SURVIVAL OF *ESCHERICHIA COLI* O157: H7 IN DOMIATI CHEESE

By

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ABSTRACT

The survival of *E. coli* O157: H7 during the manufacture, pickling and storage of Egyptian white soft cheese (Domiati cheese) was studied in this work. The results revealed that the counts of *E. coli* O157: H7 were slightly increased during processing of fresh cheese, then gradually decreased on further pickling until disappeared in cheese stored for 6 weeks at room temperature. The last detection of *E. coli* O157: H7 (counts < 10 CFU/g) was observed at 5th weeks in artificially inoculated cheese samples, which have a pH value (4.4) and salt% (6.1%). The fresh cheese is considered to be a risk to consumers than cheese stored for 6 weeks. The public health importance of *E. coli* O157: H7 and the suggestive measures for keeping the Domiati cheese safe were discussed.

INTRODUCTION

Domiati cheese is a white pickled soft cheese, widely produced and consumed in Egypt.

Escherichia coli is a part of the normal flora of the large intestine of humans and animals, its presence may be a sign of unhygienic food handling and can serve as an indicator of faecal pollution (**Eley, 1996**).

E. coli O157: H7 is the most well known enterohaemorrhagic *E. coli* strain that may be present in the dairy products as pasteurized milk, cheese and whey powder (**Kvenberg and Schwalm, 2000**).

Recently, several outbreaks of food-borne disease occurred in the U.S.A. were attributed to contamination of food of animal origin with *E. coli* O157: H7, caused hundred cases of haemorrhagic colitis and haemolytic ureamic syndrome and some of the affected children died (**CAST, 1994**).

Outbreaks of *E. coli* infections were associated with eating cheese made from raw milk (**Altekruse *et al.*, 1998**).

Risk of *E. coli* O157: H7 outbreak is highly dependent on pH, salt content and storage temperature of the dairy products (**Guraya *et al.*, 1998**).

Therefore, the present study was conducted to investigate survival of *E. coli* O157: H7 during the manufacture and pickling of Egyptian white soft cheese (Domiati cheese).

MATERIAL AND METHODS

Growth and survival of *E. coli* O157: H7 in white soft cheese (Domiati cheese):

E. coli O157: H7 (No. 1106 ATCC 43888) obtained from the Microbiology Department, Queen Univ. of Belfast, U.K. was inoculated at a level of 5.1 x 10^5 CFU/ml into a pasteurized buffaloe's milk as determined by standard plate count (**A.P.H.A., 1985**).

The inoculated and control milk samples were used for making of Domiati cheese according to **El-Koussy (1966)**.

The inoculated and control cheese were pickled in whey standardized to 10% salt and stored at room temperature (22 °C).

Samples of cheese were taken at the 1st day after processing (fresh cheese), then every week during pickling period to determine *E. coli* counts, pH value and salt %.

Three replicates were done and the received data were computed.

Enumeration of surviving E. coli O157: H7:

10 g of cheese sample were homogenized with 90 ml of sterile 2% sodium citrate solution (40 ° C). Decimal dilutions were prepared in 0.1% sterile peptone water.

0.1ml of each serial dilution was surface plated onto tellurite cefixime sorbitol MacConkey agar and incubated at 37 °C for 24 h. (**Roberts *et al.*, 1995**). Typical colonies of presumed *E. coli* O157: H7 (non sorbitol fermenting, colourless colonies) were counted.

pH determination:

pH value was determined with pH meter (Micro-computer pH meter HI 8424 Portable, England) equipped with standard combination electrodes.

Determination of salt %:

Salt % was determined according to the method of the **Association of Official Analytical chemists (1984)**.

RESULTS

Table (1): Survival rate of *E. coli* O157: H7 in Domiati cheese

Storage period "week"	pH value*	Salt %*	*E. coli* O157: H7 count* CFU/ml or g
Pasteurized milk immediately after inoculation	6.4 ± 0.3	ND	$5.1 \times 10^5 \pm 0.2 \times 10^5$
One day cheese (Fresh cheese)	6.0 ± 0.3	4.4 ± 0.2	$8.2 \times 10^5 \pm 0.3 \times 10^5$
1	5.7 ± 0.2	4.8 ± 0.3	$4.7 \times 10^4 \pm 0.1 \times 10^4$
2	5.3 ± 0.2	5.2 ± 0.3	$3.4 \times 10^3 \pm 0.1 \times 10^3$
3	5.0 ± 0.2	5.5 ± 0.3	$2.6 \times 10^2 \pm 0.1 \times 10^2$
4	4.7 ± 0.1	5.8 ± 0.3	$7.2 \times 10 \pm 0.2 \times 10$
5	4.4 ± 0.1	6.1 ± 0.3	< 10 ± 0.3
6	4.1 ± 0.1	6.3 ± 0.3	
7	3.9 ± 0.1	6.5 ± 0.3	
8	3.7 ± 0.2	6.7 ± 0.3	

* Average of triplicates.

± Standard error.

ND: Not detected.

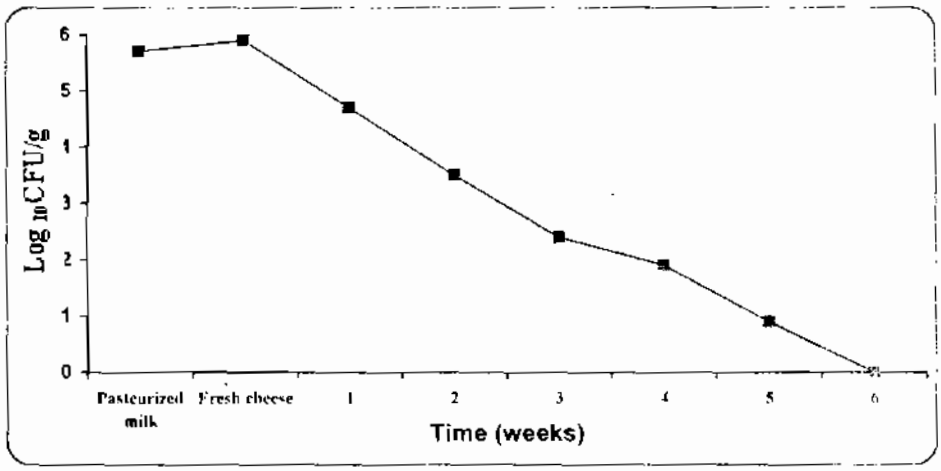

Fig. (1): Survival rate of *E. coli* O157: H7 in cheese.

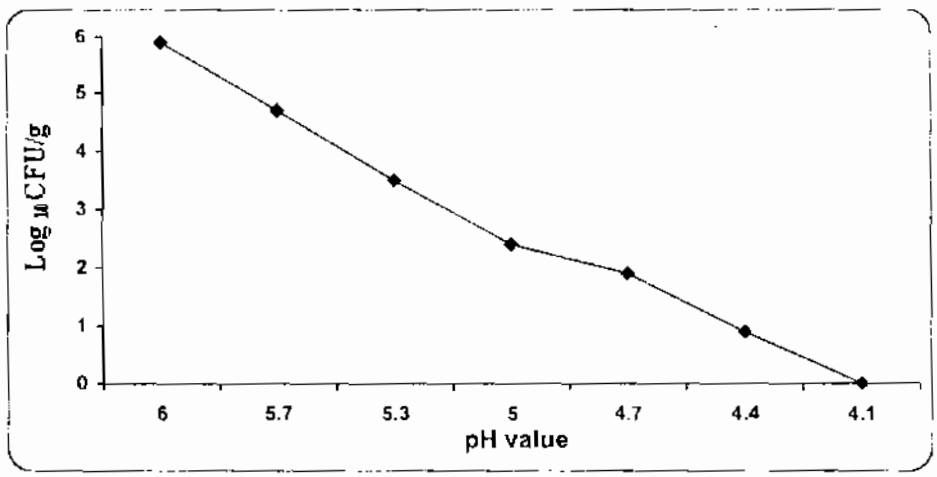

Fig. (2): Relationship between survival rate of *E. coli* O157: H7 and pH value of cheese.

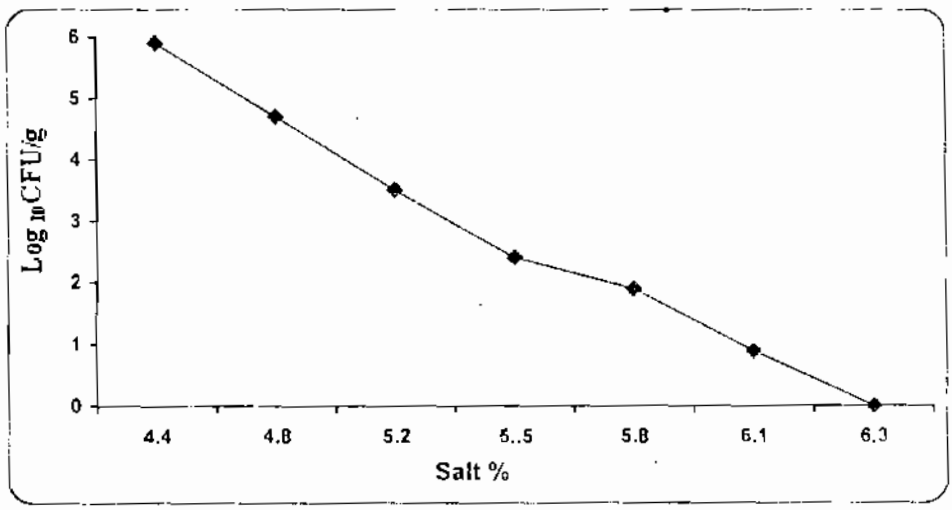

Fig. (3): Relationship between survival rate of *E. coli* O157: H7 and salt % of cheese.

DISCUSSION

The survival rate of *E. coli* O157: H7 during the manufacture and pickling periods of Domiati cheese could be observed in Table (1). The results reveal that level of *E. coli* count slightly increased during the manufacture of fresh cheese from milk, then gradually decreased on further pickling until disappeared in cheese stored for 6 weeks.

It is clear that despite of decrease in the numbers of *E. coli* during the pickling period of Domiati cheese. The *E. coli* can survive during the manufacture and pickling of cheese and remain viable (< 10 CFU/g) for 5 weeks in cheeses, which have a pH value (4.4) and salt % (6.1%). On the other hand, *E. coli* failed to be detected in cheese after 6 weeks of pickling when the pH value and salt % of cheese reached 4.1 and 6.3% respectively (Table, 1).

These results supported by **El-Gazzar, (1993)** who reported that *E. coli* O157: H7 can survive for about one month in Domiati cheese stored at room temperature and **Guraya *et al.*, (1998)** who detected that salt, pH, temperature and storage time interact to increase inhibition of *E. coli* O157: H7 in cheese.

It is interesting to note that as the salt % of cheese increased and pH value of cheese decreased with increasing the pickling period, the *E. coli* O157: H7 counts decreased (Figs. 1, 2 and 3). These findings were in acceptance with those recorded by **Reitsma and Henning, (1996), Dineen *et al.*, (1998) and Küplülü *et al.*, (1999)**.

The viability of *E. coli* in the white pickled cheese may be due to absence of the starter culture, which plays an important role in inhibition of some pathogens (**Abdalla *et al.*, 1992**). Furthermore, coliforms cannot survive in cheese with prolonged salting time due to the effect of lactic acid bacteria, high salt content and low water activity (**Nunez *et al.*, 1985**).

E. coli O157: H7 can survive during the manufacture and pickling of Domiati cheese up to 5 weeks, the Domiati cheese represents a potential health hazard and the fresh cheese considered to be a risk to consumers. So, it is preferable to consume Domiati cheese stored for 6 weeks.

In conclusion, the use of pasteurized milk, starter culture as well as applying good manufacturing practices are very useful for keeping Domiati cheese safe. In addition, hazard analysis and critical control points "HACCP" system must be applied in dairy plants to control food safety hazards.

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الملخص العربي

دراسة مدى بقاء ميكروب الايشريشيا كولاى O157:H7 فى الجبن الدمياطى

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تم فى هذه الدراسة حقن ميكروب الايشريشيا كولاى O157:H7 فى عينات اللبن المبستر المؤهل لتصنيع الجبن المصرى الأبيض الطرى (الجبن الدمياطى) وذلك لتقدير مدى بقاء هذا الميكروب فى الجبن الدمياطى أثناء مراحل التصنيع والتخزين ، حيث تم جمع عينات من الجبن الطازج ثم من الجبن المخزن على درجة حرارة الغرفة أسبوعيا وذلك لتقدير أعداد ميكروب الايشريشيا كولاى وتعيين تركيز أيون الهيدروجين وتركيز الملح.

ولقد أظهرت النتائج زيادة طفيفة أثناء فترة التصنيع ثم انخفاضا تدريجيا فى أعداد الميكروب حتى اختفى بعد ٦ أسابيع من التمليح وذلك يرجع إلى انخفاض تركيز أيون الهيدروجين (٤,١) ، وزيادة تركيز الملح (٦,٣?) فى الجبن خلال هذه الفترة.

هذا وقد تم مناقشة الأهمية الصحية والإجراءات الوقائية التى يجب اتباعها للحد من خطورة هذا الميكروب فى الجبن الدمياطى.