

EFFECTS OF ANTIBIOTIC DEVELOPMENT & RESISTANCE ON THE
GROWTH RATE AND MORPHOLOGY OF *Salmonella*

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EFFECTS OF SUBLETHL TEMPERATURE STRESSES ON THE CULTURABILITY
AND MORPHOLOGY OF *Salmonella*.

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PENGAKUAN DAN PENGESAHAN LAPORAN
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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

*Effects of Sublethal Temperature Stresses on the
Culturability and Morphology of Salmonella*

oleh *Iutan Juliana bt Saion*, No.Matrik

telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini
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DECLARATION

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ABSTRACT

This study was related to the culturability and morphology of *Salmonella* in trypticase soy broth grown at 37°C before being subjected to three different sublethal temperature stresses (45°C, 40°C and 20°C) at exponential and stationary phases as inoculums using two-plating systems; TSA with and without 4% NaCl (TSAS). A standard growth curve of *Salmonella* at 37°C was established using plate counts showed that the exponential and stationary phase of the organism were achieved after 6 and 16 hours, respectively. When the bacteria were exposed to sublethal temperature stresses, the injury was occurred and the percentage injury was different between exponential phase and stationary phase. The presence of sodium chloride in the plating agar increased heat resistance of *Salmonella*. During the exponential phase cultures, the percentage sublethal injury at 45°C, 40°C and 20°C were ranged between 0.01% to 15.81%, 0.11% to 3.40% and 0.23% to 7.47% respectively. However, the percentage of sublethal injury during stationary phase was lower than during exponential phase, which ranged between 0.12% to 13.72%, 0.11% to 2.02% and 0.11% to 3.03% for these following respective temperatures of 45°C, 40°C and 20°C. Sublethal temperature injury of *Salmonella* was developed more rapidly in log phase cells than in stationary phase cells. This is illustrated based on their percentage injury where the percentage injury during log phase was ranged between 0.01% to 15.81%, which was higher than in stationary phase (0.11% to 13.72%). *Salmonella* cells were able to survive throughout the sublethal temperature stresses and undergone morphological changes to adapt to new temperatures. The study demonstrated cells of both exponential phase and stationary phase showed a significant variation of morphology. Cells of log phase were elongated while at stationary phase cells became coccoid. The stationary phase cells of *Salmonella* were more resistant than exponential phase cells exhibited by lower percentage injury and shorter their morphologies to become coccoid.

ABSTRAK

Kajian ini adalah berkaitan dengan kekulturan dan morfologi *Salmonella* di dalam trypticase soy broth dan dihidupkan pada suhu 37°C sebelum dikenakan tekanan suhu 'sublethal' terhadap tiga suhu yang berbeza (45°C, 40°C dan 20°C) daripada fasa eksponensial dan fasa statik sebagai inoculum berbeza menggunakan dua sistem piring agar yang berbeza; TSA dengan dan tanpa 4% NaCl (TSAS). Graf pertumbuhan yang seragam pada suhu 37°C telah dilakukan menggunakan pengiraan koloni piring petri, di mana didapati fasa eksponensial dan fasa statik pada suhu 37°C telah diperolehi selepas 6 dan 16 jam. Apabila bakteria didedahkan kepada tekanan suhu, kecederaan berlaku dan peratus kecederaan adalah berbeza pada fasa eksponensial dan fasa statik. Penambahan garam di dalam piring agar meningkatkan kerintangan haba mikroorganisma tersebut. Semasa fasa eksponensial, peratusan kecederaan pada suhu 45°C, 40°C dan 20°C di dalam julat antara 0.01% hingga 15.81%, 0.11% hingga 3.40% dan 0.23% hingga 7.47% masing-masing. Walaubagaimanapun, peratusan kecederaan semasa fasa statik di dalam julat antara 0.12% hingga 13.72%, 0.11% hingga 2.02% dan 0.11% hingga 3.03% pada suhu 45°C, 40°C dan 20°C masing-masing. Kecederaan tekanan suhu pada *Salmonella* adalah paling tinggi dalam fasa eksponensial berbanding dengan fasa statik. Ini dapat digambarkan berdasarkan kepada peratusan kecederaan di mana peratus kecederaan semasa fasa eksponensial di dalam julat antara 0.01% hingga 15.81%, iaitu lebih tinggi berbanding fasa statik iaitu 0.11% hingga 13.72%. Sel-sel *Salmonella* telah menunjukkan keupayaan merintang tekanan suhu 'sublethal' dan mengalami perubahan morfologi semasa penyesuaian suhu baru. Sel-sel daripada fasa eksponensial telah memanjang manakala pada fasa statik sel menjadi 'coccoid'. Didapati, fasa statik *Salmonella* adalah lebih resisten berbanding sel yang berada pada fasa eksponensial berdasarkan kepada peratus kecederaan yang rendah dan morfologinya menjadi 'coccoid'.