CHARACTERISTICS OF *E. coli* O157:H7 AFFECTED BY ACID ADAPTATION

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Background

Since its first recognition in 1982, *Escherichia coli* O157:H7 has emerged as one of the most important food-borne pathogens. Foods of animal origin such as ground beef and raw milk are proven vehicles responsible for spreading *E. coli* O157:H7 (Riley et al., 1983; Doyle 1991). Acid adaptation response is a phenomenon which shows the elevated resistance of microorganism in a subsequent severer acid challenge after exposed to a sublethal acid condition (Foster and Hall, 1990; Hill et al., 1995). Previously it was found that acid adaptation increased the acid tolerance of *E. coli* O157:H7 (Cheng et al., 2001). Here, we further investigated the susceptibility of acid-adapted and nonadapted cell to sodium chloride, bile salt and ethanol.

Objectives

The purpose of this study was to examine the survival behavior of *E. coli* O157:H7 933 in presence of 10 % NaCl, 0.85 % or 15.0 % ethanol as affected by acid adaptation.

Methods

E. coli O157:H7 933 was used as the test organism. To prepare the acid-adapted cells of E. coli O157:H7, essentially, the procedure described by Tasi and Inghan (1997) was adapted. Cells were suspended in pH 5.0 TSB and then incubated at 37 ℃ for 4 h. To perform subsceptibility test, one tenth ml of the acid-adapted or non adapted culture was inoculated into 10.0 ml of solution containing either 10 % NaCl, 15 % ethanol or 0.85 % bile salt and incubated at room temperature (ca 23-25 ℃) for various periods. After various times of incubation, samples were taken for the determination of viable population of *E. coli* O157:H7. For enumeration of *E. coli* O157:H7, samples were surface plated (0.1 ml) on trypic soy agar (Difco). Colonies were counted after incubation for 48 h. The mean values and standard deviation were calculated from data obtained from three separate experiments. These data were then compared by Duncan's multiple range method (SAS, 1989).

Results and Discussion

In presence of 10% NaCl, the survival of the adapted and nonadapted cell of *E. coli* O157:H7 933 decreased as the incubation period extended. However, in general, the acid-adapted cell was less susceptible to 10 % sodium chloride than the nonadapted cells (Table 1). After 8 days of incubation, percent survival of acid-adapted and nonadapted cell of strain 933 was found be 16.3 and 0.7 %, respectively. Table 2 shows the survival of the acid-adapted and nonadapted *E. coli* O157:H7 933 when exposed to 0.85 % bile salt solution for a period of 120 min. a slight and gradual decline in the viable population of both adapted and nonadapted cells of *E. coli* O157:H7 933 was noted during the exposure period. However, the percent survival of the adapted cells determined at all the time intervals or at the end of exposure, did not show significant difference ($p>0.05$) with that of nonadapted cells. It was also noted that viable population of both acid-adapted and nonadapted cell of test organism declined when exposed to 10 % ethanol solution (Table 3). The survival behavior of acid-adapted and nonadapted cell of strain 933 showed no significant difference ($p>0.05$) throughout the entire exposure period.

Conclusion

This study has shown that adaptation of *E. coli* O157: H7 933 in a pH 5.0 for 4 h resulted in an increase tolerance of *E. coli* O157:H7 to 10% NaCl, although its tolerance to 0.85% bile salt or 15.0% ethanol was not affected. Much should be done for the better understanding of the effect of acid adpatation on the survival of this pathogen when they are subjected to subsequent stress condition. So more accurate risk assessments can be made on food process operation in order to enhance the safety of processed food.

Reference

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Table 1. Survival of acid-adapted and non-adapted *E. coli* O157:H7 933 after exposure to 10 % NaCl soulation

Exposure time (days)	Survival (%)[1]	
	Non acid-adapted	Acid-adapted
1	98.84A[2]	99.67A
2	93.18A	98.68B
3	81.20A	96.20B
4	80.87A	93.55B
5	72.38A	91.24B
6	72.05A	88.76B
8	64.89A	86.94B

1. Calculated base on the population of survival and initial population
2. Values in the same row that are not followed by the same letter are significantly different ($p < 0.05$).

Table 2. Survival of acid-adapted and non-adapted *E. coli* O157:H7 933 after exposure to 0.85 % bile salt solution

Exposure time (mins)	Survival (%)[1]	
	Non acid-adapted	Acid-adapted
30	99.35A[2]	99.18A
60	99.02A	98.85A
90	97.87A	98.02A
120	93.45A	92.75A

1. Calculated base on the population of survival and initial population
2. Values in the same row that are not followed by the same letter are significantly different ($p < 0.05$).

Table 3. Survival of acid-adapted and non-adapted *E. coli* O157:H7 933 after exposure to 15 % ethanol solution

Exposure time (mins)	Survival (%)[1]	
	Non acid-adapted	Acid-adapted
30	99.18A[2]	99.51A
60	98.52A	99.34A
90	98.03A	99.01A
120	97.54A	98.85A
180	96.56A	97.04A

1. Calculated base on the population of survival and initial population
2. Values in the same row that are not followed by the same letter are significantly different ($p < 0.05$).