THE EFFECT OF POLYUNSATURATED FATTY ACID ENRICHMENT ON ACUTE HEAT AND LIGHT-RELATED STRESS TOLERANCE OF THE SCLERACTINIAN CORAL, *Galaxea fascicularis* Linnaeus 1767

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This study was conducted to evaluate the assimilation of polyunsaturated fatty acid (PUFA) of a scleractinian coral, *Galaxea fascicularis* in enrichment. After that, the trend of PUFA accumulation in corals was determined by optimum time of PUFA enrichment. This study had also investigated the survival rate of starved and PUFA-enriched *G. fascicularis* in stress and the effects of different types of stressors on the PUFA composition of the corals. Lastly, the effects of different treatments on the coral's PUFA recovery rate after a stress event were also examined. Previous studies on coral's PUFAs are mainly concentrated during the actual stress event rather than the post-stress recovery period. The roles of PUFAs in coral stress studies remained unclear. In this study, two main components in the corals were examined: 1) the PUFA accumulation trend; and 2) the effects of heat and high light intensity stress. Firstly, the corals were fed with non-enriched and PUFA-enriched *Artemia* with starved corals as control for the durations of 1 week, 2 weeks, 5 weeks and 10 weeks. The optimized enrichment period was determined at 5 weeks. The 5-week PUFA-enriched corals were exposed to high light intensity (~2600 µmol quanta m^{-2} s^{-1}) and heat stress (33°C) separately for four days before the application of post-stress PUFA enrichment. The post-stress recovery rate of fatty acid content of *G. fascicularis* was at 84-92% of the total lipids. The PUFA-enriched corals of both

post-light and post-heat stress enrichments had fully recovered their pre-stress total PUFA content. A significant increase of 57% in PUFA-enriched corals of post-heat stress enrichment compared to pre-stress corals was recorded. The essential PUFAs, 20:4ω6 (arachidonic acid) and 20:5ω3 (eicosapentanoic acid) were significantly higher in PUFA-enriched corals of both post-stress enrichments. Furthermore, this study had found that the PUFA enrichment was more proficient in heat stress treatment than high light intensity stress treatment. The PUFA-enriched corals also had high zooxanthellae densities and chlorophyll levels to validate the efficiency of post-stress PUFA enrichment especially when the corals are recovering following a stress event.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN PENGKAYAAN ASID LEMAK POLI TAK TEPU TERHADAP TOLERANSI STRES AKUT HABA DAN CAHAYA KE ATAS KARANG SKLERAKTINIA, *Galaxea fascicularis* Linnaeus 1767

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Kajian ini bertujuan untuk mengkaji tahap asimilasi asid lemak poli tak tepu (PUFA) oleh karang skleraktinia, *Galaxea fascicularis* dalam pengkayaan. Selepas itu, tren akumulasi PUFA dalam karang ditentukan oleh tempoh optimum dalam pengkayaan PUFA. Kajian ini juga menyelidik kadar kemandirian *G. fascicularis* tanpa pemakanan dan yang diperkaya dengan PUFA dalam stres dan kesan stres yang berlainan terhadap komposisi PUFA dalam karang. Kesan rawatan yang berlainan terhadap kadar pemulihan karang selepas peristiwa stres juga dikaji. Kajian sebelum ini lazimnya tertumpu pada PUFA karang semasa peristiwa stres berbanding tempoh pemulihan selepas stres. Peranan PUFA dalam kajian stres karang adalah tidak jelas. Dalam kajian ini, terdapat 2 komponen karang yang dikaji: 1) tren akumulasi PUFA, dan; 2) kesan stres suhu air tinggi dan intensiti cahaya tinggi. Pertama, karang diberi makan *Artemia* tanpa pengkayaan dan dengan pengkayaan PUFA untuk tempoh 1 minggu, 2 minggu, 5 minggu dan 10 minggu. Karang tanpa pemakanan adalah sebagai kawalan. Tempoh pengkayaan optimum ditentukan pada 5 minggu. Karang pengkayaan 5 minggu didedahkan kepada intensiti cahaya tinggi (~2600 µmol quanta m^{-2} s^{-1}) dan suhu air tinggi (33°C) secara berasingan untuk empat hari sebelum applikasi pengkayaan PUFA selepas stres. Kadar pemulihan selepas stres kandungan asid lemak *G. fascicularis* adalah pada 84-92% (daripada jumlah lipid).

Karang yang diperkaya dengan PUFA dalam kedua-dua rawatan pengkayaan selepas stres menunjukkan pemulihan kandungan PUFA kepada tahap asal sebelum stres. Terdapat kenaikan signifikan 57% dalam kandungan PUFA karang yang diperkaya PUFA untuk pengkayaan selepas stres suhu air tinggi berbanding dengan karang sebelum stres. PUFA perlu, 20:4ω6 (asid arachidonik) and 20:5ω3 (asid eicosapentanoik) adalah lebih tinggi secara signifikan dalam karang diperkaya PUFA untuk kedua-dua pengkayaan selepas stres. Pengkayaan PUFA adalah lebih berkesan dalam rawatan suhu air tinggi berbanding dengan intensiti cahaya tinggi. Karang diperkaya PUFA juga mempunyai ketumpatan zooxanthellae dan tahap klorofil yang tinggi dan ini menyokong keberkesanan pengkayaan PUFA selepas stres terutamanya, semasa karang sedang memulih selepas peristiwa stres.