Sanitisers can affect *Campylobacter* survivability in different ways

In food production, sanitisers are used to reduce the presence of microorganisms that may cause human foodborne illness, such as *Campylobacter,* to levels that minimise the chance that humans will get sick.

In Australia, chlorine is commonly used as a food sanitiser in chicken meat processing because it is readily available, safe, and highly effective at destroying *Campylobacter,* commonly found in chickens. Acidified sodium chlorite (ASC) could be an alternate sanitiser to chlorine, but its effect on *Campylobacter* is not as well understood.

Sanitisers work in different ways. They can destroy or damage bacteria, or cause the bacteria to enter a protective state that allows it to survive in harsh conditions and then revive under conditions better suited to bacterial growth. Sanitisers, such as chlorine and ASC, work by inducing 'oxidative stress' in bacteria, which damages the cell membrane and the bacteria's ability to function as normal. For a sanitiser to be considered effective, it needs to reduce the total bacterial load, and damage any remaining bacteria to prevent it from recovering. Bacteria's ability to adapt in response to sanitisers is influenced by genes it has up-regulated (i.e. created more of) or down-regulated (i.e. created less of). To determine when bacterial genes are upregulated or downregulated after exposure to sanitisers, Transcriptome analysis was performed. While much is known about the impact that chlorine can have on the transcriptome of *Campylobacter*, less is known about the impact of ASC.

This study analysed how the *Campylobacter jejuni* (*C. jejuni*) transcriptome reacts, adapts and survives (or not) exposure to chlorine or ASC at 5 °C and 25 °C.

A significant difference in the ability for *C. jejuni* to adapt to stressful environments was observed at 5 °C compared to 25 °C in the presence of chlorine or ASC. This could be due to *Campylobacter* being in greater distress at a lower temperature, which is to be expected given *Campylobacter* prefers to grow at higher temperatures (37 °C – 42 °C).

C. jejuni attempts to adapt to the stress created by the presence of chlorine

Exposure of *C. jejuni* to chlorine at 5 °C resulted in the up-regulation of some genes, including those involved in cell motility and energy production, and the down-regulation of other genes, such as those involved in transferring activity, and ncRNA processing. Chlorine exposure at 25 °C resulted in significant up-regulation of genes involved in oxidative stress and ATP synthesis and down-regulation of genes involved in flagellum assembly, catalase activity, and DNA metabolic process.

These results suggest that *C. jejuni* attempts to adapt to the stress caused by the presence of chlorine in its environment, and is not destroyed or damaged, so may be able to be revived when the environment becomes more favourable.

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C. jejuni is severely damaged in the presence of acidified sodium chlorite

Exposure of *C. jejuni* to ASC at 5 °C resulted in the up-regulation of genes involved in transmembrane transport biological pathways and down-regulation of some genes, including those involved in the generation of energy and oxidoreductase activity.

ASC exposure at 25 °C resulted in significant up-regulation of genes involved in responding to oxidative stress (which initiate DNA replication and repair) and other genes that could not be firmly identified but were known to be involved in ion-binding activity, electron transport, catalytic and iron-sulfur cluster-binding and efflux protein. Under these conditions, *C. jejuni* down-regulated several genes, including those involved in cellular motility and integral membrane protein activity.

These results suggest that in the presence of ASC, *C. jejuni* experiences severe, irreversible oxidative damage caused by inhibition of vital cellular functions that are further aggravated at low temperatures. This ultimately causes the bacteria to die and suggests that *C. jejuni* is unlikely to be revived in a more favourable environment.

Further studies are required to determine whether these responses to ASC observed in a laboratory setting are reflective of the changes to *C. jejuni* gene regulation when ASC is used in commercial chicken meat processing environments.

More information

Read the journal article

- Transcriptomic response of *Campylobacter jejuni* following exposure to acidified sodium chlorite DOI https://doi.org/10.1038/s41538-021-00103-5

Download the project summaries

- Evaluating sanitisers for widespread use in the Australian chicken meat industry (PRJ-010543) https://agrifutures.com.au/wp-content/uploads/2019/11/19-053.pdf
- Sanitisers for commercial use in chicken meat production (PRJ-011593) https://agrifutures.com.au/wp-content/uploads/2022/03/22-011.pdf

Listen to the podcast

- https://cmeextensionaus.podbean.com/e/sanitisers-for-commercial-use-in-chicken-meat-production-with-dr-kapil-chousalkar/

Contact

Prof Kapil Chousalkar
The University of Adelaide

kapil.chousalkar@adelaide.edu.au

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