Temporal Infection Dynamics of *Enterocytozoon hepatopenaei* (EHP) and its Association with Shrimp Growth Performance in Commercial *Litopenaeus vannamei* Farms in Chilaw, Sri Lanka

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Enterocytozoon hepatopenaei (EHP) is an economically significant microsporidian parasite causing hepatopancreatic microsporidiosis in *Litopenaeus vannamei*, resulting in retarded growth and severe production losses in the shrimp aquaculture industry. This study investigated temporal EHP infection dynamics and associations with shrimp growth performance and water quality in commercial *L. vannamei* farms in the Chilaw aquaculture zone, Sri Lanka. Following preliminary screening, twenty commercial shrimp farms were selected and categorized into four groups based on EHP detection patterns: EHP-undetected, pre-stocking detection, early-stage detection (14–28 days of culture [DOC]), and late-stage detection (>28 DOC). Twenty shrimp were collected biweekly from stocking to harvest and pooled for PCR-based detection. The EHP copy number was quantified using quantitative PCR (qPCR) targeting the PTP2 gene. Average body weight, body length, and selected water quality parameters were recorded concurrently. A linear mixed model analysis revealed EHP copy number was significantly influenced by detection stage, sampling timepoint, and their interaction ($p < 0.001$), EHP copy numbers progressively increased throughout the culture period in infected groups, with pre-stocking detection farms exhibiting the highest sustained infection load, while EHP-undetected farms maintained zero copy numbers throughout the study period. Average body weight and body length were significantly affected by detection stage, sampling timepoint, and their interactions ($p < 0.001$). Spearman's correlation at the final harvest point (DOC 70) confirmed significant negative associations between EHP copy number and body weight ($\rho = -0.720$, $p < 0.001$) and body length ($\rho = -0.550$, $p = 0.012$) confirming impaired growth in infected groups. Among water quality parameters, total ammonia showed significant temporal and detection stage variation, whereas pH, salinity, differed significantly among detection stages ($p < 0.001$). These findings demonstrate that EHP infection stage at stocking and progressive copy number escalation are critical causes of shrimp growth outcomes, underscoring the need for rigorous pre-stocking EHP screening and early molecular detection in local commercial shrimp farming.

Keywords: EHP, infection dynamics, copy number, growth performance, temporal analysis

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