Alexandria Journal of Veterinary Sciences 2014, 40:87-94
ISSN 110-2047
www.alexjvs.com

Assessment Of Sanitary Measures Of Ras Cheese In Manufacturing Dairy Plant In Alexandria Governorate

Ahlam A. El-Leboudy, Amer A. Amer and Micheal R.Youssef
Food Hygiene Department, Faculty of Veterinary Medicine, Alexandria University

Key words:
Ras cheese, microbiological evaluation

ABSTRACT:

The assessment of sanitary measures of Ras cheese was undertaken through microbiological evaluation of cheese and its processing environments in traditional manufacturing dairy plant in Alexandria Governorate. A total of 215 representative samples include received raw milk (25), cheese curd (25), fresh Ras cheese (25), three months aged Ras cheese (25), and six months aged Ras cheese (25), As well as swabs from cheese vat (15), stainless-steel cylindrical forms (15), stainless-steel tables (15) and hand workers (15) were taken. Also (15) samples of rennet and (15) samples of annatto (coloring agent) were collected. The trials were repeated 3 times from 3 different patches within 6 months to ensure the most contaminated points. Raw milk was heavily contaminated as the mean values of total bacterial count , coliform count , S. aureus count and total mold & yeast count were $1.11 \times 10^7 \pm 2.45 \times 10^6$cfu/ml , $8.24 \times 10^4 \pm 1.68 \times 10^4$cfu/ml , $7.77 \times 10^2 \pm 4.33 \times 10^2$cfu/ml and $4.10 \times 10^2 \pm 2.0 \times 10^2$ cfu/ml, respectively .Meanwhile slight decline of all these counts was observed in curd samples . Then the counts increases again in fresh cheese samples specially Coliforms and S. aureus counts as follow $1.88 \times 10^3 \pm 8.13 \times 10$ cfu/gm and $1.64 \times 10^3 \pm 3.66 \times 10^2$ cfu/gm, respectively. Three aged cheese samples revealed slight reduction in Coliforms and S. aureus counts as follow $1.44 \times 10^2 \pm 2.14 \times 10$ cfu/gm and $8.41 \times 10 \pm 1.80 \times 10$ cfu/gm, respectively. Meanwhile, 6 months aged cheese samples showed great reduction of Coliforms and S. aureus counts as follow $0.2 \times 10 \pm 0$ cfu/gm and $2.66 \times 10 \pm 8.43 \times 10$ cfu/gm respectively indicating the fact that the prolonged aging of Ras cheese increases the safety of the product. Samples of rennet, Cheese vat, stainless-steel cylindrical forms and stainless-steel tables showed high contamination with TBC and Coliforms while hand workers swabs were harbored high S. aureus and Coliforms counts. Results posed that the most reliable sources of contamination along Ras cheese manufacturing line were received raw milk, rennet, vats, forms, tables as well as hand workers. Preventive measures and GMP these could be applied to improve the hygienic quality of Ras cheese were fully discussed.

Corresponding Author: mikola12001@yahoo.com

1.INTRODUCTION

Ras cheese is the main Egyptian hard cheese that is rather similar to the Greek, Kefalotyri cheese, where the name in both countries means "head". Ras cheese now is the most known and palatable hard cheese in Egypt and all over the Arab world (Abou-Donia, 2002). Ras cheese is valued for its portability, long life, and high content of fat, protein, calcium, and phosphorus. Ras Cheese is more compact and has a longer shelf life than milk and most of other dairy products.

Milk and milk products are highly perishable foodstuffs. They are excellent substrates for nutrition not only for humans and animals, but also for innumerable pathogenic and spoilage microorganisms. Although milk production methods have generally improved over the last few decades, the microbiological quality of some raw milk

supplies and milk products still cause concern (Robinson, 1993).

The main potential hazards in most dairy products are microbiological hazards and the dairy industry has increased its efforts for quality and safety assurance through the development and implementation of protective programs as HACCP and quality assurance system (Kassem *et al*., 2002).

The successful commercial production of dairy products requires control of microbiological presence and activity to achieve maximum shell-life consistent with safety of the product (pelcsznska and Libelt, 1995).

Food borne diseases are a common and widespread global problem. Several outbreaks have been reported as a result of eating contaminated dairy food that may look, taste and smell perfectly normal but are in fact contaminated with large number of harmful bacteria (CDC, 2009).

Handling of milk during cheese manufacture plays an important role in the proliferation of microbial flora and consequently impairs its utility and renders the product unfit for Human consumption (Yousef et al., 2001).

Coliforms are routinely used as indicator to ascertain the quality of the food products. Their presence indicates careless methods of production, handling of the processed food products and the use of insufficient sanitized equipment. Moreover, Coliforms are used to measure the quality of the practices used to minimize microbial contamination of dairy products and as an approved safety indicator in HACCP system (Banwart, 1998). High coliform in these products induce undesirable changes that lower their quality.

The presence of Staphylococcus aureus in dairy products is a good indicator of the personal hygiene of factory workers, presence of moulds and yeasts in dairy products is undesirable even when found in few numbers as they rapidly grow in the product that render it of inferior quality (Hamed, 1992).

Mould and yeast counts in cheese are used as an index of the proper sanitation and quality defects in soft cheese as rancidity, softness and color defects arise mainly from contamination by yeast and mould. Moreover, in view of the potential ability of some mould to produce mycotoxins during their growth thus, their presence poses potential hazards to food safety and human illness (Besancon et al., 1992).

Salmonella is one of the most important food-borne pathogens that can be transmitted through the consumption of contaminated milk and milk products. The severity of salmonellosis, which may result in death for some individuals, means that manufacturers need to detect contamination before food is released for sale (Mcclelland and Pinder 1994). Many contaminants find their way to raw milk, from which they gain access to dairy products from which they gain (Zeinab et al., 2009).

The Egyptian Organization for Standardization and Quality Control (ES, 1-1007: 2005) stipulated that Ras cheese should be produced from pasteurized milk or milk treated by heat equivalent to pasteurization. Also it should be free from pathogenic microorganisms and their toxins, free from E-coli, total coliform count should not exceed 10 cfu / gm, total mould count should not exceed 10 cfu / gm and total yeast count should not exceed 100 cfu / gm. The aim of this work to assess the sanitary measures in traditional Ras cheese manufacturing dairy plant in Alexandria governorate through the evaluation of its microbial criteria and also to suggest the suitable corrective measures that can be applied to produce safe and high quality product.

2. MATERIALS AND METHODS

The present study was carried out in traditional Ras cheese manufacturing dairy plant in Alexandria Governorate.

1-Process flow diagram of Ras cheese:

Receive draw milk $\xrightarrow[\text{cow and buffalo milk}]{\text{standrization of fat\%between}}$ cheese vat $\xrightarrow[35°C]{\text{heating up to}}$ Addition of liquid Rennet → Addition of Annato (coloring agent) $\xrightarrow[\text{for 45 min}]{\text{shut down heating}}$ leave for curdling $\xrightarrow[45 \text{ min}]{\text{after}}$ curd formation $\xrightarrow[\text{up to 45°C}]{\text{heating}}$ cutting and stirring $\xrightarrow[\text{for 45 min}]{\text{with continous heating,}}$ draining part of whey → addition of crystalline NaCl melted in the drained part of whey (6-8%) $\xrightarrow[45 \text{ min}]{\text{after}}$ Scalded Curd → transferred onto stainless-steel cylindrical forms lined with fine gauze on stainless-steel tables → mechanical pressing (24 – 48 hrs.) → Fresh Ras cheese → transferred onto wooden shelves $\xrightarrow[\text{for 3 months in suitable ventillation}]{\text{dry salting by crystaline NaCl}}$ →3 months aged Ras cheese → washing and drying of cheese blocks → packaging each 4 cheese blocks in Sackcloth $\xrightarrow[\text{at 4°C for 3 month}]{\text{refrigeration}}$ →6 months aged Ras cheese with shelf-life up to 18 months age.

2- Collection of samples:

2-1- Collection and preparation of samples: A total of 215 representative samples include received raw milk (25), cheese curd (25), fresh Ras cheese (25), three months aged Ras cheese (25), six months aged Ras cheese (25). As well as swabs from cheese vat (15), stainless-steel cylindrical forms (15), stainless-steel tables (15) and hand workers (15) were taken. Also (15) samples of rennet and (15) samples of annatto (coloring agent) were collected. The trials repeated 3 times from 3 different patches within 6 months.

2-2- Received raw milk: the samples were collected in sterile sampling bottles after through mixing of the bulk milk (about 250 ml each).

2-3- Ras cheese samples: Ras cheese samples (curd, Fresh, 3 months and 6 months aged cheese) were collected in sterile sampling jars (250 g each). Each sample thoroughly mashed with 2 % Sodium citrate solution in a sterile mortar and Ten-fold serial dilutions were prepared for microbiological examination.

2-4- Rennet samples: the samples were collected in sterile sampling bottles after through mixing of the bulk rennet jar (about 250 ml each) in sterile screw capped bottle.

2-5- Annatto samples: the samples were collected in sterile sampling bottles after through mixing of the bulk annatto jar (about 250 ml each) in sterile screw capped bottle.

2-6- Swab samples: samples from (cheese vat, stainless-steel cylindrical forms, Stainless-steel tables and workers' hands) were collected by swab contact method (Pritchard et al, 1994).

NB: All samples were collected under complete hygienic condition and transferred directly to the laboratory with a minimum of delay in an insulated ice-box (at 4±1°C) to be examined.

3- Microbiological examination:-

3-1- Determination of total bacterial count (ISO 4833/2003).

3-2- Determination of Coliforms count (ISO 1991)

3-3- Enumeration of Staphylococcus aureus (FDA, 2002)

3-4- Determination of Yeasts and Moulds count (Bailey and Scott, 1998)

3-5- Detection of Salmonella (ISO 6579/2002)

3. Results And Discussion

Table (1) Statistical analytical results of Total Bacterial Count and total Coliforms Count during processing steps of Ras cheese in a traditional dairy plant.

Item	Total Bacterial count	Total Coliforms Count
Received raw milk	$1.11 \times 10^7 \pm 2.45 \times 10^6$	$8.24 \times 10^4 \pm 1.68 \times 10^4$
Cheese curd	$1.24 \times 10^6 \pm 1.19 \times 10^6$	$4.15 \times 10^2 \pm 1.82 \times 10^2$
Fresh cheese	$1.15 \times 10^8 \pm 3.04 \times 10^7$	$1.88 \times 10^3 \pm 8.13 \times 10$
3 months aged cheese	$2.05 \times 10^5 \pm 1.03 \times 10^5$	$1.44 \times 10^2 \pm 2.14 \times 10$
6 months aged cheese	$1.04 \times 10^8 \pm 5.86 \times 10^7$	$0.2 \times 10 \pm 0$
Rennet	$1.70 \times 10^5 \pm 1.26 \times 10^5$	$5.33 \times 10 \pm 1.85 \times 10$
Annatto	$2.1 \times 10^3 \pm 5.3 \times 10$	-ve
Cheese vat	$1.66 \times 10^8 \pm 1.58 \times 10^8$	$1.78 \times 10^3 \pm 5.17 \times 10^2$
Stainless-steel forms	$1.24 \times 10^8 \pm 6.98 \times 10^7$	$2.13 \times 10^4 \pm 1.30 \times 10^4$
Stainless-steel tables	$1.49 \times 10^8 \pm 6.89 \times 10^7$	$8.73 \times 10^3 \pm 5.06 \times 10^3$
workers, hands	$9.90 \times 10^8 \pm 6.21 \times 10^8$	$9.14 \times 10^3 \pm 2.48 \times 10^3$

3.1.Total Bacterial count:

Total counts of bacteria are the most useful indicator for the microbiological status of the cheese. A high viable count often indicates contamination of raw material, unsatisfactory sanitation, or unsuitable time and temperature during storage and/or production (Mossel, 1983). The presence of high total bacterial count in raw milk indicates serious faults in production and handling or may be due to lack of cooling facilities during transportation (Mehari and Gashe, 1990)

3.2.Total Coliform Count:

In recent years attention paid toward Coliform bacteria because of their public health importance, fecal Coliforms are widely distributed in nature. They gain entry to milk and milk products through the water supply, equipment, unhygienic conditions of production and handling (Hafez, 1984).

The data in Table (1) revealed that the mean total bacterial count and total Coliform count during processing steps of Ras cheese start very high in Received raw milk samples ($1.11 \times 10^7 \pm 2.45 \times 10^6$) and ($8.24 \times 10^4 \pm 1.68 \times 10^4$), respectively indicating poor sanitary measures in milk handling and lake of cooling facilities during transportation from the farm to the factory, then slightly decrease in Cheese curd samples ($1.24 \times 10^6 \pm 1.19 \times 10^6$) and ($4.15 \times 10^2 \pm 1.82 \times 10^2$), respectively due to heat treatment of milk, then sharply increase in the Fresh cheese samples ($1.15 \times 10^8 \pm 3.04 \times 10^7$) and ($1.88 \times 10^3 \pm 8.13 \times 10$) due to getting contact with the followings : Cheese vat, Stainless-steel forms, Stainless-steel tables and workers, hands which is highly contaminated indicating poor sanitation of the contact surfaces in the factory, unhygienic conditions of production and handling and absence of hygienic awareness of workers .Then the counts decrease in the 3 months aged cheese samples ($2.05 \times 10^5 \pm 1.03 \times 10^5$) and ($1.44 \times 10^2 \pm 2.14 \times 10$), respectively due to aging and dry salting of the Ras cheese then the total bacterial count elevate again in the 6 months aged cheese samples ($1.04 \times 10^8 \pm 5.86 \times 10^7$) due to ripening process and action of ripening bacteria while the count sharply decrease in the total Coliforms count ($0.2 \times 10 \pm 0$) due to aging and refrigeration. Also , the Rennet samples showed high contamination as follow ($1.70 \times 10^5 \pm 1.26 \times 10^5$) and ($5.33 \times 10 \pm 1.85 \times 10$), respectively indicating the poor quality of traditional rennet used in

Table (2): Total S. aureus count and total yeast and mold count during processing steps of Ras cheese in traditional dairy plant.

Item	Total S. aureus count	Total Yeast & Mold count
Received raw milk	$7.77 \times 10^2 \pm 4.33 \times 10^2$	$4.10 \times 10^2 \pm 2.0 \times 10^2$
Cheese curd	$1.72 \times 10^2 \pm 4.18 \times 10$	$8.83 \times 10 \pm 4.57 \times 10$
Fresh cheese	$1.64 \times 10^3 \pm 3.66 \times 10^2$	$4.60 \times 10 \pm .979 \times 10$
3 month aged cheese	$8.41 \times 10 \pm 1.80 \times 10$	$3.99 \times 10^2 \pm 1.36 \times 10^2$
6 month aged cheese	$2.66 \times 10 \pm 8.43 \times 10$	$1.43 \times 10^4 \pm 2.05 \times 10^3$
Rennet	$1.37 \times 10^5 \pm 1.30 \times 10^5$	$3 \times 10 \pm .7 \times 10$
Annato	-ve	-ve
Cheese vat	$2.63 \times 10^2 \pm 1.17 \times 10^2$	$9.52 \times 10^3 \pm 3.09 \times 10^3$
Stainless-steel forms	$1.22 \times 10^3 \pm 7.69 \times 10^2$	$2.22 \times 10^2 \pm 5.11 \times 10$
Stainless-steel tables	$9.70 \times 10^2 \pm 3.71 \times 10^2$	$1.44 \times 10^5 \pm 3.98 \times 10^4$
workers' hands	$1.13 \times 10^3 \pm 5.53 \times 10^3$	$1.46 \times 10^2 \pm 3.82 \times 10$

the manufacturing of Ras cheese. While the Annatto samples was low TBC ($2.1 \times 10^3 \pm 5.3 \times 10$) and was free from Coliforms indicating high quality used Annatto.

3.3.Total S.aureus count:

The presence of large number of S. aureus in dairy products is considered a good indicator of personal hygiene of factory workers with respiratory infections and suppurative lesions as boils (Kamat et al., 1991). S. aureus can gain access to milk either by direct excretion from udders with clinical or subclinical staphylococcal mastitis or by contamination from the environment during handling and processing of raw milk (Peles et al., 2007). Staphylococcus aureus may be the main cause of several food intoxication outbreaks for their production of heat stable enterotoxins (ICMSF, 1996).

Total Yeast & Mold count:

The cheese is considered as an excellent medium for yeast and molds that may induce undesirable changes such as colour defects, off –flavour and actual rots (Mislivec et al., 1992).

The results in Table (2) revealed that the mean total S.aureus count and total yeast & mold count count during processing steps of Ras cheese start very high in Received raw milk samples ($7.77 \times 10^2 \pm 4.33 \times 10^2$) and ($4.10 \times 10^2 \pm 2.0 \times 10^2$), respectively indicating poor sanitary measures in milk handling and lack of cooling facilities during transportation from the farm to the factory, then slightly decrease in Cheese curd samples ($1.72 \times 10^2 \pm 4.18 \times 10$) and ($8.83 \times 10 \pm 4.57 \times 10$), respectively due to heat treatment of milk, then increase in the Fresh cheese samples ($1.64 \times 10^3 \pm 3.66 \times 10^2$) and ($4.60 \times 10 \pm .979 \times 10$) due to getting contact with the followings : Cheese vat, Stainless-steel forms, Stainless-steel tables and workers' hands which is highly contaminated indicating poor sanitation of the contact surfaces in the factory, unhygienic conditions of production and handling and absence of hygienic awareness of workers .

Total S.aureus count in both 3 months aged cheese samples and 6 months old cheese samples decreased as follow ($8.41 \times 10 \pm 1.80 \times 10$) and ($2.66 \times 10 \pm 8.43 \times 10$), respectively due to salting, aging and refrigeration. while the total yeast & mold count increased as follow ($3.99 \times 10^2 \pm 1.36 \times 10^2$) and ($1.43 \times 10^4 \pm 2.05 \times 10^3$), respectively indicating poor washing and drying of Ras cheese blocks and / or poor refrigeration. the Rennet samples showed high contamination with S.aureus ($1.37 \times 10^5 \pm 1.30 \times 10^5$) indicating the poor quality of traditional

rennet used in the manufacturing of Ras cheese while the Annatto samples was free from S.aureus and yeast & mold indicating high quality used Annatto.

Salmonella:

Salmonella is one of the most important food-borne pathogens that can be transmitted through the consumption of contaminated milk and milk products. Early detection of Salmonella in food is important for food safety. All samples were examined for detection of Salmonella and all was free from salmonella.

The microbiological quality of the milk and the good manufacturing practices will contribute to the safety of the final product; especially in cheeses where milk is not pasteurized (FDA, 2001).

To improve the safety of this product, efforts to raise awareness of the importance of hygiene barriers and raw milk quality as well as improved process control can be suggested, we can recommend that the receiving of raw milk should be carefully monitored and only obtained from suppliers apply good manufacturing practices. Also strict hygienic measures of cleaning and sanitization of all food contact surfaces and hygienic training of plant workers should be applied to avoid contamination, water supply must be clean and comply with the standard requirements, prevention of environmental contamination, good cleaning and sanitizing of food processing is essential to produce safe and high quality cheese, added Rennet should be carefully monitored and only obtained from suppliers apply good manufacturing practices . Good conditions of hygiene should be maintained throughout cheese manufacture until consumption to prevent contamination. HACCP – based risk assessment, good manufacturing practice and ISO 22000 food safety should be implemented for all stages of manufacture in order to produce safe and good quality dairy product.

4.REFERENCES

Abou-Donia, S.A. 2002. Recent development in Ras cheese research: A review. Egyptian J. Dairy Sci. 30:155-160.

A.P.H.A. American Public Health Association 1992. Standard methods for the examination of dairy products.16th Ed., American Public Health Association, Washington, D.C.

A.P.H.A., American Public Health Association 1985. Standard methods for the examination of dairy products.15th Ed., Richardson, G.H.A.P.H.A., Washington, D.C.

Abdou, A.M. 1990. Dairy utensils as a source of contamination of raw milk in dairy farms. M.V. SC., Fac. Vet. Med. Moshtohor, Zagazig Univ.

Abou Dawood, A.I., Soada, H., Taha, M.A. 2005. Chemical and microbiological quality of raw milk, soft and hard cheeses collected from districts at Giza governorate. Egyptian J. Dairy Sci. 33:201-214.

Awad, S., El Attar, A., Ayad, E.H.E., El-Soda, M. 2003. Characterization of Egyptian market Ras cheese. 1. Sensory evaluation, rheological, physicochemical properties and microbiological analysis, Egypt. J. Dairy Sci. 31:289–303.

Bailey, W.R., Scott, E.G. 1998. Diagnostic Microbiology. A text book for isolation and identification of pathogenic microorganisms.The C.V. Mosby Company Saint Louis.

Banwart, G. J. 1998. Basic Food Microbiology. 2nd Ed. CBS Publishers and Distributors. New Delhi 11002. (India).

Besancon, x. Smet.c. Chabalier, C., Rivemale, M., Reverbel, J.P.; Ratomahenina, R. and Galzy, P. 1992. Study of surface flora of cheese. International J. Food Microbiology.17: 9-18.

Centers for Disease Control and Prevention (CDC). 2009. Surveillance for food borne disease outbreak, United States, 2006. Morbidity Mortality Weekly Rep., 58: 609-615.

Egyptian standards. 2005. general standard for hard cheese, ES:1008-1

EL Hofi, A.A., Youssef, E.H., Ghoneim, M.H., Tawab, G.A. 1970. Ripening changes in Cephalotyre 'Ras'cheese manufactured from raw and pasteurized

milk with special reference to flavor. J Dairy Sci., 53:1207-1211.

Abdulla E.A.M., Soher, E., Saleh,Y., Mary, S., Amal, S., 2008. Probiotic bacteria as a tool to produce high quality and safe Ras cheese, Egypt. J. Dairy Sci., 36:0378-2700.

FDA, Food and Drug Administration 2002. Bacteriological Analytical Manual. 9th Ed., AOAC International, Arlington, VA, USA.

FDA Food and Drug Administration 2001. Evaluation and Definition of Potentially Hazardous Foods: A Report of the Institute of Evaluation and Definition of Potentially Hazardous Foods: A Report of the Institute of Food Technologists for the Food and Drug Administration of the US Department of Health and Human Services December 31, 2001 IFT/FDA Contract No. 223-98-2333 Task Order No. 4.

Hafez, N.M.1984. Incidence and public health importance of coliform with special references to enteropathogenic sero type of E. coli in milk and some dairy products. M.v.Sc. Thesis Fac. Vet. Med., Cairo Univ.

Hamed, A. 1992. Effect of pasteurization and storage conditions on the microbiological, chemical and organoleptic properties of Domiatia cheese during pickling. Egypt. J.Dairy Sci., Vol.20:177-190.

Hayes, M.C., Ralyea, R. D., Murphy, S. C., Carey, N. R., Scarlett, J. M., Boor, K. J. 2001. Identification and characterization of elevated microbial counts inbulk tank raw milk. J. Dairy Sci. 84: 292–298.

Hicks, C.L., Onuorach, C., OLeary, J.,Langioris, B.E.1986. Effects of milk quality and low temperature storage on cheese yield. A summation of Dairy Sci., 649-657.

ICMSF, 1996. International Committee of Microbiological Specification of Food, Microorganism in foods. Microbiological specification of food pathogens, 1 st Ed. Black academic and professional, London, Pages 112-300.

ISO 1991. General guidance for enumeration of Coliform ISO 1991-8432.

ISO 1995. Microbiology of food and animal feeding stuffs- Horizontal method for the enumeration of coagulase positive Staphylococcus aureus. ISO/CD 688-1995.

ISO 4833/2003. Microbiology of food and animal feeding stuff. Horizontal method for the Enumeration of microorganisms- colony count technique at 30co.

ISO 6579/2002. Microbiology of food and animal feeding stuffs . Horizontal method for the detection of Salmonella spp.

Kamat, M.Y.; Sulebele, G. and Nairupama, Sabnis 1991. A comparative evaluation of media for enumeration of enterotoxigenic staphylococci by selective enrichment technique. J. Food Sci. Technol., India, 28(6):381-383.

Kassem, M., Salem, E., Ahwal, A.M., Saddik, M., Gomaa, N.F 2002. Application of hazard analysis and critical control point system in the dairy Industry Eastern Mediterranean Health Journal Volume 8, no. I, January 2002.

Kivanc, M. 1990. Mould growth and presence of aflatoxins in Turkish cheese. J. Food Safety, 10: 289-294.

Mehari, T., Gashe, B.A. 1990. A survey of the micro flora of raw and pasteurized milk and the sources of contamination in milk processing plant in Addis Ababa, Ethiopia, J. Dairy Res. Vol57:233-238.

Mislivec, P,B., Beuchat, L.R., Cousin, M.A. 1992. Yeasts and molds. Chapter 16 Compendium of methods for microbiological examination of food. 3rd Ed., American Public Health Association. Washington, DC.

Mossel, D.A.A. 1983. Essential and preservatives of the microbial ecology of foods. In: Roberts, T.A, Skinner, F,A, editors. Food microbiology: advances and prospects. London: Academic Press.

Pelcszynsak, E., Libelt, K. 1995. Analysis of hygienic risk factors and critical control points in milking and processing of raw milk for consumption. Medycyna-Weterynaryjna, 51(7):396-399; 42 Dublin Poland.

Peles, F.; Wagner, M.; Varga, L.; Hein, I.; Rieck, P.; Gutser, K.; Kereszturi, P.; Kardos, G.; Turcsanyi, I.; Beri, B. and Szabo A. 2007. Characterization of Staphylococcus aureus strains isolated from bovine milk in Hungary. International Journal of Food Microbiology. 118: 186-193.

Pritchard, T.J.; Beliveau, C.M.; Flanders, K.J.and Donnelly, C.W. 1994. Increased incidence of listeria species in dairy processing plants having adjacent farm facilities. J.Food Prot., 57(9):770-775.

Mcclelland R. G., Pinder, A. C. 1994. Detection of Salmonella typhimunrum in Dairy Products with Flow Cytometry and Monoclonal Antibodies. Applied and Environmental Microbiology, 60(12):4255.

Robinson, R.K. 1993. Modern Dairy Technology, advances in milk products, 2nd Edition, Vol. 2, London, New York, and Elsevier Applied Science.

UNEP 1992. “The contamination of foods, UNEP/GEMS environmental library. No. 5. UNEP, Nairobi.

Yousef, H. M. Sobieh, K. Nagedan, 2001. Microbial status of Domiati cheese at Al Gassiem area Saudi Arabia. 8th Sci. Con. Fac. Vet. Med. Assiut University, p: 91-97Zeinab, I.; Sadek, I.M.; Hosny, W.I. El Kholy and R.K. El Dairouty 2009. Comparative investigations for detection of food borne microorganisms in Egyptian cheese using conventional and fast biochemical tests. Global Veterinaria 3(3): 189-195.