 1997). Aerobic spore forming bacteria are important because the formation of spores by the bacterium allows it to be resistant to heat, freezing, chemicals, and other adverse environments that our food undergoes during processing and preparation. Although the vegetative cell is killed by these conditions, the spores can survive and need harsher conditions to be inactivated. (Cousin, 1989). Therefore, this work was planned out to study the quality of some battered and breaded fish products (fish pane, fish fingers and fish nuggets).

2. MATERIAL AND METHODS

2.1. Collection of samples

A total of 90 random samples of frozen half cooked fish panne, fish fingers and fish nuggets; (30 of each) were collected from different supermarkets in Kalyoubia governorate. Each sample was transferred, without delay, in an insulated ice box to the laboratory and then subjected to the following examinations.

2.2. Organoleptic examination

It was carried out by seven trained panelists team from the staff members of the Animal Health Research Institute, Shebin El-Koom Branch. The panelists scored for color, adhesion, texture and overall acceptability on 5-point hedonic scale according to Hale and Goodwin (1968).

2.3. Sample preparation (ICMSF, 1996)

Twenty five grams of the examined sample were aseptically transferred into sterile flask contain 225 ml of sterile peptone water (0.1%) and homogenized in a blender at 1400 rpm for 1-2 minutes to provide a homogenate of 1/10 dilution. One ml of the homogenate was transferred with sterile pipette to another sterile test tube containing 9 ml sterile buffered peptone water (0.1%) and mixed well to make the next dilution, from, which further decimal serial dilutions were prepared. The prepared serial dilutions were subjected to the following examination: 1. Determination of Aerobic Plate Count (ICMSF, 1996). 2. Determination of aerobic spore formers (Oxoid, 1990). 3. Identification of aerobic spore formers by microscopical

identification and biochemical identification

2.4. Statistical Analysis

The obtained results were statistically analyzed by application of Analysis of Variance (ANOVA) test according to Feldman et al. (2003).

3. RESULTS

The results achieved in table (2) revealed that the mean scores of color, adhesion, texture and over all acceptability were 6.76, 6.64, 6.58, 6.56, 6.85 for fish panne, 6.35, 6.26, 6.6, 6.30, 6.4 for fish fingers and 5.93, 6.1, 5.68, 6.17, 6.015 for fish nuggets, respectively. The results in table (3) indicated that the mean values of APC (cfu/g) were $1.07 \times 10^4 \pm 0.35 \times 10^5$ for fish panne, $8.33 \times 10^4 \pm 1.04 \times 10^5$ for fish fingers and $2.61 \times 10^5 \pm 1.73 \times 10^4$ for fish nuggets, respectively. Table (4) revealed that the mean values of ASF were 2.084×10^3 for fish panne, 6.54×10^2 for fish fingers and 2.44×10^3 for fish nuggets, respectively. The results given in table (5) showed that the incidence of *Bacillus* species in the examined samples of battered and breaded fish panne, fish finger and fish nuggets were, 30%, 10% and 43.33% for *B.cereus*, 26.66%, 13.33% and 63.33% for *B.megaterium* and 36.66%, 10% and 50% for *B. subtilis* respectively while *B. coagulans* were detected in 10% of the examined samples of fish nuggets only, *B. macerans* were detected in 3.33% of fish finger and 10% of fish nuggets and *B. licheniformis* were detected in 13.33% of fish panne and 26.66% of fish nuggets samples.

Table (1): Sensory characteristics of battered and breaded products

Score	1	2	3	4	5
Color	Too Light	Slightly Light	Just right	Slightly dark	Too dark
Adhesion	Too loose	Slightly loose	Just right	Slightly tight	Too tight
Texture	Too flaky	Slightly flaky	Just right	Slightly smooth	Too smooth

Table (2): Sensory panel score of battered and breaded fish products

Battered and Breaded Fish Products	Color			Adhesion			Texture			overall acceptability		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Fish Panne	1	4	2.96	1	5	2.93	1	5	2.88	1	5	2.92
Fish Fingers	1	5	2.90	1	5	3.13	1	5	2.67	1	5	2.9
Fish nuggets	1	5	2.93	1	5	3.16	1	5	2.56	1	5	2.89

Table (3): Statistical analytical results and acceptability of APC (cfu/g) in the examined samples of battered and breaded fish products (n=30)

Buttered breaded Fish products	Min	Max	Mean \pm S.E**	Permissible limits	Accepted Sampled		Unaccepted Sampled	
					NO.	%	NO	%
fish pane	9.6×10^2	2.0×10^5	$1.07 \times 10^4 \pm 0.35 \times 10^4$	Not more than 10^5	8	26.66	22	73.33
fish finger	3.1×10^3	7.4×10^5	$8.33 \times 10^4 \pm 1.04 \times 10^4$	Not more than 10^5	5	16.66	25	83.33
fish nuggets	8.5×10^3	1.9×10^6	$2.61 \times 10^5 \pm 1.73 \times 10^5$	Not more than 10^5	3	10	27	90

S.E* = Standard error of mea ** High significant difference between products (P<0.01).

Table (4): Statistical analytical results of total aerobic spore former count (cfu/g) in the examined samples of battered and breaded fish products (n=30)

Fish products	+Ve Samples		Min	Max	Mean
	No.	%			
Fish Panne	13	43.33	3.4×10^2	4.6×10^3	$2.419 \times 10^3 \pm 0.62 \times 10^3$
Fish Finger	7	23.33	1.0×10^2	1.2×10^3	$6.54 \times 10^2 \pm 0.92 \times 10^2$
Fish nuggets	21	70	4.0×10^2	9.0×10^3	$2.44 \times 10^3 \pm 0.59 \times 10^3$

Table (5): Incidence of Bacillus species isolated from the examined samples of buttered breaded fish products (n=30)

Fish Product	Panne		Finger		Nuggets	
	No	%	No	%	No	%
<i>B.cereus</i>	9	30	3	10	13	43.33
<i>B.coagulans</i>	0	0	0	0	3	10
<i>B.macerans</i>	0	0	1	3.33	3	10
<i>B.megaterium</i>	8	26.66	4	13.33	19	63.33
<i>B.licheniformis</i>	4	13.33	0	0	8	26.66
<i>B.subtilis</i>	11	36.66	3	10	15	50

4. DISCUSSION

The quality of fish products is of major concern to the food processors, consumers and public health authorities. Provisions of safe, wholesome and acceptable fish and its products as well as control of microorganisms are essential to meet these objectives (Younes and Bartram, 2001). During the last decade, increasing demand for high quality ready-to-cook fish products with the extended shelf-life has initiated the development of several innovative techniques to keep quality attributes as long as possible and yield safe products (Maftoonazad and Badii., 2009). Fish panne, fish fingers and fish nuggets are produced from fish fillets or minced fish flesh as battered and breaded products and commonly stored and marketed in frozen state. Such fish products can undergo undesirable changes during frozen storage time leading to loss of quality due to microbial contamination from various sources and rapid spoilage as a result of protein denaturation (Benjackulet al., 2005) and lipid oxidation (Richard, 2002). Sensory evaluation is an easy, quick and efficient method for getting idea about the quality of the product and its overall acceptance. One of the most important parameters that affect the marketability of coated products is the final color of these products. Coated food that lack golden yellow color are usually not accepted by the majority of the consumers, while darker color in coated food products is usually associated with off-flavor and low quality (Krokidaet al., 2001). Color of battered and breaded fish products are mostly influenced by the breaded coating and size of its granulations and less dependent on the interior materials and intermediate surfaces (Jamshidi and Shabanpour, 2013). Adhesion is the chemical and physical bonding of the battered and breading material with the food substrate (Ojaghet al., 2013). Coating loss results in a less pleasant appearance, which decrease the purchasing power of the consumers. Factors

affecting the adhesion of coating are properties and attributes of the food substrate (Suderman, 1983), cooking method (Albert, et al., 2009) and the batter ingredients (Primo-Martin et al., 2010). Texture is an important attribute contributing to the acceptability of the consumer because correct texture allows freshness and high quality (Chang et al., 1993). The obtained results of APC were in agreement with those obtained by (Sindhu, 2007) who reported that APC (cfu/g) of fish fingers was 2×10^3 - 2.35×10^5 . Aerobic plate count is considered as one of the parameters, which are useful to evaluate keeping quality of frozen fish products, faulty processing and/or handling practices such as cross contamination with raw products, contamination from workers and inadequate refrigeration which may create hazards (Zoldos et al., 2011). APC is also an important quality index because of the effect of bacteria in spoilage (Makri and Douvi, 2014). The occurrence of *Bacillus* organisms in food is the cause for concern, since some species, such as *Bacillus cereus*, *Bacillus subtilis*, and *Bacillus licheniformis*, have been implicated in various foodborne diseases (Kramer and Gilbert., 1989). The most likely source of the *Bacillus* organisms found in such fish products is primarily bread crumbs used in coating, since farinaceous foods such as flower and cereal products are common sources of *Bacillus spp.* (Kramer and Gilbert, 1989). Other possible sources of *Bacillus spp.* include batter mix, wheat flour, and spice mix. *Bacillus cereus* is an important food-borne pathogen causing two distinct types of food poisoning diarrhoea and emesis- which are caused by two different types of toxins (Schoeni and Wong, 2005). This organism is responsible for spoilage of different food products including fish (Meer et al., 1991). Since it is a spore forming organism, there is a risk of its transmission through heat-treated and processed food products since its spore can survive very high temperatures. Finally, it can be concluded that, the sensory quality of the examined

battered and breaded fish products was good. While, the presence of different types of microorganisms in the examined products reflect the level of contamination of the product at the different stages of processing, the raw material used and the improper handling of the product during and after the processing, especially in fish nuggets which have the highest aerobic plate counts and aerobic spore former count this may resulted from manipulation. Since the raw materials used in the processing step were obtained from fish caught in weirs, far away from any sewage and from that nuggets exposed to intensive human handling during processing. Thus, it is important to note that every stage of handling from fishing to consumption affect fish quality.

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