

MICROBIAL EVALUATION OF IMPORTED FROZEN MEAT SOLD IN MARKETS

ABDEL-FATTAH, S. A. AND H. M. SOBHY

Animal Health Research Institute, ARC, Ministry of Agriculture, Dokki Giza- Egypt

(Manuscript received 18 October 2006)

Abstract

Fifteen samples of frozen boneless beef meat imported to Egypt were examined for Aerobic Plate Count (APC), *Staphylococcus aureus* (*S. aureus*), Enterobacteriaceae and Mold counts, also for aflatoxin B₁ & B₂ detection. The obtained results revealed that the mentioned organisms were higher in frozen meat thawed in ambient conditions than in frozen meat thawed in refrigerated conditions and examined before their expire date. Negative detection of aflatoxin B₁ and B₂ was recorded in all examined frozen meat. Public health significance of *S. aureus*, Enterobacteriaceae, Mold and aflatoxin, as well as the recommendations for handling and storage of frozen meat were discussed.

INTRODUCTION

Meat is an important food for human being as it is the most concentrated and easily assimilated nitrogenous food. It is a good source of first class protein as it contains the amino acids essential for human life. Fresh meat has water activity about 0.99, thus, it is liable to spoil through the growth of a wide range of organisms. From the economic point of view, molds grow over an extreme wide range of temperature under which foods are held. Molds lead to certain defects that may change the food quality leading to food poisoning, or render it unfit for human consumption. Molds have lipase enzyme which causes hydrolysis, decomposition and oxidation of fats, giving musty flavours to meat (Hafez, 1986 and Marouf, 2004).

The muscle tissues and body fluids of healthy living animals are usually free from bacteria, but during slaughtering and processing, contamination occurs and cannot be avoided leading to introduction of pathogens into the meat. The source of these pathogens may be endogenous from the animal gastrointestinal tract or from the surrounding environment in slaughter house. Freezing kills a small proportion of microorganisms present, and more die during frozen storage. Gram-negative bacilli are more susceptible than positive cocci. The lethal effect of freezing may be due to the denaturation of cell protein (Frazier and Westhoff, 1983).

The aim of the present study is to study the microbial evaluation of imported meat sold in Egypt market.

MATERIALS AND METHODS

A total of fifteen samples of frozen boneless beef meat imported to Egypt was obtained from local markets in Cairo governorate and transferred immediately to the laboratory. These samples were divided into three parts: the 1st part was thawed in

ambient condition (at 25°C) for 24 h; the 2nd part was thawed in refrigerated condition (at 4°C) for 48 h; while, the 3rd part was examined before its expired date and thawed in refrigerated condition (at 4°C).

- 1- Samples preparation: 10 grams of each meat sample to which 90 ml 1% sterile buffered peptone water were aseptically added to provide a dilution of 1/10 then 10th fold decimal dilutions were prepared (APHA, 1992).
- 2- Aerobic plate count (APC), *S. aureus*, Enterobacteriaceae and Mold counts were carried out according to APHA (1992).
- 3- Determination of aflatoxin B₁ and B₂ in meat was carried out using TLC (Thin Layer Chromatography) method according to the technique recommended by AOAC (1990).

RESULTS

Table 1. Incidence of bacteria and molds in frozen meat thawed in ambient conditions Log₁₀ cfu/g.

Microorganisms	No. of Positive samples	%	Min.	Max.	X ± SE
APC	15	100	3.78	5.60	5.05 ± 4.18
<i>S. aureus</i>	2	13.3	2.95	3.72	3.19 ± 2.53
Enterobacteriaceae	4	26.7	3.15	4.30	3.83 ± 3.04
Molds	13	86.7	3.00	4.34	3.70 ± 3.11

Min. = minimum Max. = maximum X = Mean SE = standard error

Table 2. Incidence of bacteria and molds in frozen meat thawed in refrigerated conditions Log₁₀ cfu/g.

Microorganisms	No. of Positive samples	%	Min.	Max.	X ± SE
APC	8	53.3	2.60	3.30	3.05 ± 2.48
<i>S. aureus</i>	2	13.3	2.00	2.86	2.00 ± 1.32
Enterobacteriaceae	2	13.3	2.04	3.30	2.83 ± 2.04
Molds	3	20	2.00	2.79	2.48 ± 1.04

Min. = minimum Max. = maximum X = Mean SE = standard error

Table 3. Incidence of bacteria and molds in frozen meat examined before its expired date thawed at refrigerated conditions Log₁₀ cfu/g.

Microorganism	No. of Positive samples	%	Min.	Max.	X ± SE
APC	3	20	2.00	3.90	2.34 ± 1.11
<i>S. aureus</i>	2	13.3	2.00	2.85	2.00 ± 1.32
Enterobacteriace	1	6.7	2.00	2.60	2.00 ± 2.08
Molds	3	20	2.04	2.78	2.48 ± 1.04

Min. = minimum Max. = maximum X = Mean SE = standard error

Table 4. Incidence of Aflatoxin B₁ and B₂ in frozen meat.

Frozen meat thawed in	Total No. of samples	Aflatoxin B ₁		Aflatoxin B ₂	
		No. of Positive samples	%	No. of Positive samples	%
Ambient conditions	15	0	0	0	0
Refrigerated conditions	15	0	0	0	0
Before its expired date	15	0	0	0	0

DISCUSSION

The microbiological limits for acceptance of boneless frozen meat are as follows: aerobic plate count 5.70 as acceptable and 7.00 as marginally acceptable, while > 7.00 is considered unacceptable (ICMSF, 1978). Thus, the aerobic plate count was the most suitable method for evaluating the microbial quality of foods.

The results recorded in Table 1 revealed that APC, Enterobacteriaceae and *S. aureus* counts in frozen meat thawed in ambient conditions agree with those recorded by Goda *et al.* (1981), Mates (1983) and Hafez (1986) who found that the counts of APC, Enterobacteriaceae and *S. aureus* per gram were 5.84 ± 5.40, 5.97 ± 4.86 and 3.35 ± 2.91 organisms/g of meat, respectively. The higher results recorded by Refaie, *et al.* (1991) as the aerobic plate count ranged from 4.30 to 7.00 Log cfu/g, the count of Enterobacteriaceae and *S. aureus* ranged from 2.78 to 6.48/g and 2.90 to 5.00, respectively.

The data recorded in Table 2 showed that mean values of APC and *S. aureus* 3.05 ± 2.48 and 2.00 ± 1.32, respectively, are in agreement with those mentioned by Marriot *et al.* (1980) who stated that no significant differences were found in the *Staphylococcus aureus* counts of the frozen meat thawed in ambient and refrigerated conditions, but, higher aerobic counts were found in meat samples thawed at ambient temperatures than samples thawed at refrigerated temperatures. The higher results

for APC, *S. aureus* and Enterobacteriaceae count than the data recorded in Table 2 were reported by Reda (1995) who found that the average of APC and Enterobacteriaceae counts were 6.11 and 5.11 cfu/g, respectively. At the ambient condition surrounding the thawed frozen meat, molds and staphylococci are widely distributed in nature.

The obtained results showed that the total mold counts in frozen meat thawed at refrigerated condition agreed with those recorded by Fahmy (1986) who found that the mean value was 3.15 ± 0.07 cfu/g. Frozen meat thawed in ambient conditions agreed with those mentioned by Samaha and El_Gohary (1992) who summarized that the total mold count / g ranged from 2.48 to 5.60 cfu/g, while the higher results were recorded by Reda (1995).

Molds affected our food as a result of its contamination, and is responsible for a major portion of food deterioration in developing countries, also, it constitutes a big hazards for human being as it produces numerous mycotoxins which are carcinogenic, hepatotoxic and nephrotoxic (Hafez, 1986 and Marouf, 2004).

In Table 3, APC and Enterobacteriaceae showed a decrease in counts rather than *S. aureus* and molds which are relatively resistant to freezing without change in count. These findings agreed with those reported by ICMSF (1978) who mentioned that total aerobic counts decreased as storage time increased. Also, freezing could not eliminate Staphylococci or other Gram-positive bacilli from the food.

Gram-negative bacilli were more susceptible to freezing than positive cocci, the lethal effect of freezing may be due to the denaturation of cell protein (Frazier and Westhoff, 1983).

Aflatoxin B₁ and B₂ cannot be detected in the three types of frozen meat. These results are attributed to that meat obtained from animals grazing in a wide area of natural green fodders is free from mycotoxin contamination (Fahmy, 1986).

From view of public health of the main organisms in this study, molds contaminating our food are responsible for a major portion of food deterioration in developing countries, also, constitute big hazards for human being as they produce a numerous mycotoxins which are carcinogenic, hepatotoxic and nephrotoxic (Horner *et al.* 1995). Heknby & Gondroesn (1981) and Hobbs & Gilbert (1978) concluded that pathogenic Staphylococci and Enterobacteriaceae have been implicated in several food poisoning outbreaks.

From the obtained results, one can conclude that microorganisms, molds and aflatoxins may be found in frozen meat which appears to be suitable for consumption. So, to protect food from microorganisms, molds and to avoid the public health hazards and the economic losses, the following suggestive measures should be conducted:

- Strict hygienic precautions should be recommended during slaughtering till freezing.
- Frozen meat must be thawed in refrigerator not at ambient conditions to avoid more contamination.

REFERENCES

1. APHA "American Public Health Association". 1992. Compendium of methods for the microbiological examination of foods. 3rd Ed., (Vanderzant, C and Splitttoesser, D. eds) Washington, D.C. USA.
2. A. O. A. C. "Association Official Analytical Chemists". 1990. Official methods of analysis of the Association of Official Analytical Chemists .Washington D.C. 15th Ed. USA.
3. Fahmy, A. M. 1986. Mycological evaluation of frozen meat and chicken. Thesis, Ph. D. Fac. Vet. Med. Alex. Univ.
4. Frazier, W. C. and D. C. Westhoff. 1983. Food microbiology. 3rd Ed. Tata Mcgraw-Hill Publishing Co. Limited. New Delhi, India.
5. International Committee on Microbiological Specifications for Foods "ICMSF". 1978. Microorganisms in food. 1, their significance. Toronto Press, Toronto, Canada.
6. Goda, E. F., N.A.Wassef, Z. Saad and H. El-Sawah. 1981. Microbial contamination of imported frozen meat. J. Egypt Vet. Med . Assoc., 41(4):89-97.
7. Hafez, A. E. 1986. Studies on sanitary condition of frozen meat marketed in sharkia province. Thesis, Ph. D. Fac. Vet . Med. Sci., Zagazig Univ.
8. Heknbly, A. and B. Gondroesn. 1981. Food poisoning due to *S.aureus* after consumption of food. Norsk. Vet., 93, 12, 843. Dairy Sci. Abst., 44,524 (1982).
9. Hobbs, C. and R. Gilbert. 1978. Food poisoning and food hygiene. 4th Ed. English Language Book society and Eward Arnold (publisher) Ltd.
10. Horner, R., A. Helbing and J. Salvaggio. 1995. Fungal allergens. J. Microbiology, 83, (4): 7.
11. Marouf, H. 2004. Prevalence of aflatoxin residues in some meat products in Damietta governorate. J. Egypt Vet. Med. Assoc., 64(6): 19- 29.
12. Marriot, N., G. Garcia, R.A. Pulene and D.R. Lee. 1980. Effect of thawing conditions on ground beef. J. Food Prot., 43 (3): 180-184.
13. Mates, A. 1983. Microbiological survery of frozen ground meat and proposed standard. J. Food Prot., 46:87-89.
14. Reda, W. 1995. Studies on frozen meat as a possible source of occupational infections. Vet . Med. J., Giza., 43(1): 65-70.

15. Refaie, R. S., M. A. Semah, A. R. Thabet and A. M. El-Timawy. 1991. Microbiological quality of frozen meat in Assiut. *Assiut Vet. Med. J.*, 24 (48):158-136.
16. Samaha, M. and A. El_Gohary .1992. Isolation of some moulds and yeast from frozen ground beef of zoonotic importance . *Assiut Vet. Med. J.*, 27(54): 130-134.

التقييم الميكروبي للحوم المجمدة المستوردة والمباعة بالأسواق

شهاب عبد الوهاب عبد الفتاح ، حسن محمد صبحي

معهد بحوث صحة الحيوان- مركز البحوث الزراعية- وزارة الزراعة- الدقي-جيزة- مصر

تم جمع خمسة عشرة عينة من اللحوم المستوردة المجمدة من المجمعات الاستهلاكية وتقسيمها إلى ثلاثة أجزاء ثم فحصها للعد البكتيري الكلي، والمكور العنقودي الذهبي والميكروبات المعوية وكذلك للفطريات والافلاتوكسين B_1 , B_2 .
وأظهرت النتائج أن الميكروبات السابق ذكرها كان عددها مرتفعا بعينات اللحوم التي تركت حتى ذوبان الثلج بالبيئة المحيطة مقارنة بالعينات التي تركت بالثلاجة حتى ذوبان الثلج بها، في حين أن العد البكتيري الكلي، والميكروبات المعوية قل كثيرا في العينات التي تم فحصها قبل انتهاء تاريخ الصلاحية ، بينما لم يتأثر المكور العنقودي الذهبي والفطريات بها، أيضا لم يتواجد الافلاتوكسين B_1 , B_2 في أي من الأنواع الثلاثة للحوم المجمدة.
تم مناقشة الأهمية الصحية لهذه الميكروبات وكذلك التوصيات اللازمة للتعامل السليم مع اللحوم المجمدة.