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Poster title:
Trans-cinnamaldehyde nanoemulsion dip treatments rapidly inactivate *Salmonella* Enteritidis on eggs.

Salmonella Enteritidis (SE) is a major foodborne pathogen that is largely transmitted through the consumption of undercooked, raw, or contaminated eggs. Egg surfaces are contaminated with SE during oviposition, egg collection, or transport. To reduce SE on eggs, disinfectants are such as chlorine, hydrogen peroxide, quaternary ammonium compounds or electrolyzed oxidizing water are used. However, many of the aforementioned chemicals have shown to possess limited antimicrobial effect in killing SE. Therefore, there is a need of developing novel disinfection strategies that are safe and effective in killing SE on eggs. Phytochemicals such as trans-cinnamaldehyde (TC) have been previously shown to exhibit significant anti-*Salmonella* efficacy, however the low solubility of TC in water is a major challenge in its adoption as a safe, effective and easy to use disinfectant. This study investigated the efficacy of TC nanoemulsions (TCNE) prepared with Tween 80 (Tw.80) or Gum Arabic and lecithin (GAL) as dip treatments for reducing SE on the eggshell surface at 32℃. TCNE were prepared by high-energy sonication method using a published protocol. White-shelled eggs were spot inoculated (200 µL; attachment time 60 min) with a 4-strain mixture of SE (10^8 CFU/mL) followed by dipping of eggs in sterile deionized water (control) or water containing TC, or TCNE-Tw.80, or TCNE-GAL at 0.03, 0.06, 0.12, 0.24, or 0.48% for 1, 3, or 5 min. Post washing, the eggs were transferred to Dey-Engley broth and the population of surviving SE on eggshell was enumerated by dilution and plating on XLD agar. All experiments had triplicate samples, repeated thrice and analyzed using one-way ANOVA at $p<0.05$. In case of baseline (inoculated eggs, not washed), ~ 6.2 log CFU SE/egg were recovered. After washing with water for 5 min (control), ~ 4.2 log CFU SE/egg were recovered indicating that water alone is not sufficient to completely eliminate SE on the eggs. In case of TC, only the highest concentrations (0.12, 0.24 and 0.48%) were effective in reducing SE by ~ 1.7, 2.7, 2.3 log CFU/egg respectively as compared to control by 1 min ($P<0.05$). In contrast, all TCNE-Tw.80 treatments were effective in killing SE by at least 2-2.5 log CFU/egg as early as 1 min ($P<0.05$). Similarly, all TCNE-GAL treatments were effective in killing SE as corresponding TCNE-Tw.80 treatments. TCNE-Tw.80 and TCNE-GAL (0.24, 0.48%) were the most effective treatments and reduced SE to below detection limit of 2 log CFU/egg by 1 min of treatment ($P<0.05$). Results suggest that TCNE could be used as an antimicrobial wash to disinfect SE contaminated eggs.