INTEGRATING EGG HATCHING DYNAMICS AND BIOMARKER PROFILING TO ADVANCE ENVIRONMENTAL SURVEILLANCE OF SCHISTOSOMIASIS

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Background and aims

Environmental detection of *Schistosoma* remains a challenge for schistosomiasis surveillance and elimination efforts. Egg hatching fluid (EHF) contains schistosome-derived molecules released during miracidial emergence and represents an underexplored source of diagnostic biomarkers. This study aimed to identify and characterise EHF-derived molecular biomarkers from liver and intestine *Schistosoma mansoni* eggs of chronically-infected mice to support diagnostic innovation.

Methods

Eggs were isolated from mouse intestinal and liver tissues, assessed for viability and developmental stage prior to hatching. Hatching rates and miracidia swimming velocities were quantified for each tissue source. EHF was collected, analysed using mass spectrometry–based proteomics to enable biomarker discovery. EHF was additionally evaluated by Western blotting and ELISA using monoclonal antibodies targeting schistosome egg glycoproteins.

Results

Liver-derived eggs showed significantly higher viability (74.6%) than intestinal eggs (45.3%; $P = 0.0002$). Egg staging revealed a marked tissue-associated distinction, with Stage 8 eggs enriched in liver-derived samples (56% vs. 32% in intestines), whereas Stage 3 eggs predominating in intestinal-derived samples (47.5% vs. 27.4% in liver). Hatching rates averaged 43% for liver eggs and 22% for intestinal eggs . Proteomic analyses revealed distinct and reproducible EHF biomarker profiles, including proteins differentially abundant in intestinal-derived (Smp_047650) or liver-derived (Smp_241860) EHF, as well proteins abundant in both samples. Immunoreactive EHF components were detected by Western blotting and ELISA, demonstrating their diagnostic potential and analytical stability.

Conclusions

EHF represents a source of schistosome-specific diagnostic biomarkers. Integrating egg developmental dynamics with molecular profiling advances biomarker-driven strategies for environmental surveillance of schistosomiasis.