

The occurrence of *Campylobacter jejuni* in fresh food and survival under different conditions

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SUMMARY

Campylobacter jejuni was an almost regular finding in chickens and in minced meat from pigs and cattle sold in ordinary food stores. The bacteria survived on the food at 4 °C for one week and frozen at -20 °C for three months. None of the stains tested survived heat treatment at 60 °C for longer than 15 min. *C. jejuni* is apparently a frequent guest in most kitchens. Correct food handling and heat treatment to at least 60 °C for 15 min should be enough to prevent infection.

INTRODUCTION

Diarrhoea is a common disease in both poor and rich countries. In 1977, Skirrow drew attention to *C. jejuni* as a frequent cause of bacterial diarrhoea in man (Skirrow, 1977). Later reports have confirmed his findings. In a recent investigation from the Hospital for Infectious Diseases in Göteborg, Sweden, *C. jejuni* was the most common cause of bacterial diarrhoea, corresponding to almost 11% of the patients with diarrhoea (Svedhem & Kaijser, 1980).

The epidemiology of *C. jejuni* diarrhoea is still under debate. There is much support for the theory that the meat from several domestic animals constitutes a major source of transmission of the disease (Grant, Richardson & Bokkenheuser, 1980; Simmons & Gibbs, 1979; Smith & Muldoon, 1974; Svedhem & Kaijser, 1981). The aim of the present investigation was to study the occurrence of *C. jejuni* in fresh food as well as the survival of the bacteria under different conditions.

MATERIALS AND METHODS

Studies on occurrence in fresh food. Chickens were bought at three ordinary grocery stores - ten of the chickens, originating from three different factories, were frozen and an additional eight chickens were fresh. These had been refrigerated at 4 °C, prepacked on plastic plates and wrapped in plastic sheetings.

Three samples of approx 2 × 2 × 0.5 cm were cut out from each chicken and enriched in Case-lac-camp broth (broth) in a microaerophilic atmosphere at 42 °C (Falsen, 1979). After 24 h the broth was cultured by using the Skirrow technique (Skirrow, 1977). After a further 24 h the dishes were examined for *C. jejuni* as defined by Véron and Chatelain (Véron & Chatelain, 1973).

Another seven chickens were bought frozen and kept in a freezer for three months. Then they were examined as just described.

Minced meat from pigs and cattle were bought in the same stores in one sample of each separately and one sample of a mixture of the two. The minced meat was not prepacked in the stores.

Three cubes with a 1 cm side were cut out from each sample of minced meat. The cubes were then treated in the same way as described for chickens.

Studies on survival under different conditions. Testing of survival of *C. jejuni* on chickens and minced meat was performed at different storing temperatures 4, 20, and 42 °C up to 7 days. A strain of *C. jejuni* originally obtained from a patient was used as test strain. The strain was grown in broth for 24 h. Five samples from fresh chickens and 5 cubes with a side of 2 cm from minced meat were cut out for each storing condition. All samples were dipped in the culture broth, wrapped in plastic sheetings and stored at different temperatures. Culture samples were obtained with a cotton swab over an area of 4 cm² after 8 h and 1, 2, 3, 6 and 7 days. The swab was cleaned in 2 ml of broth, from which a quantification was made and presented as the total number of *C. jejuni* colony forming units/4 cm² examined area.

Heat sensitivity. Thirteen strains of clinical campylobacter isolates were tested for heat sensitivity during 5–60 min at 55, 57.5 and 60 °C. Two days growth in broth grown microaerophilically at 42 °C was used for all strains. Five ml of each broth were put in glass tubes in a waterbath. Then 0.1 ml of the heat-treated broth was obtained and cultured microaerophilically on blood agar plates at 42 °C, and examined for recovery of *C. jejuni*.

RESULTS

Studies on occurrence in fresh foods. Chicken. *C. jejuni* was isolated from 6 of 10 frozen chickens and from 5 to 8 fresh chickens stored at 4 °C. Eleven of 24 samples from the 8 fresh chickens revealed *C. jejuni*.

C. jejuni was isolated from 6 of 7 chickens which had been stored frozen for three months.

Minced meat. *C. jejuni* was isolated from all 9 samples of minced meat.

Studies on survival under different conditions (Fig. 1). The results were similar for chicken and minced meat. When stored at 4 °C, *C. jejuni* remained in approximately the same numbers found originally for at least 7 days. When stored at 42 °C, there was a considerable increase of *C. jejuni* during the first day especially in chickens. This was followed by a rapid decrease, and after 2 days the bacteria could not be recovered. When stored at 20 °C, *C. jejuni* also decreased rapidly and could not be isolated after 3 days.

Heat sensitivity (Table 1). The results are shown in table 1. None of the 13 *C. jejuni* strains survived 60 °C for longer than 15 min.

Table 1. Survival after heating for 13 different strains of *C. jejuni*

Strain no.	Temperature (°C)																							
	55												57.5						60					
Time for heating of bacteria (min)...	5	10	15	20	30	45	60	5	10	15	20	30	45	60	5	10	15	20	30	45	60			
1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
2	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	-	-	-	-	-	-	-		
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-		
4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-		
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
7	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-		
8	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-		
9	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
12	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
13	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		

+, positive cultivation; -, negative cultivation.

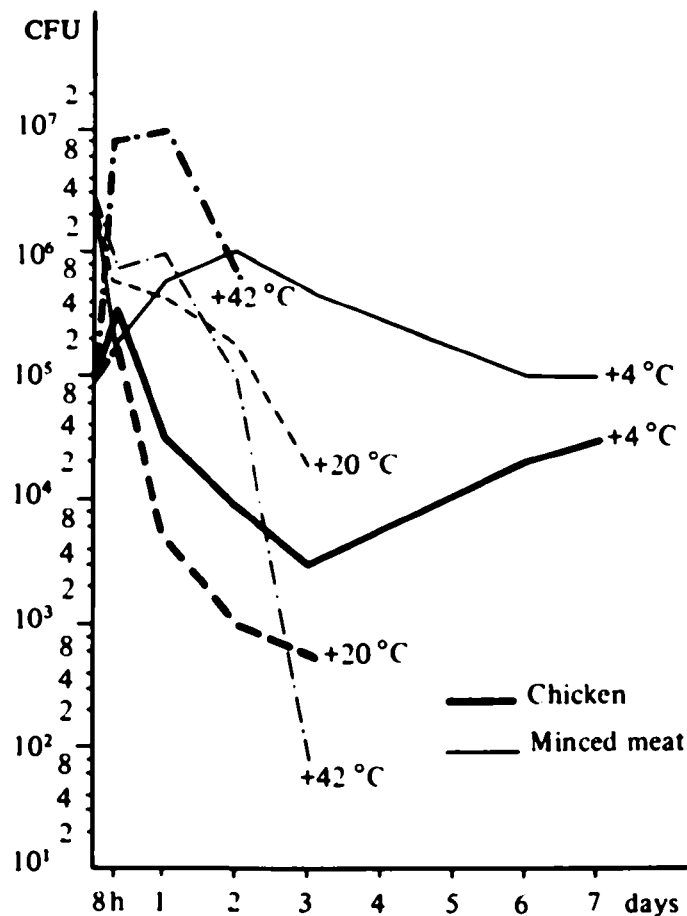


Fig. 1. Survival of *C. jejuni* on food at different storing temperatures. CFU, log. colony forming units per 4 cm². Each curve represents the mean of five samples.

DISCUSSION

There is support that transmission of *C. jejuni* can take place via a number of different routes. Such domestic animals as chickens, pigs and cattle seem to harbour the bacteria in their intestines as a part of the normal flora (Svedhem & Kaijser, 1981). This can result in contaminated products, such as raw milk (Taylor, Weinstein & Bryner, 1979) and meat (Grant *et al.* 1980; Svedhem & Kaijser, 1981) from these animals, as well as contamination of water resources and drinking water (CDC, Center for Disease Control, 1978). Sick pets have been reported to be capable of transmitting the disease, but *C. jejuni* is seldom found in stools of healthy pets (Blaser *et al.* 1978; Svedhem & Kaijser, 1981; Svedhem & Norkrans, 1980). Transmission from man to man has occasionally been shown to occur, mainly between children (Butzler & Skirrow, 1979).

In the present investigation it is shown that *C. jejuni* is a common or regular finding in chickens and minced meat for sale in ordinary grocery stores. *C. jejuni* survive in the food when refrigerated at 4 °C for at least one week, but tolerate heating to 60 °C for a maximum of 15 min. Deep freezing of the food preserves *C. jejuni* for several months.

In conclusion, we believe that *C. jejuni* enterocolitis is mainly a foodborne disease caused by contaminated, raw animal food products. However, if contamination is that common, proper treatment of the food, including heating to at least 60 °C, should be important to avoid disease.

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