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Microbial Quality of Some Canned Meat and Fish

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Abstract: A total of 100 random samples of corned beef, canned luncheon, canned tuna and canned sardine (25 of each) were collected from different supermarkets and shops at Kafrelsheikh city to be examined microbiologically and the results showed that the mean values of total anaerobic bacterial counts of corned beef, canned luncheon, canned tuna and canned sardine were $2.84x10^3±0.76x10^3$, 9.10x104±0.97x104, 4.39 $x10^3±2.12x10^3$ and $7.16x10^2±2.83x10^2$ cfu/g respectively. On the other hand, the mean values of total aerobic sporeforming bacterial counts were $6.01x10^2±2.15x10^2$, $2.57x10^2±0.32x10^2$, $3.71x10^2±0.89x10^2$ and $1.34x10^2±0.68x10^2$ cfu/g respectively, the mean values of total mold and yeast counts were $1.47x10^2±0.53x10^2$, $5.86x10^2±0.90x10^2$, $1.14x10^2±0.56x10^2$ and 6.90x10±3.11x10 cfu/g respectively. The public health importance, economic significance of existing microorganisms as well as suggestive measures for improving the quality and safety of the products have been discussed.

Key words: Microbial quality · Canned beef · Canned luncheon · Canned tuna · Canned sardine

INTRODUCTION

Canning is an art of preserving foods and the industry expanded based on trial and error basis and skill of individual canners. During the 1990's, this method received much scientific scrutiny and has now developed into a sound and established technology to produce commercially sterilized safe foods having an almost infinite shelf life [1].

Canned meat products are considered popular meals compared with other food meals, easily to be prepared, thus suiting most working ladies and families as well as canteens and quick service cafeterias. They are also suitable for camping and other activities where refrigeration may not be available [2, 3].

Many marine species produce excellent canned products, supporting an important role in the field of human nutrition [4].

Fish allows for protein improved nutrition in that it has a high biological value in term of high protein retention in the body, low cholesterol level and presence of essential amino acids [5].

Appling food safety standards on a product is very important because it relates closely to human's health. Good food products have a high nutritional quality, as well as being free from physical, chemical and biological contaminations. The food industry development encourages food manufacturer's to produce more practical and durable products, but still must have high nutrition [6, 7].

Sporeforming bacteria that are present in foods are important because the formation of the spore 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. Some of the bacteria that are important belong to the genus Bacillus, which are aerobic to facultative anaerobic bacteria. These Bacillus species can cause food spoilage or some cause food-borne illnesses. The other important group of sporeforming bacteria is the Clostridium species which are anaerobic bacteria.

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They are of interest in foods because they also cause food spoilage and some species cause food-borne disease [8].

Most molds have little heat resistance and cannot survive the thermal processes for canned foods. Some molds produce a type of spore (ascospore) that is more resistant to heat, but these spores are much less resistant than the bacterial spores that are the target of processes for canned foods. Since molds must have oxygen to grow, only slight growth can occur, unless the food container has an opening to the outside environment [9].

Yeasts are widely found in nature and they are quite adaptive to adverse conditions such as acidity and dehydration. Compared to bacterial spores, yeasts and their spores possess little resistance to heat. Heating to 170 °F (77 °C) destroys most yeast forms [9].

The goal of this study is to evaluate the microbial quality of some canned meat and fish.

MATERIALS AND METHODS

Collection of Samples: A total of (100) random samples of canned beef, canned luncheon, canned tuna and canned sardine 25 of each were collected from different super markets and shops in Kafr-El-Sheikh city on different production days. The collected samples were transferred to the laboratory in original cans to be examined microbiologically to evaluate the safety of such products.

Preparation of Samples: The collected samples were prepared according to ICMSF [10]. The different cans were handled under complete aseptic conditions by surface sterilization with alcohol and flame. Further, the cans were opened by using sterile can opener to induce small opening. Twenty five grams of each sample were aseptically put into sterile flask contained 225 ml of sterile peptone water (0.1%) and thoroughly mixed by using sterile blender for 1.5 minutes to provide a homogenate of 10^{-1} dilution.Accordingly, tenfold serial dilutionwas prepared by transferring 1ml of the original homogenate into sterile test tube containing 9ml of sterile peptone water (0.1%) from which further dilutions were obtained. Then the prepared serial dilutions were subjected to the microbiological examination.

Determination of total anaerobic count was carried out according toICMSF[10].

Determination of total aerobic spore former countwas carried out according to APHA [11].

Determination of total Mold and Yeast countwas carried out according to Gill *et al.* [12].

Statistical Analysis: the samples were examined statistically.

RESULTS AND DISCUSSION AND CONCLUSIONS

Results given in Table (1) indicated that mean values of anaerobic spore forming bacterial counts in the examined samples of corned beef, canned luncheon, canned tuna and canned sardine were $2.84x10^3 \pm 0.76x10^3$, 9.10x104±0.97x104, $4.39x10^3 \pm 2.12x10^3$ and $7.16x10^2 \pm 2.83x10^2$cfu/g, respectively.The obtained result ofcanned beef is nearly similar to those recorded By El khawas [15] but higher than Radwan [16], Abd El Hafez [17], Seadway *et al.* [18], Mansour [19] and Hamasalim [20] and lower than Taman [21]. While the obtained result of canned luncheon is higher than Seadway *et al*. [18] and Mansour [19]. The obtained result of canned tuna is higher than Barhoma [22] and El Dengawy *et al*. [23]. The obtained result of canned sardine is lower than Barhoma [22] and higher than El Dengawy *et al.* [23] and Oranusi *et al.* [24].

Results given in Table (2) indicated that 36% of corned beef, zero% of canned luncheon, 64% of canned tuna and 64% of canned sardine were acceptable according to EOS [13,14].

The cause of low number of bacteria indicates the preparation of this productswas correct and indicate possibly to add some preservatives to it, especially nitrates, which have an important role in reducing the growth of anaerobic bacteria and their inhibition, especially Clostridium [25].Temperature abuse and poor storage condition prevalent in kiosks and stores form where these products were purchased could encourage proliferation of these organisms (*C. perfringens, B. cereus*) to unacceptable level [24].

Table 1: Statistical analytical results of anaerobic spore-forming bacteria (cfu/g) in the examined samples of canned meat and fish (n=25)

Canned Products	Min	Max	Mean ± S.E
Corned beef	1.1×10^3	1.3×10^4	$2.84\times10^3 \pm 0.76\times10^3$
Canned luncheon	1.2×10^4	1.6×10^5	$9.10\times10^4 \pm 0.97\times10^4$
Canned tuna	2.0×10^2	3.9×10^4	$4.39\times10^3 \pm 2.12\times10^3$
Canned sardine	2.5×10^2	5.4×10^3	$7.16\times10^2 \pm 2.83\times10^2$

S.E= standard error of mean

Min= minimum

Max=maximum

Table 2: Acceptability of the examined samples of canned meat and fish based on their anaerobic sporeforming bacteria/ g (n=25)

		Accepted samples		Unaccepted samples	
Canned Products	Accepted limits*	No.	%	No.	%
Corned beef	Free	9	36	16	64
Canned luncheon	Free	0	0	25	100
Canned tuna	Free	16	64	9	36
Canned sardine	Free	16	64	9	36

Egyptian Organization for Standardization and Quality Control "EOS"(2005)[13, 14].

No 3491/2005 for canned beef

No 804/2005 for canned tuna

No 1521/2005 for canned sardine

No1114/2005 for luncheon

Table 3: Statistical analytical results of aerobic spore-forming bacteria (cfu/g) in the examined samples of canned meat and fish (n=25)

Canned Products	Min	Max	Mean ± S.E
Corned beef	1.5×10^2	3.6×10^3	$6.01\times10^2 \pm 2.15\times10^2$
Canned luncheon	1.2×10^2	6.7×10^2	$2.57\times10^2 \pm 0.32\times10^2$
Canned tuna	7.0×10	1.3×10^3	$3.71\times10^2 \pm 0.89\times10^2$
Canned sardine	6.0×10	1.7×10^3	$1.34\times10^2 \pm 0.68\times10^2$

Table 4: Acceptability of the examined samples of canned meat and fish based on their aerobic spore-forming bacteria/ g (n=25).

		Accepted samples		Unaccepted samples	
Canned Products	Accepted limits *	No.	%	No.	%
Corned beef	Free	9	36	16	64
Canned luncheon	Free	3	12	22	88
Canned tuna	Free	9	36	16	64
Canned sardine	Free	13	52	12	48

Egyptian Organization for Standardization and Quality Control "EOS" (2005) [13, 14].

No 3491/2005 for canned beef

No 804/2005 for canned tuna

No 1521/2005 for canned sardine

No 1114/2005 for luncheon

From the data recorded in Table (3) it is obvious that aerobic sporeforming bacterial counts in examined samples of corned beef, canned luncheon, canned tuna and canned sardine were with average values of$6.01x10^2\pm2.15x10^2$,$2.57x10^2\pm0.32x10^2$,$3.71x10^2\pm0.89x10^2$ and $1.34x10^2\pm0.68x10^2$ cfu/g, respectively. The obtained result of corned beef isnearly similar to Radwan [16] and Mansour [19] but lower than Saleh and Salah El Dien [26] in canned meat and higher than Abd El Hafez [17] and Hamsalim [20]. The obtained results of canned luncheon arenearly similar toMansour [19] but lower than Saleh and Salah El Dien [26] and higher than El Ansary [27]. The obtained result of canned tuna ishigher than Barhoma [22] and El Dengawy *et al*. [23]. The obtained results of canned sardine are nearly similar toBarhoma [22] but higher than El Dengawy *et al*. [23].

Results illustrated in Table (4) indicated that 36% of corned beef, 12% of canned luncheon, 36% of canned tuna and 52% of canned sardine were acceptable according to EOS [13, 14].

The higher bacterial count may be due to processing practice, which might have exacerbated contamination through poor hygienic practices [28]. The combined effects of high temperature treatment, pH, preservatives and anaerobic condition of canning could have been responsible for the low microbial loads [24]. High bacterial count may be due to storage condition. If storage conditions become favorable due to abuse encourage growth and multiplication of some microorganisms [24].

It is evident from the results recorded in Table (5) that total mold and yeast counts in examined samples of corned beef, canned luncheon, canned tuna and canned sardine were with averagevalues of $1.47x10^2\pm0.53x10^2$,

Table 5: Statistical analytical results of total mold and yeast count (cfu/g) in the examined samples of canned meat and fish (n=25)

Canned Products	Min	Max	Mean ± S.E
Corned beef	5.0×10	9.8×10^2	$1.47\times10^2 \pm 0.53\times10^2$
Canned luncheon	2.9×10^2	1.3×10^3	$5.86\times10^2 \pm 0.90\times10^2$
Canned tuna	1.0×10	1.3×10^3	$1.14\times10^2 \pm 0.56\times10^2$
Canned sardine	6.0×10	5.8×10^2	$6.90\times10 \pm 3.11\times10$

Table 6: Acceptability of the examined samples of canned meat and fish based on their mold and yeast count/ g (n=25)

		Accepted samples		Unaccepted samples	
Canned Products	Accepted limits*	No.	%	No.	%
Corned beef	Free	15	60	10	40
Canned luncheon	Free	7	28	18	72
Canned tuna	Free	16	64	9	36
Canned sardine	Free	16	64	9	36

Egyptian Organization for Standardization and Quality Control "EOS" (2005) [13, 14].

No 3491/2005 for canned beef

No 804/2005 for canned tuna

No 1521/2005 for canned sardine

No1114/2005 for luncheon

$5.86x10^2\pm0.90x10^2$, $1.14x10^2\pm0.56x10^2$ and $6.90x10\pm3.11x10$ cfu/g, respectively. The obtained results of corned beef and canned luncheon arelower than Ali *et al*. [29] and Nasser [28]. The obtained results of canned tuna arehigher than Vendrell and Rodriguez [30] but lower than Ali *et al*. [29] in canned fish and Francesco *et al*. [31]. The obtained result of canned sardine islower than Ali *et al*. [29] in canned fish.

From the results recorded in Table (6) it is obvious that 60% of corned beef, 28% of canned luncheon, 64% of canned tuna and 64% of canned sardine were acceptable according to EOS [13, 14].

Presence of fungal elements and bacteria in some samples reveals the presence of unsanitary condition in the processing plants and their numbers were considered to be a more practical indicator of the hygienic efficiency and microbiological status of processing the canned products [28].

From the obtained results in the present study it could be concluded that microbiological examination of canned meat and canned fish products is of great importance for determination of the efficiency of the processing.

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