Microbiological Examination of some Imported Canned and Frozen Foods

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Abstract

A number of juices, jams, canned foods and frozen fishes available in local markets were inspected with respect to microbial contamination. We have determined the total viable bacterial cell counts in these samples and the number of g(-) lactose fermentors as a bacterial indicator of food spoilage.

The results indicated that most of the food items inspected, were contaminated with large numbers of different species of g(-) ,g(+), yeast and fungi and some were contained more than the maximum permissible number of pathogenic g(-) enteric E-coli, which render these food items unsafe for human consumption.

Introduction

Food spoilage has been an important problem throughout human history. Finding ways to overcome this problem was crucial as communities becomes larger and individuals no longer grew their own food, some kind of system was needed to maintain the nutrient content of various stuffs for long period of time and prevent them from rotting and becoming inedible due to spoilage caused by growth of microorganisms primarily bacteria and fungi(1). Controlling food microorganisms is an issue of great economic and health importance in todays global markets(2). The major source of the bacteria in the environment is probably the feces of infected humans, but there may also be animal reservoirs, feces and untreated water are the most likely sources of contamination of food(3).

Canning is a method of food preservation involving heat. It increase the length of time that a food can be stored at room temperature, during the heating processes certain microorganisms that cause food spoilage are destroyed(4). Canning is used to preserve a wide variety of foods, including soups, sauces, fruits, vegetable, juices, meats, and some milk products(5). Canning preserve food by heating it in airtight vacuum-sealed containers. The can is filled with foods, air is pumped out of the space remaining at the top of the can to form a vacuum. This process removes oxygen, destroy enzymes involved in food spoilage and kill most microorganisms that may be present in the food(6).

Food-borne illness is a major threat to the public, that can be prevented with proper care and handling of food products, it is estimated that between 24 and 81 million cases of food-borne diarrhea disease occur each year in the United States, costing between $5 billion and $17 billion in medical care and lost productivity(3). Bacteria related food poisoning is the most common. More than 90% of the cases of food poisoning each year are caused by Staphylococcus aureus, Salmonella spp., Clostridium prefringens, Campylobacterium, Listeria monocytogenes, vibrio parahaemolyticus, Bacillus cereus, and Entero-pathogenic E-coli. These bacteria are commonly found on many raw foods. Normally a large

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number of food-poisoning bacteria must be present to cause illness(3,7).

The strain of E-coli 0157:H7 according to national center of disease control and prevention (CDC) is the most worrisome food-related threat to public health, it takes very small(microscopic) amount to cause serious illness or even death. According to CDC estimation, E-coli 0157:H7 bacteria are responsible for at least 20.000 cases of sever food-borne illness in the United States(8). Unfortunately, there is no official statistics concerning the cases of food-borne diarrhea disease in Iraqi people caused by specific strain of enteropathogenic E-coli or other diarrhea causing pathogenic bacteria.

While there is no way to provide absolute safety in food products measurement of risk to an appropriate level is possible and achievable. It is possible to determine a maximum frequency of concentration of microbiological hazards in food that would be considered appropriate in terms of consumers protection(9).

Tradesman import to Iraq different varieties of fresh, frozen and canned food products from abroad and overseas countries without regular inspection and monitoring of food sources from heavy metals, radioactive materials or microbiological point of view.

The purpose of this study is to inspect some of the imported frozen and canned food products in the markets from the microbiological point of view.

Materials and Methods

1. food items

The following bottled sterilized juices and canned foods were purchased from the local markets during 2006 in triplicate numbers Grape juice, Apple juice, Orange juice, Strawberry juice, Apple jam, Peach jam, pasteurized milk, canned tuna, canned bean, canned pea, Tomato paste, and four types of frozen fishes, fresh water carp, marine mackerel, trout and yellow perch.

2. microbiological Examination of juices and cans content:

The methods of Warren,L.Landry,etal(7) were followed to determine the Microbial counts in canned food. Cans were opened aseptically in vertical Laminar flow hood. Can opener was sterilized by flaming until it is red.

Thirty milliliter(ml.) of juices is removed aseptically by sterile pipette, or 30 gram of the solid pieces of the can content is removed by sterile spatula and added to 70 ml. of sterile saline, shaked vigorously to homogenize the liquid or solid samples. Then serial decimal dilutions were made from the samples, and one ml. from the proper dilutions were spread on petri dishes containing nutrient agar, MacConkey agar or Sabouraud's dextrose agar (SAB). All the petri dishes were incubated at 37ºC for 24-48 hrs. After the end of the incubation period, the number of colonies were counted, then the total number of bacteria per ml. of the original juice samples or per gram of can content were calculated. Gram staining also were made from these colonies to determine the types of bacteria and gram stain reactions.

The colonies which were grown on MacConkey agar were inoculated on Eosin-Methylene blue agar (EMB), and incubated at 37ºC for 24-48 hrs to determine the g(-) enteric E-coli. Gram straining was made from the colonies appeared on EMB.

The colonies from EMB agar were incubated on to the lactose broth containing Durham's tubes and incubated at 37ºC for 24-48 hrs to determine the fermentation of lactose and production of gases.

3. microbiological Examination of frozen fishes

a. Skin:

One centimeter square (cm^2) of the skin was cut aseptically with sterilized knife

from the 4 types of frozen fishes and transferred separately to 4 different test tubes containing one ml. of saline. Agitated vigorously and 0.5ml. is spread on N.A and MacConkey agar plates, the plates then incubated at37ºC for 24-48 hrs(14).

b.Gills:

Swabs from the gills were homogenized vigorously in one ml. of saline, and 0.5ml. portion was spread on MacConkey agar. The other portion was serially diluted and 0.1ml. from the suitable dilution was spread on N.A, and all the plates were incubated at37ºC for 24-48 hrs(14).

4. microscopic Examination

Direct smears from content of each can or bottled juices after culturing were prepared, dried fixed and stained with gram stain and examined under compound microscope to determine the types and staining reactions of the bacteria present(7).

Results and Discussion

The results were listed in Table 1 and Table 2 . Table 1 shows the mean number of enteric lactose fermentor colonies in triplicate samples of some juices and jams and canned foods.The number of g(-), lactose fermentors isolated ranges between 5cell/gm in pea to 133cell/gm in peach jam. And the number of g(-) lactose fermentors in most of the food items analyzed in Table 1 exceeding the maximum permissible number (10cell/gm)(15) except apple juice, bean and pea, where the number of g(-) lactose fermentors were with in the maximum permissible number in canned foods. Strawberry juice and pasteurized milk showed confluent growth of yeast and fungi, which also indicate that, these food items were spoiled and are unsafe for human consumption. Cultural examination on macConkey agar, EMB and lactose broth, as well as microscopic examinations indicate the presence of g(-) bacilli, most likely to be E-coli. However all the labels on these juice bottles and food cans did not indicate that these food items were expired.

Bacteria occationally have been observed to contaminate fruits and vegetables. E-coli 0157:H7 was found to contaminate apple juices (11). And invade the inner tissues of radish sprout(12) and lettuce(13), highlighting the importance of thoroughly washing fresh fruits and vegetable prior to consumption.

Canning food are popular become they are already partially prepared and cooked, can be stored without refrigeration for long time and generally low in cost. However, because of the high temperature required for sterilization, canning affect the color, texture, flavour, and nutrient content of food especially, water soluble vitamins like thiamine, riboflavin and Vit.C(5). Mumtaz(10) indicated that the advantages of canning process compared to other preservation techniques is that in canning the stable vitamins are retained and color and flavor of food items is retained better, it makes the starches and proteins in food easier to digest.

Four types of imported frozen fishes were also studied with regard to microbial burden. Table 2 represent the total viable number of bacteria present on the skin and gills, and the total number of g(-) enteric lactose fermentors present in gills of fresh water carp, mackerel, trout and yellow perch. The total viable number of bacteria per cm^2 on the skin of carp, mackerel and perch were between 7×10^2-8×10^2, whereas huge numbers of bacteria was detected per cm^2 on the skin of trout and gills of all the fishes studied. These numbers are well within the expected number of commensal bacteria as indicated by Hoarsely 1977(14).

Our study also indicated the absence of g(-) lactose fermentors (enteric E-coli) in the gills of fresh water carp, trout and yellow perch, while mackerel showed large number of enteric E-coli (74cell/gm) that is much more than maximum permissible number (4cell/gm) (15) for human consumption

Microscope examinations of colonies grown on N.A and MacConkey agar isolated from skin and gills showed different forms of g(-) bacilli, g(+) bacilli yeast and fungi.

The large number of bacteria grown in the gills of all types of fishes compared to skin constitute a health hazard to the consumers, and might indicate the contamination of these fishes from nearby contaminated rivers and bays with plant discharges, dead animal bodies and sewage discharge or may due to contamination during transportation and handling etc.

Histamine intoxication is the best known sanitary problems of food-borne disease associated with eating fish(16). Histamine forms in a variety of food, including raw fish, fermented meat, and fish products(17).while histamine in fermented products such as wine, chease, fish sauce is produced by g(-) lactic acid bacteria. Histamine in raw fish products is caused mostly by g(-) enteric bacteria such as Klebsiella spp. And Enterobacter spp. during decomposition of fish such as tuna and mackerel, histamine forms in significant amount due to bacterial decarboxylation of histamine present in the muscle tissues(18,19).

Providing a safe food products is a complex process requiring process and products control throughout the entire food system from production to consumption. Multiple meaningful performance criteria may be necessary at different stages in food chain to achieve a desired food safety objectives(9).

United kingdom agencies perform a regular pathogenic monitoring on canned food and monitoring food sources as well as subtyping of animals retail foods.(20,21).

We recommend establishing a food administration office responsible for protecting public health through a regular monitoring of food source on imported frozen and canned food and ensuring that foods are safe, wholesome, sanitary and properly labeled, and it oversees all domestic and imported foods sold in Iraq.

Table 1: Numbers of lactose fermentor colonies grown on MacConkey Agar per milliliter of juices or per gram of canned food.

Food item	Total no. of lactose-fermentor colonies
Grape juice	21cells/ml.
Orange juice	18cells/ml.
Apple juice	8cells/ml.
Strawberry juice	Confluent growth of yeast
Apple jam	50cells/ml.
Peach jam	133cells/ml.
Pasteurized milk	Confluent growth of yeast & Fungi
Canned tuna	32cells/ml.
Bean	7cells/ml.
Pea	5cells/ml.
Tomato paste	28cells/ml.

N.B. The number of lactor fermentors represent the mean number of Triplicate sample.

Table 2: Total number of bacteria grown on NA and no. of lactose fermentors grown on MacConkey agar from skin and gills of frozen fishes.

Types of frozen Fishes	Total no. of bacteria/cm^2 of skin grown on N.A	No. of lactose fermenter/ml. From gills grown on Mac.A.	Total no. of Bacteria/ml on gills grown on N.A
1. Fresh water Carp	700	Nil.	Confluent growth
2. Mackerel	780	75	Confluent growth
3. Trout	Large No.	Nil.	Confluent growth
3. Yellow perch	770	Nil.	Confluent growth

N.B. The number of colonies represent the mean number of Triplicate Sample.

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الفحص الجرثومي لبعض الأغذية المستوردة المعلبة والمجمدة

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الخلاصة :

فحص عدد من نماذج العصائر والمربيات والأغذية المعلبة والأسماك المجمدة المتوفرة في الأسواق المحلية من ناحية التلوث الجرثومي. وحسب العدد الحي للخلايا الجرثومية في هذه النماذج إضافة إلى عدد الجراثيم السالبة لصبغة جرام المخمرة لسكر اللاكتوز كإشارة لفساد هذه الأطعمة من الناحية الجرثومية.

أشارت النتائج إلى أن معظم الأغذية التي خضعت للفحص الجرثومي كانت تحتوي على نسبة عالية من أنواع مختلفة من الجراثيم السالبة لصبغة جرام والموجبة لصبغة جرام والخمائر والاعفان. بعض هذه الأطعمة كان عدد الجراثيم من نوع الاشريشيا القولونية اكبر من العدد المسموح به دولياً بحيث أصبحت هذه المواد الغذائية غير صالحة للاستهلاك البشري .