Egypt. J. Chem. **Vol. 65**, No. 5 pp. 319 - 324 (2022)

Egyptian Journal of Chemistry

http://ejchem.journals.ekb.eg/

Incidence of some pathogens in beef burger sold in Cairo

Moustafa A.El-Shenawy*,Zeinab I. Sadek, Samy Mohamed Abdelhamid, Mohamed T. Fouad

Department of Dairy Science, Division of Food Industries and Nutrition, National Research Centre, 12311 Dokki, Giza, Egypt

Abstract

Thirty burger samples were randomly collected from food shops super marks in Great-Cairo governorate. Samples were microbiologically investigated for the presence of some pathogenic microorganisms including *Staphylococcus aureus, Escherichia coli* 0157:H7, ***Salmonella*** *typhimurium, Yersinia enterocolitica* and ***Bacillus*** *cereus*. *Staphylococcus aureus* and *Bacillus cereus* were detected in 60% of the examined samples with an average counts of $14x10^2$ and $5.1x10^2$ cfu/g. however, ***Escherichia coli*** 0157:H7, *Salmonella typhimurium* and ***Yersinia enterocolitica*** were detected in 50, 50 and 40% of the examined samples, with an average counts of $12x10^2$, $4.8x10^2$ and $5.1x10^2$ cfu/g respectively. Eighty -five isolates of pathogenic bacteria including 20 isolates each of *Bacillus cereus* and ***Staphylococcus*** *aureus* as well as 15 isolates each of *Escherichia coli* 0157:H7, *Salmonella typhimurium* and *Yersinia enterocolitica* were purified and identified following the biochemical identification tests (Bergey's Manual). Only 56 out of the testes 85 isolates were confirmed as pathogenic species using Hi identification kits and latex test kits. The obtained results indicated that these foods may pose a source of infection to the consumer. Measures to control the quality of the raw material, environmental and hygienic conditions during preparation and serving should be taken.

Keywords; Super-markets; Egyptian sausage; microbiological analysis; pathogens.

Introduction

Meat and meat products are among the most important protein sources in the daily diet of people living in developed countries. Beef burger is almost the most popular meat product consumed by millions of people from all over the world. The common processes (such as mincing, cooking, and salt addition) applied in the production of burgers enhance the formation of reactive oxygen species; therefore, the resultant product is highly vulnerable to oxidation [1, 2].

The increasing number and severity of food poisoning outbreaks worldwide has considerably increased public awareness about food [3], especially meat and meat products which are one of the most important sources of human infections with a variety of foodborne pathogens [4,5]. However, meat and meat products continues to be an important food group in the diet for many consumers [6-8], *Staphylococcusaureus* is considered to be one of the most important foodborne diseases worldwide due to its ability to produce wide arrays of toxins[9,10]. Meat products like luncheon, burger and minced meat are considered important sources of pathogenic *Salmonella* spp. which caused sever gastroenteritis in human, especially products manufactured from raw and minced meat and not subjected for heat treatment [11]. *Yersinia enterocolitica* in meat and meat products is a special concern since those organisms are capable of growth at refrigerator temperatures [12].*Yersinia enterocolitica* is by far the most frequent cause of yersiniosis worldwide. Yersinia

*Corresponding author e-mail: elshenawy_moustafa51@yahoo.com (Moustafa A.El-Shenawy).
Receive Date: 12 October 2021, Revise Date: 24 October 2021, Accept Date: 31 October 2021
DOI: 10.21608/ejchem.2021.100669.4677

enterocolitica occurs in several biotypes and serotypes, which differs in pathogenicity to humans, geographical distribution and animal reservoirs [13,14].

B. cereus occurred in 98% of test minced meat, 60% of sausage, 48% of rice grains, 44% of Koshari or ice-cream and 36% of pasteurized milk samples. [15]. Shehu and Adesiyun [16] reported 39.5% of milk to be positive for *E. coli*. Enterotoxigenic *Escherichiacoli* has been involved in food-borne illness and recovered from various food types, processed or raw [17]. Microbial food safety is an increase in public health concern worldwide. It is estimated that approximately 76 million foodborne illness occurring in the united states every year [18,19]. Contaminated, raw or undercooked poultry and red meats are particularly important in foodborne diseases. Microorganisms in fast and traditional fast foods are responsible for many human diseases. *Salmonella* is common cause of foodborne illness, particularly in chicken and undercooked eggs [20, 21], whereas *Listeria* spp. is common from chilled and frozen foods. Other foodborne microorganisms include *Camphylobacter*spp, *Staphylococcus* spp., *E. coli* and *Yersinia* spp., whose incidence was reported by Kaneko *et al*. [22] and Pelczar*et al*. [23, 24]. Consequently, this work has been done to evaluate the general bacteriological condition of the burger product sold in the Egyptian market.With a focus on the feasibility of the presence of some pathogenic microbes including *Staphylococcus aureus* counts, *Escherichia coli* 0157:H7, *Salmonella typhimurium, Yersinia enterocolitica* and *Bacillus cereu*s in order to give a general idea of the health and safety condition of this food product.

Experimental

Three samples from 10 different food shops super markets in Great-Cairo governorate including (Bulak, Giza, Dokki, Ramsis, Bin El-Sarayat, El-Saeda, Ain-Shams, Attaba, Misr El-Gadida and Moasasa) were collected. The samples were handled in sterile plastic containers and transferred to the laboratory in ice-box within 2h of collection.

Samples preparation:

Twenty-five gm. of each sample was mixed, homogenized in sterile mixer and diluted with 225 ml buffered peptone water .Ten-fold dilutions of homogenates were prepared and subjected to all the microbiological analysis [25].

Microbiological Analysis:-

Ten-fold dilutions of the homogenates samples were inoculated onto plates of selective media. Enumeration of *Escherichia coli* O157: H7 was carried out by spreading 0.l ml of each dilution onto plates of sorbitol MacConkey agar medium and colourless colonies counts were done after 24 hrs incubation at 35º C incubation [26]. For detection of *Salmonella typhimurium* , (25g) of each sample was mixed with 225ml of sterile buffer peptone water and incubated at 35 ºC for 24 hrs. One to ten ml of this mixture was transferred to selenite cystein broth and incubated at 35 ºC for 72 hrs. Plates of *Salmonella &Shigella* ager were streaked from the last process and incubated at 35 ºC for 24 hrs. Growth of *Salmonella typhimurium* is appears as colorless colonies with black centers [27].

For *Yersinia,* Each sample (25 g) was homogenized and mixed with 225ml *Yersinia* selective enrichment in 500ml flasks. Flasks were incubated at 30 ºC for 48 hrs, and then spread onto plates of *Yersinia* selective agar medium. After 18-24 hrs incubation at 35 ºC, suspected colonies of *Y. enterocolitica* which appear form dark red colonies resembling bulls' eye were picked up and further tested for specific identification. Enumeration of *S. aureus* in samples was carried out by spreading 0.l ml of each dilution onto the surface of Baird Parker media supplemented with egg yolk and potassium tellurite solution. Plates were incubated at 37 ºC for 48 hrs, typical colonies, which appear gray-black, shiny and convex with a narrow white margin surrounded by a clearing zone, were counted [28, 29]. Suspected colonies were picked up and propagated for further specific morphological and biochemical tests.

Bacillus cereus was determined by the surface plating technique using the *Bacillus cereus* agar medium, supplemented with polymyxin B and egg yolk. Plates were incubated at 37 ºC for 48 hrs, a typical colony, which appears peacock blue-coloured and surrounded by precipitation zone were counted and tested for further specific identification [26].

Purification and Identification of the isolated strains:-

Three to five suspected isolates of each organism, isolated from each positive sample, were subjected for identification using the microscopic examination as well as their chemical and biochemical confirmation tests according to Bergy's Manual [30]. Additional kits used to help for accurate identification including Hi Staphylococcus identification kit, Hi *Staphylococcus* Latex test kit, Hi *E. coli* identification kit, Hi *E. coli* 0157 Latex test kit, Hi *Salmonella* identification kit and Hi *Salmonella* Latex test kit. All results of identification tests done for these isolates were compared with a specific reference strains obtained from ATCC.

References strains

Strains of *Escherichia coli* 0157: H7 ATCC *6933, Bacillus cereus* ATCC 33018*, Staphylococcus aureus* ATCC 20231, *Yersinia enterocolitica* ATCC 27729 and *Salmonella typhimurium* ATCC 14028were obtained from the Department of Dairy Science, National Research Centre, Cairo, Egypt. The abovementioned strains were served as reference indicators for comparison among the tested strains.

Results and discussion

Meatand meat products are considered as a major vehicle of most reported food poisoning outbreaks. Therefore, it is important to use the microbiological criteria as it gives guidance on the acceptability of burger samples and their manufacturing, handling and distribution processes. The incidence of different pathogens in the burger samples in present study were presented in table 1.

The incidence of *Escherichia coli* 0157: H7 in the burger samples was high in the present study, in this work, this organism was detected in 20% of total samples, where *Escherichia coli* 0157: H7 contaminated with counts ranged from $7x10^2$ to $21x10^2$cfu/g. (Table 1). Our results agreed with those obtained by Saleh et al. [31] and El-Dosoky et al. [32] they found that incidence (12%and 15%) in burger samples was reported by respectively, whereas very low incidence (5.12%) was reported by El Shrek and Ali (2012) [33] in cooked meat products.

The incidence of *Salmonella typhimurium* in burger samples was 50% total samples, where *Escherichia coli* 0157: H7 contaminated with counts ranged from $2x10^2$ to $11x10^2$cfu/g. El-Dosoky et al. [32] reported(10%) incidence of *Salmonella typhimurium* in beef burger. An incidence of 20% and 14% and 5.71% were reported by Edris [34], Mousa et al. [35] and Ibrahim et al. [36] respectively, which are far less than the incidence observed in the present study in the burger samples.

Staphylococcusaureus could cause food poisoning and if it grows in large numbers can leave toxins in the product, which may survive heating. It lives on the skins of humans and animals and can easily be transferred to food products. Table (1) showed that *Staphylococcusaureus* was detected in 60% of total samples of examined burger, where *Staphylococcusaureus* contaminated counts ranged from $2x10^2$ to $20x10^2$cfu/g. counts of $8.3x10^2$, $2.8x10^2$ and $1.05x10^2$ to $2.3x10^2$cfu/gm) were observed by Ali and Abd-El-Aziz [37], El-Mossalami et al. [38], and Min et al. [39] respectively, which were almost similar to the counts observed in the present study.

A rise in notified cases of food poisoning has occurred across the most of Europe and North America; in particular, in the incidence of microbial food poisoning of animal origin [40]. *Bacillus cereus* was detected in 60% of examined burger. The presence of this bacterium in meat has been widely reported in different parts of the world [41]. For example Mosupye and Von Holy [42], reported (22%) incidence of *B. cereus* in a related study in South Africa, however Ismail [43] reported higher incidences (48%) in beef and Lamb ready to eat foods. Also table (1) indicated the incidence of *Yersiniaenterocolitica* isolated from burger samples as 40%. Our results overlap those obtained by Mousa et al. [35], who found that the incidence of Yersinia *enterocolitica* isolated from meat product samples including beef burger, luncheon, pasterma and sausage were 46, 40, 54 and 34%, respectively. Most common sources for this microorganism could be in factories during preparation of the examined product.

Identification of the isolated pathogenic bacteria:

Table (2) summarizes the number of examined samples and the bacterial isolates detected, and their percentages. As shown in Table (2) all the selected 66 isolates of different pathogens bacteria were subjected to identification according to their morphological, physiological and biochemical characteristics as described in Bergy's manual of determinative Bacteriology [30].

Twenty typical isolate were picked up from Baird Parker media agar, 15 typical isolate were picked up from sorbitol MacConkey agar, 15 typical isolate were picked up from *Yersinia* selective agar medium, 15 typical isolate were picked up from *Salmonella &Shigella* ager and 20 typical isolate were picked up from *Bacillus cereus* agar medium. After Identification and confirmation, only 14 strains (out of 20) were found to belong to genus *Staphylococcus aureus*, representing 25% of the total strains (56), however the other 11(out of 15), 9(out of 15), 10(out of 15) and 12 (out of 20) isolates were belonged to *Escherichia coli* 0157:H7, *Yersinia enterocolitica*, *Salmonella typhimurium* and *Bacillus cereu*s, representing 20, 16, 18 and 21% of the total strains respectively.

Final assessment of burger product according to Egyptian Standards (ES: 1688/2005)

According to the microbiological specifications of the Egyptian Standards (ES: 1668/2005), this product should be free of all examined pathogens. Consequently, most of burger samples representing 73% of total samples were not accepted to the ES due to one or more of criterion, however the remain 27% of the burger samples were accepted. The result demonstrates the fact that the unhygienic and poor sanitary conditions under which the meat and meat products are handled and processed are not acceptable from sanitary point of view. It has further evidence that the undesirable

level of contamination which might have acquired from the environment and agents and to obtain wholesome, safe and sound meat products, the principles Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) must be adopted.

Conclusion

The results of this study indicate that hygienic conditions of burger were very poor and may constitute a considerable hazard to human health. Using of high quality raw materials, efficient heat treatment, adequate cleaning and sanitization of utensils may assist reducing this cross contamination.

Acknowledgment

This work was totally supported through the research project No. 12050306 funded by the National Research Center, Cairo, Egypt.

References

[1] D. Ladikos and V. Lougovois, (1990). "Lipid oxidation in muscle foods: a review," Food Chemistry, vol. 35, no. 4, pp. 295–314, 1990.

[2] Ghazya, O.A., M.T. Fouad, H.H. Saleha, A.E. Kholif, T.A. Morsy. (2021). Ultrasound-assisted preparation of anise extract nanoemulsion and its bioactivity against different pathogenic bacteria. Food Chemistry. 341:1-7.

[3] Forsythe, S. J. (2008). The Microbiology of Safe Food. Department of life sciences. Nottingham Trent Univ. ISBN: 978-0-470-99942-4.

[4] Norrung, B., Andersen, J. K., Buncic, S. (2009). Safety of Meat and Processed Meat. Food Safety and Nutrition. Pp.: 3-29.

[5] Fouad M.T, AmrMoustafa, Laila Hussein, RamyRomeilah, Mostafa Gouda. (2015). In-Vitro Antioxidant and Antimicrobial Activities of Selected Fruit and Vegetable Juices and Fermented Dairy Products Commonly Consumed in Egypt. Research Journal of Pharmaceutical, Biological and Chemical Sciences 6 (2): 541-550.

[6] Rosergant, M. W., Leach, N., Gerpacio, R. V. (1999). Alternative Futures for World Cereal and Meat Consumption. Proceeding of the Nutrition Society, 58 (2). Pp.: 219-234.

[7] Delgado, C. L. (2003). Rising Consumption of Meat and Milk in Developing Countries has created a New Food Revolution. J. Nutr.133 (11). 3907 – 3910.

[8] Speedy, A. W. (2003). Global Production and Consumption of Animal Source Foods. J. Nutr. 133. 4048-4053.

[9] Balaban, N., Rasooly, A. (2000). Staphylococcal enterotoxins. International J. F. Microbiol. Vol. 61. No. (1); 1–10.

[10] Argudín, M. Á., Mendoza, M. C., Rodicio, M. R. (2010). Food Poisoning and *Staphylococcusaureus* enterotoxins Toxins. Vol. 2. No. (7).: 1751–1773.

[11] Karmi, M. (2013). Prevalence of *Salmonella* in Meat Products. Fac. Vet. Med. Aswan Univ. Glob. Vet. 11 (5): 685-688.

[12] Johnson, J. L. (1998). Isolation and Identification of Pathogenic *Yersinia enterocolitica* from Meat and Poultry Products. USDA/FSIS Microbiology Laboratory Guidebook. 3rd Ed. Chap. (9): 1-28.

[13] European Food Safety Authority (EFSA) (2007). Scientific Opinion of the Panel on BIOHAZ on A Request From EFSA on Monitoring and Identification of Human Enteropathogenic *Yersinia spp*. The EFSA J. 595: 1–30.

[14] Abbas, H. M., Nadia M. Shahein, Nabil S. Abd-Rabou, Mohammed T. Fouad and Wafaa M. Zaky (2017). Probiotic fermented Milk Supplemented with Rice Bran Oil. International Journal of Dairy Science, 12, 204-2010.

[15] Saleh, Y.E.; EL-Fouly, M.Z.; Khalil, M.S. and Abo-State, M.A. (1993).Incidence and characterization of *Bacillus cereus* isolated from Egyptian foods. Qatar Univ. J., 13(1): 75-80.

[16] Shehu, L. M. and Adesiyun, A. A. (1990). Characteristicsof strains of *Escherichiacoli* isolated from locally-fermented milk (Nono) in Zaria, Nigeria. J. Food Protection53:574-577.

[17] Firstenberg, E. R. and Sullivan, N. M. (1997). EZ ColiRapid Detection System: a rapid method for the detectionof Escherichia coli 0157 in milk and other foods. Journalof Food Protection 60(3):219-225.

[18] Meng J, Doyle MP. (1998). Emerging and evolving microbial foodborne pathogens. Bulletin de l'InstitutPasteur.; 96(3):151-163.

[19] El-Shenawy, Moustafa, Mahmoud Abd El-Aziz, WagihElkholy and Mohamed T. Fouad (2016). Probiotic Ice Cream Made with Tiger-nut (Cyperusesculentus) Extract. American J. Food Technology, 11(5):204-212.

[20] Angelillo IF, Viggiani NM, Rizzo L, Bianco A. (2000). Food handlers and foodborne diseases: knowledge, attitudes, and reported behavior in Italy. Journal of food protection, 63(3):381-385.

[21] Abosereh N.A., Salem Abd El Ghani, Rasha S. Gomaa and Mohamed T. Fouad (2016). Molecular Identification of Potential Probiotic Lactic Acid Bacteria Strains Isolated from Egyptian Traditional Fermented Dairy Products. Biotechnology 15 (1-2): 35-43.

[22] Kaneko KI, Hayashidani H, Ohtomo Y, Kosuge J, Kato M, Takahashi K. (1999). Bacterial contamination of ready-to-eat foods and fresh

products in retail shops and food factories. Journal of food protection, 62(6):644-649.
[23] Pelczar MJ, Chan ECS, Krieg NR. (2006). Microbiology 5th edition. Tata McGraw-Hill Publishing Company Limited, New Delhi.
[24] El-Kholy, W., Azzat B. Abd El-Khalek, Sahar H.S. Mohamed, Mohamed T. Fouad and Jihan M. Kassem (2016). Tallaga Cheese as a New Functional Dairy Product. American J. Food Technology, 11(5):182-192.
[25] Hussein Ahmed Mohamed Saied, Mohamed TawfeekFouad, Mahmoud Abd El-Aziz, Nagah El NoemanyAshour and Esam Ahmed Mohamed Mostafa (2017). Evaluation of Physico-chemical Properties of Some Date Varieties and Yoghurt Made with its Syrups. J. Biol. Sci., 17:213-221.
[26] El-ShenawyMoustafa A., Rashed A. Zaghloul, Ibrahim H. Abbass, Amira I. Esmail and Mohamed T. Fouad (2016). Incidence of some epidemiologically relevant food-borne pathogens in street-vended sandwiches. Journal of Pharmaceutical, Biological and Chemical Sciences 7 (2), 468-474.
[27] Al-Dughaym, A. M., Altabari, G. F. (2010). Safety andquality of some chicken meat products in Al-Ahsamarkets-Saudi Arabia. Saudi Journal of Biological Sciences ، vol. 17, no. 1, 37-42.
[28] Mohamed Doha A., Minar Mahmoud Hassanein, Tamer M. El-Messery, Mohamed T. Fouad, Marwa M. El-Said, KaremFouda and Adel Gabr Abdel-Razek. (2017). Amelioration of Type 2 Diabetes Mellitus by Yoghurt Supplemented with Probiotics and Olive Pomace Extract. J. Biol. Sci., 17:320-333.
[29] Hussein H. A. & Mohammed T. Fouad&Khaled A. Abd El-Razik&Amal M. Abo El-Maaty& C. D'Ambrosio4 & A. Scaloni& A. M. Gomaa. (2020). Study on prevalence and bacterial etiology of mastitis, and effects of subclinical mastitis and stage of lactation on SCC in dairy goats in Egypt. 52:3091–3097.
[30] Neath, P.H.A.; Mair, N.s.; Sharpe ، M. Elizabeth and Holt, J.G. (2009). Bergy,s Manual Bergy,s Manual of Systematic Bacteriology. S (Eds.) Pub. Williams and Wilkins, 2605.
[31] Saleh EA, Ali HA, Abu-KhadraAM. (2010). Detection of some food poisoning microorganisms in some meat products. Alexandria Journal of Veterinary Sciences.; 31(1):27-33.
[32] El-Dosoky H, Shafik S, Baher M. Weam. (2013). Detetion of Spoilage and Food Poisoning Bacteria in Some Ready to Eat Meat Products in Dakahlia Governorate. Assiut Vet .Med J.; 59:138-55.
[33] El Shrek YM, Ali MRM. (2012). Microbiological study of spiced chicken burgers in Tripoli City, Libya,.
[34] Edris AM. (1993). Isolation and identification of *E. coli* and salmonella from ready-to-eat meat products. Zagazig Veterinary Journal (Egypt).
[35] Mousa MM, Awad HA, Yassien MM, Gouda HI. (1993). Microbial quality of some meat products. Veterinary Medical Journal, Cairo Univ. (Egypt).
[36] Ibrahim SM, Abdelgadir MA, Sulieman AME, Adam AB. (2014). Influence of Halal and non-Halal slaughtering on the quality characteristics of broiler chicken burger. Int. J. Food Sci. Nutr. Eng.; 4:113-117.
[37] Ali SFH, Abd-El-Aziz DM. (2011). Incidence of enterotoxigenic*Staphylococcus aureus* in some ready-to-eat meat sandwiches in assuit city with special reference to methicillin resistant Staphylococcus aureus strains. Assiut Veterinary Medical Journal; 57(129):95-106.
[38] El-Mossalami AH, Abd-El-Rahman AA, Magdy ME. (2008). A study on the effect of garlic and Nigella sativa on some food poisoning bacteria isolated from ready to eat meat sandwiches in Alexandria city. Assiut Vet. Med. J., 119(54):140-158.
[39] Min M, Dawson CO, Hussain MA. (2013). Microbiological Risk Assessment of Hamburgers Sold in Canterbury New Zealand. Internet Journal of Food Safety; 13:99-102.
[40] Miles, S.; Braxton, D.S. and Frewer, L.J. (1999). Public perceptions about microbiolo- gical hazards in food. British Food J., 101 (10): 744-762.
[41] Holds G, PointonA,Lorimer M, Kiermeier A, Raven G,sumner J. (2007). Microbial profiles of carcasses andminced meat from Kangaroos processed in South Australia Int. J. Food. Microbiol., 123: 88-92 .
[42] Mosupye FM, Von Holy A. (1999). Microbiological quality and safety of ready-to-eat street-vended foods inJohannesburg, South Africa. J. Food Prot., 62: 1278-1284.
[43] 29. Abou E.A. (1995). Bacteriological quality of ready to eat meals. J Egypt Public Health Assoc., 70: 627-41.

Table 1: Incidence of different pathogens in burger samples from different sources

No.	Source	E. c.	Sal.	Sta.	B.c.	Yers.
1	Bulak	7×10^2	6×10^2	18×10^2	3×10^2	Nil
		Nil	7×10^2	14×10^2	5×10^2	7×10^2
		Nil	Nil	Nil	Nil	Nil
2	Giza	9×10^2	5×10^2	Nil	Nil	Nil
		Nil	Nil	Nil	Nil	Nil
		Nil	Nil	16×10^2	3×10^2	5×10^2
3	Dokki	18×10^2	Nil	12×10^2	8×10^2	9×10^2
		Nil	3×10^2	Nil	7×10^2	Nil
		Nil	Nil	Nil	Nil	Nil
4	Ramsis	11×10^2	2×10^2	15×10^2	2×10^2	11×10^2
		12×10^2	6×10^2	17×10^2	6×10^2	Nil
		Nil	Nil	Nil	3×10^2	Nil
5	Bin El-Sarayat	16×10^2	Nil	2×10^2	Nil	Nil
		Nil	Nil	Nil	Nil	Nil
		Nil	3×10^2	9×10^2	7×10^2	3×10^2
6	El-Saeda	Nil	Nil	Nil	Nil	Nil
		12×10^2	4×10^2	17×10^2	5×10^2	8×10^2
		Nil	Nil	11×10^2	Nil	3×10^2
7	Ain-Shams	18×10^2	7×10^2	23×10^2	4×10^2	Nil
		Nil	Nil	Nil	Nil	Nil
		Nil	Nil	Nil	Nil	Nil
8	Attaba	10×10^2	Nil	14×10^2	6×10^2	10×10^2
		16×10^2	6×10^2	8×10^2	8×10^2	6×10^2
		9×10^2	3×10^2	13×10^2	4×10^2	Nil
9	Misr El-Gadida	Nil	5×10^2	17×10^2	Nil	3×10^2
		Nil	Nil	Nil	Nil	Nil
		13×10^2	Nil	Nil	4×10^2	Nil
10	Moasasa	21×10^2	4×10^2	12×10^2	2×10^2	Nil
		11×10^2	6×10^2	19×10^2	7×10^2	8×10^2
		13×10^2	5×10^2	16×10^2	5×10^2	4×10^2

Sta.=*Staphylococcus aureus;* E.C.= *Escherichia coli* 0157:H7; Yers.= *Yersinia enterocolitica*; Sal.= *Salmonella typhimurium; B.c. = Bacillus cereu*s

Table 2. Number of positive samples and isolates form burger samples

	No.	Sta.	E.c.	Yers.	Sal.	B.c.
Sausages samples	30	18* (60%)	15* (50%)	12* (40%)	15 * (50%)	18* (60%)
Total isolates	85	20 (23%)	15(18%)	15 (18%)	15 (18%)	20(23%)
Total strains	56	14 (25%)	11 (20%)	9 (16%)	10 (18%)	12 (21%)

Sta.=*Staphylococcus aureus;* E.c.= *Escherichia coli* 0157:H7; Yers.= *Yersinia enterocolitica*; Sal. = *Salmonella typhimurium* ;B.c. = *Bacillus cereu*s, () no. of isolates/ strains, *; positive samples