# aerobic spore formers in some vacuum packed meat product

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# AEROBIC SPORE FORMERS IN SOME VACUUM PACKAGED MEAT PRODUCTS

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## ABSTRACT

One hundred and fifty random samples of vacuum packaged meat products (salami, frankfurter and cocktail) produced by 2 different processing plants terminated A and B (75 0f each) were collected from different supermarkets located in Qalyobia governorate for determination of their contamination with aerobic spore forming bacteria. The obtained results indicated that the mean values of aerobic spore formers and *B.cereus* counts/g in the examined samples of vacuum packaged meat products processed by plant A were $9.27\times10^2\pm 2.03\times10^2$ & $6.53\times10^2\pm1.17\times10^2$ for salami, $2.64\times10^3\pm0.28\times10^3$ &$1.74\times10^3\pm 0.42\times10^3$ for frankfurter and $8.35\times10^3\pm 1.51\times10^3$& $4.69\times10^3\pm 0.81\times10^3$ of cocktail, respectively. Concerning plant B, the mean values of aerobic spore formers and *B.cereus* counts/g in the examined samples of vacuum packaged meat products were $3.81\times10^3\pm 0.52\times10^3$& $9.05\times10^2\pm 2.21\times10^2$ for salami, $7.59\times10^3\pm 1.12\times10^3$ & $3.61\times10^3\pm 0.74\times10^3$for frankfurter and $2.07\times10^4\pm 0.48\times10^4$& $8.25\times10^3\pm 1.57\times10^3$of cocktail, respectively. The different species of Bacillus isolated from the examined samples of vacuum packaged meat products were *B.cereus, B.coaggulans ,B.circulans, B.macerans, B.megaterium, B.licheniformis, B. stearothermophilus* and *B.subtilis* which were isolated from the examined samples of salami, frankfurter and cocktail either of plant A or B with varying percentages. The significance of isolated aerobic spore forming bacteria in vacuum packaged meat products and some recommendations to improve their quality were discussed.

**Keywords:** Aerobic spore formers, vaccum packaged meat products, Salami, Frankfurter, Cocktail.

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## 1. INTRODUCTION

Technological developments in meat processing , preservation and handling have given consumers a much greater choice over the foods they can buy. Consequently, consumers have become more selective, more considers of quality and more concerned about the value of money. As a result, the quality of the product has become a more significant factor in marketing meat products (Kasprowiak and Hechelmann, 1992).

Processed meats are subjected to contamination with several types of microorganisms from different sources during the period elapses from the time of slaughtering, preparation, processing and cooking. These microorganisms varied according to the method of manufacture, quality of used non-meat ingredients and contamination level during the processing chain, packaging and storage (Narasimha and Ramesh, 1988). Aerobic spore forming bacteria have epidemiological interest as some of its members are pathogenic and may result in serious infections and food poisoning. Moreover, the total number of these organisms can be taken as an indication of possible potential hazards to consumers (Borch et al., 1996).There for, the current study was applied to investigate the contamination of vacuum packaged meat products with aerobic spore forming bacteria.

## 2. MATERIALS AND METHODS

A total of 150 random samples of vacuum packaged meat products represented by salami, frankfurter and cocktail (50 0f each) related to 2 different processing plants namely A and B (75 0f each) were collected from different supermarkets located in Kalyobia governorate. In other words, each processing plant was represented by 25 samples each of salami, frankfurter and cocktail to determine their contamination with aerobic spore forming bacteria.

*2.1 Preparation of the samples*

The samples were prepared according to the technique recommended by ICMSF (1978) to obtain tenfold decimal serial dilution.

*2.2 Determination of total aerobic spore formers*

The technique recommended by Oxoid (1990) was applied. Isolation and identification of isolated aerobic spore formers were adapted according to Giffel et al. (1996).

*2.3 Determination of Bacillus cereus*

It is applied according to Harrigan and McCane,( 1976).Typical colonies of *B. cereus* characterized by blue turquoise color and surrounded by a halo zone of white precipitation were picked up and spread over the surface of slope nutrient agar slant then incubated at 37°C for 24 hours then kept in the refrigerator at 4°C for further identification of such bacteria.

The isolated aerobic spore formers were further identified microscopically and biochemically.

## 3. RESULTS

Table (1) indicated that all salami samples had higher total aerobic spore formers count as compared with frankfurter or cocktail .Also, all meat products processed by plant B were more contaminated with such bacteria than those of plant A. Table (2) declared that B.cereus was the most isolated aerobic spore former from the examined samples of vacuum packaged meat products of plant A followed by *B.subtilis, B.megaterium and B.licheniformis.*

Table (3) revealed that the majority of vacuum packaged meat products of plant B were contaminated with *B.cereus and B.subtilis.* Table (4) pointed out that the mean values of total B.cereus counts in vacuum packaged meat products of plant A and B were higher in salami ($6.53\times10^2$&$9.05\times10^2$),frankfurter ($1.74\times10^3$&$3.61\times10^3$) and cocktail ($4.69\times10^3$&$8.25\times10^3$).

Table (1) Statistical analytical results of total aerobic spore formers count in the examined samples of vacuum packaged meat products (n=25).

| Plant / Product | A | | | B | | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Mean ± S.E* | Min. | Max. | Mean ± S.E* |
| Salami++ | $1.6\times10^2$ | $8.5\times10^3$ | $9.27\times10^2\pm 2.03\times10^2$ | $3.0\times10^2$ | $2.2\times10^4$ | $3.81\times10^3\pm 0.52\times10^3$ |
| Frankfurter | $2.5\times10^2$ | $1.0\times10^4$ | $2.64\times10^3\pm 0.28\times10^3$ | $5.1\times10^2$ | $8.3\times10^4$ | $7.59\times10^3\pm 1.12\times10^3$ |
| Cocktail | $4.9\times10^2$ | $6.7\times10^4$ | $8.35\times10^3\pm 1.51\times10^3$ | $1.8\times10^3$ | $9.9\times10^4$ | $2.07\times10^4\pm 0.48\times10^4$ |

S.E* = standard error of mean

++ = High significant differences ($P<0.01$)

Table (2) Incidence of Bacillus species isolated from the examined samples of vacuum packaged meat products produced by plant A (n=25).

| Bacillus Spp | Salami | | Frankfurter | | Cocktail | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| *B.cereus* | 4 | 16 | 5 | 20 | 8 | 32 |
| *B.circulans* | - | - | - | - | 2 | 8 |
| *B.coagulans* | - | - | 2 | 8 | 4 | 16 |
| *B.macerans* | 1 | 4 | - | - | - | - |
| *B.megaterium* | 3 | 12 | 3 | 12 | 6 | 24 |
| *B.licheniformis* | 2 | 8 | 4 | 16 | 3 | 12 |
| *B.stearothermophilus* | - | - | 3 | 12 | 5 | 20 |
| *B.subtilis* | 3 | 12 | 7 | 28 | 6 | 24 |

Table (3) Incidence of Bacillus species isolated from the examined samples of vacuum packaged meat products produced by plant B (n=25).

| Product / Bacillus Spp | Salami | | Frankfurter | | Cocktail | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| *B.cereus* | 6 | 24 | 9 | 36 | 13 | 52 |
| *B.circulans* | 2 | 8 | 1 | 4 | 4 | 16 |
| *B.coagulans* | - | - | 5 | 20 | 6 | 24 |
| *B.macerans* | 1 | 4 | - | - | - | - |
| *B.megaterium* | 4 | 16 | - | - | 8 | 32 |
| *B.licheniformis* | - | - | 3 | 12 | 2 | 8 |
| *B. stearothermophilus* | 5 | 20 | 7 | 28 | 4 | 16 |
| *B.subtilis* | 4 | 16 | 10 | 40 | 11 | 44 |

Table (4) Statistical analytical results of total *B.cereus* count in the examined samples of vacuum packaged meat products (n=25).

| Plant / Product | A | | | B | | |
|---|---|---|---|---|---|---|
| | Min. | Max. | Mean ± S.E* | Min. | Max. | Mean ± S.E* |
| Salami++ | $1.0\times10^2$ | $4.2\times10^3$ | $6.53\times10^2\pm 1.17\times10^2$ | $1.0\times10^2$ | $7.0\times10^3$ | $9.05\times10^2\pm 2.21\times10^2$ |
| Frankfurter | $1.0\times10^2$ | $9.0\times10^3$ | $1.74\times10^3\pm 0.42\times10^3$ | $2.0\times10^2$ | $1.9\times10^4$ | $3.61\times10^3\pm 0.74\times10^3$ |
| Cocktail | $3.0\times10^2$ | $1.5\times10^4$ | $4.69\times10^3\pm 0.81\times10^3$ | $5.0\times10^2$ | $3.1\times10^4$ | $8.25\times10^3\pm 1.57\times10^3$ |

S.E* = standard error of mean
++ = High significant differences ($P<0.01$)

## 4. DISCUSSION

Aerobic spore forming bacteria such as Bacillus can effectively resist heating and exert selective effect on the type of surviving bacteria which remain in such food items (Potter, 2001).The current results come in accordance with those reported by Giffel et al. (1996) and Little et al. (2003). While, lower results were obtained by Juneja et al. (1997). Although wrapping of vacuum packaged meat

products will decrease contamination by dust and microbes, they will maintain humidity inside the foods, thus creating a suitable environment for multiplication of microbes. Furthermore, wrapping foods will maintain the warmth and moisture for extended periods, thus allowing germination of spores and growth of vegetative cells which will be extremely dangerous in summer when air temperatures rises above 40°C and relative humidity to above 80% (Bryan et al., 1992). The present findings agree, quite well, with those obtained by Ghoniem- Amal (1995), Giffel et al. (1996), Nassif et al. (2002) and Samir et al. (2012). However, higher results were reported by Hafezetal. (1990).In contrast, *B. cereus* could not be isolated from the examined samples of meat products by El-Khawas (2001). The obtained results revealed that the examined samples of vacuum packaged meat products contained high counts of *B. cereus* and this could be attributed to the lack of sanitary measures during processing, handling and storage of such products (Varnam and Evans, 1991).

Moreover, the meat additives are considered the main sources of *B. cereus* contamination in meat products (Shinagawa et al., 1988). In this respect, addition of spices results in an increase of the bacterial population including *B. cereus*as stipulated by El- Mossalami (1994) who found that the Bacilli count in the spices and condiment was between $10^4$ to$10^7$ /g. Finally, the possibility of contamination of vacuum packaged meat products with aerobic spore forming bacteria remains as a public health problem where such organisms can survive cooking and have the ability to produce the heat resistant spores.

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# الميكروبات الهوائية في بعض منتجات اللحوم المعبأة تحت التفريغ

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## الملخص العربي

تعتبر منتجات اللحوم من أهم الأغذية التي يقبل عليها عدد كبير من المستهلكين في مصر والعالم وذلك لقيمتها الغذائية نتيجة احتوائها على نسبة عالية من البروتين الحيواني ولطعمها الشهي وسهولة إعدادها علاوة على انخفاض ثمنها بما يتوافق مع ايقاع الحياة السريع. لذلك فقد تم جمع عدد مائه وخمسين عينة (150) من منتجات اللحوم المعبأة تحت التفريغ من شركتين مختلفتين (أ) و (ب) بواقع خمس وسبعين(75) عينة من كل شركة. وكانت عينات تلك المنتجات عبارة عن السلامى، الفرانكفورتر والكوكتيل بواقع خمس وعشرين (25) عينة من كل شركة وذلك لدراسة مدى تلوثها بالميكروبات المتجرثمة الهوائية مع عزل وتصنيف ميكروبات الباسيلس سيريس من تلك المنتجات. وقد دلت نتائج الدراسة على أن متوسط العدد الكلى للبكتيريا المتجرثمة الهوائية وبكتيريا الباسيلس سيريس (جم) منتجات اللحوم المعبأة تحت التفريغ للشركة (أ) هو 9,27× 10 $^{2}$ و 6,53× 10 $^{2}$ لعينات السلامى، 2,64× 10 $^{3}$ و 1,74× 10 $^{3}$ لعينات الفرانكفورتر و8,35× 10 $^{3}$ و 4,69× 10 $^{3}$ لعينات الكوكتيل، على التوالي. وبالنسبة للشركة (ب)، كان العدد الكلى لتلك الأنواع البكتيرية (جم) هو 3,81× 10 $^{3}$ و 9,05× 10 $^{2}$ لعينات السلامى، 7,59× 10 $^{3}$ و 3,61× 10 $^{3}$ لعينات الفرانكفورتر و2,07× 10 $^{4}$ و 8,25× 10 $^{3}$ لعينات الكوكتيل، على الترتيب. كما تم عزل وتصنيف العديد من أنواع هذه البكتيريا من جميع المنتجات محل الدراسة وبنسب متنوعة. وكانت هذه الأنواع المعزولة كما يلي:

*B.cereus, B.coaggulanss, B.circulans, B.macerans, B.megateriumB.licheniformis, B. stearothermophilus* and *B.subtilis*

وقد وجد أن الاختلافات بين العينات محل الدراسة كانت معنوية كنتيجة للتباين بين شركات الإنتاج من ناحية وبين أنواع منتجات اللحوم محل الدراسة من ناحية أخرى. هذا وقد تم مناقشة الأهمية الصحية للميكروبات المتجرثمة الهوائية المعزول من منتجات اللحوم المعبأة تحت التفريغ مع تحديد المصادر المختلفة لتلوثها بالإضافة لوضع بعض التوصيات لتحسين جودة تلك المنتجات والحفاظ على صحة المستهلك.

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