

Survival of *Vibrio* spp. including inoculated *V. cholerae* 0139 during heat-treatment of cockles (*Anadara granosa*)

ABSTRACT

The effect of heat-treatment on the internal temperature of raw cockles (*Anadara granosa*) and survival of their intrinsic flora of *Vibrio* spp. as well as of inoculated *V. cholerae* 0139 was examined. The cockles were purchased from markets in Malaysia and had an average weight including shells of 8.90 ± 2.45 g. In one experiment heatpenetration of individual cockles was examined. Cockles weighing <8 g (including shell) exhibited maximum internal temperatures of between 50 and 75°C when heated in water at 99°C for 10 s and 71693°C when heated for 30 s. Cockles weighing >12 g exhibited maximum internal temperatures between 42 and 58°C when heated in water at 99°C for 10 s and 56669°C when heated for 30 s. In another experiment, heat-treatment of 10 cockles treated as a group at 99°C for 10 or 30 s resulted in reduction of levels of intrinsic *Vibrio* spp. (enumerated directly on thiosulphateó citrateóbile salt sucrose agar; TCBS) from 5.73 to 3.15 log cfu g⁻¹ or below 1 log cfu g⁻¹, respectively. The levels of *Vibrio* spp. after heat-treatment decreased with an increase in numbers of cockles grouped together during treatment. In a third experiment *V. cholerae* 0139 was inoculated into cockles and subjected to heat-treatment at 99°C for 0, 10, 15, 20, 25 or 30 s. The levels of *Vibrio* spp. in uninoculated, non-heat-treated cockles was 4.89 log cfu g⁻¹ on TCBS, and the predominant species were *V. parahaemolyticus* and *V. alginolyticus*. *V. cholerae* 0139 inoculated into cockles with an average weight of 13.5 ± 1.90 g (including shell) decreased for samples examined immediately after heat-treatment from 6 log cfu g⁻¹ initially to 3.5 log cfu g⁻¹ after 25 s and <1 log cfu g⁻¹ (TCBS) after 30 s of heat-treatment. The most probable number method by enrichment in alkaline peptone water gave in general within 1 log unit higher counts than TCBS direct enumeration. TCBS direct enumeration and MPN counts were up to 2.38 or 1.30 log units higher, respectively, for samples heat-treated for 20 s or longer and stored for 6 h at 30°C before examination, than for samples heat-treated for same periods of time and examined immediately. This study shows that a mild heat-treatment of cockles for up to 25 s is inadequate to ensure a large reduction in numbers of *Vibrio* spp., including *V. cholerae* 0139.

Keyword: Cockles; Heat-treatment; *V. cholerae* 0139; *Vibrio*