

IMPORTANCE OF HYGIENIC PRACTICE OF RETAIL MEAT WORKERS AND THEIR IMPACT ON WORKERS' HEALTH AND FUNGAL CONTAMINATION OF FROZEN MEAT

ALSHIMAA A. HASSANIEN¹ and NAHED MAHMOUD ABDEL-AZIZ²

¹ Department of Zoonoses, Faculty of Veterinary Medicine, Sohag University, Egypt.

² Department of Food Hygiene, Faculty of Veterinary Medicine, Sohag University, Egypt.

Received: 21 February 2017; Accepted: 20 March 2017

ABSTRACT

This study was performed to detect the hygienic practice of retail meat workers during handling and processing of meat, as well as the health hazards caused by fungi to retail meat workers. In addition, the fungal contamination of frozen meat samples sold in different retail meat shops in Sohag Governorate. The results revealed that out of 49 workers; 16 (32.7 %) periodically washing their hands, 31 (63.3 %) not wearing gloves during handling and processing of meat, 38 (77.5 %) have the habit of continuous freezing and thawing of meat, 35 (71.4 %) workers were apparently healthy and 14 (28.6%) have hand lesions. *Fusarium oxysporum* was the most prominent fungal species detected in workers hands with percentage of 20.4%, while in frozen meat samples; *Cladosporium cladosporioides* represented the highest contamination rate with percentage of 26 %. Infection of retail meat workers and contamination of frozen meat with different fungi species was enhanced by improper hygienic practice of some retail meat workers.

Key words: Retail meat workers, Frozen meat, Hygienic practice.

INTRODUCTION

Food contaminated with fungi leads to economic losses to food producers and consumers. Yeasts and molds can invade and grow on several types of foods such as grains, beans, fruits before harvesting, meat and processed food during storage. Fungal growth in food can be detectable based on fungus and food type as well as the invasion degree; food may be slightly spoiled, severely spoiled or decomposed completely. Food contaminated with fungus show either cotton mycelium, spots with different sizes and color or slim but in some instances appear normal and contamination was detected by mycological examination (Tournas *et al.*, 2001).

Fungal contamination is one of the most important pathogen caused spoilage of meat. It is occurred during animal slaughtering, meat transportation, handling and processing, as well as using of contaminated utensils and equipment (Abd El-Rahman *et al.*, 1995). Spoilage of food was enhanced in temperature of 10 - 35°C, at pH 2 - 9, moisture and unsanitary measures obtained by the workers in meat shops causing bacteria, yeast and mould growth (Jakobsen and Narvhus, 1996).

Freezing temperatures dose not kill all human pathogens especially mould which resist the cold temperature. Yeast and molds originated mainly from contaminated water and soil. Human hazards caused by yeast and moulds represented in production of mycotoxin, skin lesion, eye affection and allergy (Averkiewa, 2009 and Wafaa, 1995). This work was designed to detect the hygienic practice taken by retail meat workers in handling and processing of meat as well as the hazards caused by fungi to workers. In addition, examine the fungal contamination of frozen meat.

MATERIALS AND METHODS

Data and samples collection

Human samples

A total of 49 hand swabs were randomly collected from workers in different retail meat shops in Sohag Governorate. Data were collected from workers after their consent including health status (apparently healthy or symptomatic), hygienic practice during working and handling of food (periodical hand washing, periodical washing of articles and utensils, continuous freezing and thawing of frozen meat).

Meat samples

A total of 73 samples of frozen meat were randomly purchased from different retail meat shops in Sohag

Corresponding author: Dr. ALSHIMAA A. HASSANIEN

E-mail address: hassanien2008@yahoo.com

Present address: Department of Zoonoses, Faculty of Veterinary Medicine, Sohag University, Egypt

Governorate. Meat samples were homogenized with sterile saline in a sterile blender and the homogenate was used for mycological examination.

Isolation and identification of fungi

Hand swabs and prepared frozen meat samples were cultured on Potato dextrose agar supplemented with antibiotics, and then incubated at 25°C for 2-7 days. Fungal growth was morphologically and microscopically identified.

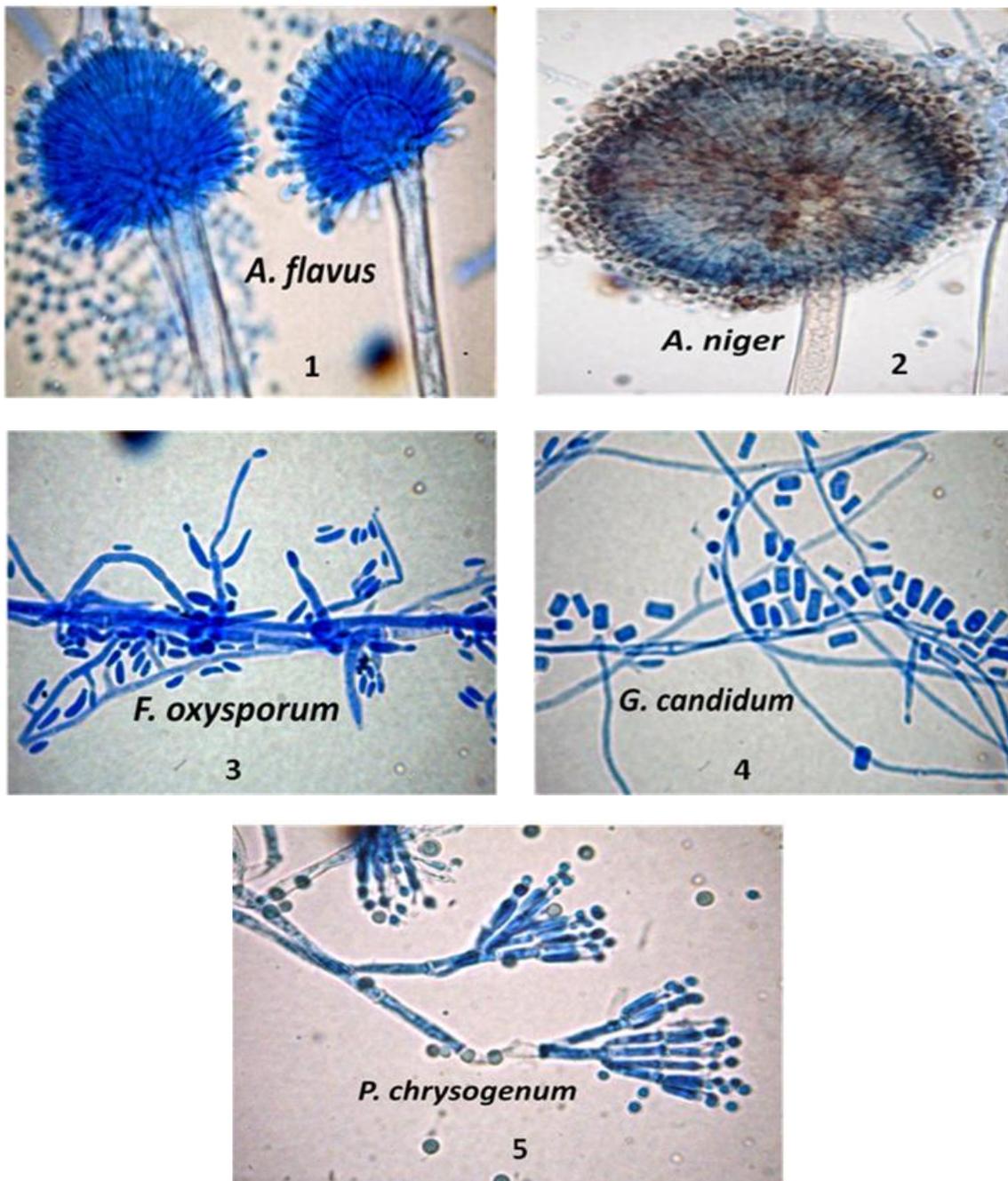
RESULTS

Table1: Health status and hygienic practice of retail meat workers and factors associated with fungal infection.

Risk factors	No. of examined workers	
	No	%
Health status		
Apparently healthy	35	71.4
Hand lesion	14	28.6
Hygienic practice		
Periodical hand washing		
Yes	16	32.7
Sometimes	17	34.7
No	16	32.7
Wearing gloves during meat handling		
Yes	11	22.4
Sometimes	7	14.3
No	31	63.3
Periodical washing of articles and utensils		
Yes	17	34.7
Sometimes	20	40.8
No	12	24.5
Continuous freezing and thawing of frozen meat		
Yes	38	77.5
No	11	22.4

Table 2: Frequency distribution of fungal species among retail meat workers and frozen meat samples.

Fungal species	Examined workers N/ 49		Examined frozen meat N/ 73	
	No	%	No	%
<i>Penicillium species</i>				
<i>P. corylophilum</i>	4	8.2	16	21.9
<i>P. jensii</i>	5	10.2	3	4.1
<i>P. expansum</i>	7	14.3	10	13.7
<i>P. oxalicum</i>	-	-	2	2.7
<i>P. chrysogenum</i>	5	10.2	6	8.2
<i>Cladosporium species</i>				
<i>C. cladosporioides</i>	7	14.3	19	26
<i>Fusarium species</i>				
<i>F. oxysporum</i>	10	20.4	10	13.7
<i>Aspergillus species</i>				
<i>A. flavus</i>	7	14.3	9	12.3
<i>A. niger</i>	9	18.4	11	15.1
<i>A. fumigatus</i>	5	10.2	12	16.4
<i>A. terreus</i>	-	-	1	1.4
<i>A. sydowi</i>	-	-	1	1.4
<i>Alternaria species</i>				
<i>Alternaria alternata</i>	2	4.1	4	5.5
<i>Geotrichum species</i>				
<i>G. candidum</i>	6	12.2	6	8.2
<i>Cryptococcus species</i>				
	5	10.2	5	6.8
<i>Candida species</i>				
	6	12.2	11	15.1
<i>Rhodotroula species</i>				
	-	-	1	1.4
<i>R. mucilaginosa</i>	1	2.04	1	1.4



Photos 1- 5: Some fungal species under light microscope stained with lactophenol cotton blue stain

DISCUSSION

The results in Table 1 revealed that 35 (71.4%) of retail meat workers were apparently healthy and 14 (28.6%) showed lesions in their hands as peeling of skin in the palm of hands, around the nail and between fingers. Some workers suffered from Paronychia and hand eczema. The majority of workers did not wear gloves during meat handling (63.3%), also, some workers preferred to wash their hands periodically (32.7%). Although washing hands is a good practice, keeping hands wet for long time increased the chance of fungal growth. So, wearing

gloves is better as it keeping hands dry and prevent fungal invasion into the blood in case of skin lesion affection.

Workers used to clean their shops, articles and utensils only with water and they lack the knowledge of using disinfectant, as well as most of them wearing dirty clothes. Some articles as meat mincing machine was cleaned only once daily, this practice leads to accumulation of organic matters for long time inside the machine and enhancing the growth of pathogens. Moreover, may disseminate these pathogens to other minced meat and reducing its quality (Cenci-Goga *et al.*, 2005).

Concerning freezing and thawing of meat, most of workers (77.5%) have this habit. This explained by that frozen meat mostly sold as minced or sliced meat; therefore upon request, workers get it out of a freezer and left it at room temperature to thaw to be easy for mincing and cutting, then they return it back to deep freeze. Holding food at room temperatures exposed to air, dust and microorganisms as yeast, mold and bacteria causing rapid food spoilage. Microbial growth in food depends on pH level, chemical structure of food and environmental conditions as relative humidity and temperature (Ashrae, 2006).

The most common fungal zoonoses were ranged from mild (self limited) to fatal diseases especially in individuals with poor immunity. Among these fungi; some species of *Penicillium*, *Candida*, *Cladosporium*, *Fusarium*, *Aspergillus*, *Cryptococcus*, *Rhodotroula* and *Alternaria*. *Penicillium species* are soil saprophytes, upon entry into the body of the host, it secretes phosphatase enzyme which enabling them to survive in the macrophage. It affects different organs as lung, liver, spleen, skin and bone marrow. The severity of infection associated with the health status of the host (Samanta, 2015), while pathogenic species of *Cladosporium* causing symptoms as skin lesion, allergy, eye affection, sinusitis, pulmonary affection and asthma (CDC, 2015).

Candida species are commensally inhabit the digestive tract and vagina of healthy individuals. It is responsible for onychia with paronychia especially for those hands immersed for long time in water. Although candidiasis mainly limited to mucocutaneous form, systemic infection may occur through hematogenous transmission (Acha and Szyfres, 2006). Whereas, some *Fusarium species* cause superficial lesions as keratitis, locally invasive lesions, or disseminated infections. Also cause allergic diseases and mycotoxicosis in humans and animals after ingestion of contaminated food by toxin producing *Fusarium species* (Nelson *et al.*, 1994).

Aspergillus species was saprophyte on air, soil and vegetables. Human and animals get infected by inhalation of fungal spores or ingestion of mycotoxins which produced by different *Aspergillus species*. After inhalation, conidia of fungal spores were engulfed by tracheal and nasal epithelial cells but most of them are killed by phagolysosome. Lung injuries act as a major factor for invasion of Aspergillosis. Therefore, it is common in patients with chronic diseases as tuberculosis, cancer and diabetes, also in those with prolonged antibiotic usage especially for lung diseases and in hematological malignancy patients. Occupationally exposed persons to fungal spores for long time were also more susceptible to Aspergellosis infection (Torres *et al.*, 2003).

Table (2) illustrated the fungal species which isolated from human swabs and frozen meat samples. The results indicated that *F.oxysporum* were the most prominent fungal species in workers hands with percentage of 20.4%, followed by *A.niger* (18.4%), *P. expansium*, *Cladosporium cladosporioides* and *Aspergillus flavus* (14.3%), *G. candidum* and *Candida species* (12.2%), *P. chrysogenum*, *Aspergillus fumigates*, *Cryptococcus species* and *P.jensii* (10.2%) and *P. corylophilum* (8.2%). This result is lower than the results reported by Allam *et al.* (2016). This difference may be associated with hygienic practice taken by the workers, the type of handled food and weather temperature. Presence of different fungal species in human hands may affect on the human health especially in case of systemic mycoses infection. Also, disseminate the infection to all utensils and articles as well as to the handled meat.

Cryptococcus inhabits avian excreta and transmitted to human through inhalation or precutaneous route (Samanta, 2015). Their presence in retail meat shops explained by that most of shops have live poultry cages such as pigeon, chicken, rabbits and duck. Poultry excreta were loaded with fungi which disseminated with air and contaminate all utensils and articles inside the shop as well as workers hands. Up to 80 species of *Alternaria*, *Alternaria alternata* and *Alternaria infectoria* are the most common human pathogens. It causes asthma, sinusitis, pneumonia, keratitis and granulomatous lung disease in immunocompromised patients (Santiago *et al.*, 2010).

Concerning fungal contamination of frozen meat, *Cladosporium cladosporioides* represented the highest contamination rate (26%), followed by *P. corylophilum* (21.9%), *Aspergillus fumigatus* (16.4%), *Candida species* and *Aspergillus niger* (15.1%), *P. expansium* and *F. oxysporium* (13.7%), *Aspergillus flavus* (12.3 %), *P. chrysogenum* and *G. candidum* (8.2 %), and *Cryptococcus species* (6.8%). As reported by Campbell *et al.* (2013); *Cladosporium cladosporioides* can grow in temperature ranged from - 10 °C to - 3 °C and *P. corylophilum* grow well in - 5°C, so this explain their presence in frozen meat with highest contamination rate. Our results incompatible with the results of Mansour *et al.* (1994) and Nahed, (1999) who detected *Aspergillus species* as a predominant fungal species in frozen meat and El-Katieb and Abd El-Rahman, (1989) who detect *Penicillium species* as a predominant mold species. This diversity may be related to the origin of the imported frozen meat; also, meat may be contaminated during transportation for long time under unsuitable temperature.

As reported by Mansour *et al.* (1991); freezing temperature up to - 8°C didn't kill most of fungi species and not stop their growth. Also, contamination of frozen meat may be caused by

improper handling and processing in retail meat shops; our results reported that most of workers not follow the hygienic practice during handling of meat; in addition, presence of live poultry in meat shops will increase the chance of fungal contamination from the excreta of these birds. Therefore, workers in retail meat shops should be subjected to regular health and veterinary inspection and live poultry should not be sold in retail meat shops.

CONCLUSION

Workers in retail meat shops should follow strict hygienic measures during handling and processing of frozen meat. Workers should wear gloves during meat handling, store frozen meat at a suitable temperature and prevent freezing and thawing of meat to stop fungal growth, also clean and disinfect all articles and utensils.

REFERENCE

- Abd El-Rahman, H.; Youssef, H. and Hefanwy, Y. (1995):* Mycological quality of meat products in Egypt. *J. Assiut Vet. Med.*, 12: 153.
- Acha, P. and Szyfres, B. (2006):* Zoonoses and communicable diseases common to man and animals. Bacterioses and mycoses, 3rd ed. WHO, Geneva, P: 315-320.
- Allam1, H.; AlBatany, M.; Seif, A. and Awad, E. (2016):* Hand contamination among food handlers. *J. British Microbiology Research*, 13(5): 1-8.
- Ashrae (2006):* Handbook of Refrigeration. Atlanta: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
- Averkiewa, O. (2009):* Mycotoxins in grains harvested in 2008: wheat. Kemin Industries, Inc.
- CDC (2015): Cladosporium.* Available at: <https://www.cdc.gov/fungal/diseases/other/cladosporium.html>
- Cenci-Goga, B.; Ortenzi, R.; Bartocci, E.; Codega, A.; Clementi, F. and Vizzani, A. (2005):* Effect of the implementation of HACCP on the microbiological quality of meals at a university restaurant. *Foodborne Pathogens Dis.*, 2: 138-145.
- Campbell, C.; Johnson, E. and David W. (2013):* Identification of pathogenic fungi (2nd ed.). Chichester, West Sussex: Wiley-Blackwell. pp. 100–109.
- EL-Khateib, T. and Abd El-Rahman, H. (1989):* Mold and yeast hazard in frozen ground beef. *Assiut Vet. Med. J.* 21, 41: 123-128.
- Jakobsen, M. and Narvhus, J. (1996):* Yeasts and their possible beneficial and negative effect on the quality of dairy products. *International Dairy J.*, 6: 755-768.
- Mansour, N.; Yassien, N.; Darwish, A. and El-Sherif, A. (1991):* Psychrotrophic spoilage molds in imported frozen beef cuts. *Vet. Med. J. Giza.* 39: 209-219.
- Mansour, N.; Yassien, N. and El-Sherif, A. (1994):* Mycoflora of imported frozen beef. *Vet. Med. J. Giza.* 42,1: 89-94.
- Nahed, M. (1999):* Mycological status of meat and some meat products. PhD thesis, faculty of Vet. Med. Assiut University.
- Nelson, P.; Dignani, M. and Anaissie, E. (1994):* Taxonomy, biology, and clinical aspects of *Fusarium species*. *Clin. Microbiol. Rev.*, 7: 479-504.
- Samanta, I. (2015):* Cutaneous, subcutaneous and systemic mycology. *Veterinary mycology*, Springer India, p: 91-102.
- Santiago, F.; Serra, D.; Vieira, R.; Brites, M. and Figueiredo, A. (2010):* Successful cryotherapy for a cutaneous alternariosis in a renal transplant recipient. *Eur. J. Dermatol.*, 20, e841.
- Torres, H.; Rivero, G.; Lewis, R.; Hachem, R.; Raad, I. and Kontoyiannis, D. (2003):* Aspergillosis caused by *non-fumigatus Aspergillus species*: risk factors and in vitro susceptibility compared with *Aspergillus fumigatus*. *Diagn. Microbiol. Infect. Dis.*, 46: 25–28.
- Tournas, V.; Michael, E.; Philip, B.; Herbert, A. and Ruth, B. (2001):* Yeasts, Molds and Mycotoxins. *Bacteriological Analytical Manual Chapter 18.* Available at: <http://www.fda.gov/Food/FoodScienceResearch/LaboratoryMethods/ucm071435.htm>
- Wafaa, W. (1995):* Studies on frozen meat as a possible source of occupational infections. *Vet. Med. J.*, 43(1): 65-70.

أهمية الممارسات الصحية للعاملين بمحلات اللحوم وتأثيرها على صحة العاملين وتلوث
اللحوم المجمدة بالفطريات

الشيماء أحمد حسنين ، ناهد محمود عبد العزيز

Email: hassanien2008@yahoo.com Assiut University web-site: www.aun.edu.eg

أجريت هذه الدراسة لتحديد الممارسات الصحية أثناء تداول اللحوم للعاملين بمحلات التجزئة، وكذلك المشاكل الصحية التي تسببها الفطريات لهؤلاء العاملين بالإضافة الى تحديد مدى تلوث اللحوم المجمدة بالفطريات في محلات بيع اللحوم المختلفة في محافظة سوهاج. وقد أوضحت النتائج أن 16 (32.7%) من بين 49 عامل يقومون بغسل ايديهم بشكل دوري، 31 (63.3%) لا يرتدون قفازات أثناء التعامل مع اللحوم، 38 (77.5%) يقومون بإذابة اللحوم وإعادة تجميدها مرة أخرى ، 35 (71.4%) ظاهريا بصحة جيدة و 14 (28.6%) يعانون من التهابات جلدية مختلفة. وقد سجلت الفيوزاريم أوكسيبورم أعلى نسبة في أيدي العمال بنسبة ٢٠.٤% ، بينما الكلاوسبوريم كلاوسبورويدز سجلت أعلى نسبة في اللحوم المجمدة بواقع ٢٦% من بين ٧٣ عينة لحوم مجمدة. عدم اتباع الاجراءات الصحية لبعض العاملين بمحلات اللحوم يؤدي الى اصابة العاملين بالفطريات وكذلك تلوث اللحوم المجمدة بالفطريات المختلفة.