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Anti-Parasite Targeting with Amino Acid-Capped Nanoparticles Modulates Multiple Cellular Processes in Host

Authors : Oluyomi Stephen Adeyemi, Kentaro Kato

Abstract : Toxoplasma gondii is the etiological agent of toxoplasmosis, a common parasitic disease capable of infecting a range of hosts, including nearly one-third of the human population. Current treatment options for toxoplasmosis patients are limited. In consequence, toxoplasmosis represents a large global burden that is further enhanced by the shortcomings of the current therapeutic options. These factors underscore the need for better anti-T. gondii agents and/or new treatment approach. In the present study, we sought to find out whether preparing and capping nanoparticles (NPs) in amino acids, would enhance specificity toward the parasite versus the host cell. The selection of amino acids was premised on the fact that T. gondii is auxotrophic for some amino acids. The amino acid-nanoparticles (amino-NPs) were synthesized, purified and characterized following established protocols. Next, we tested to determine the anti-T. gondii activity of the amino-NPs using in vitro experimental model of infection. Overall, our data show evidence that supports enhanced and excellent selective action against the parasite versus the host cells by amino-NPs. The findings are promising and provide additional support that warrants exploring the prospects of NPs as alternative anti-parasite agents. In addition, the anti-parasite action by amino-NPs indicates that nutritional requirement of parasite may represent a viable target in the development of better alternative anti-parasite agents. Furthermore, data suggest the anti-parasite mechanism of the amino-NPs involves multiple cellular processes including the production of reactive oxygen species (ROS), modulation of hypoxia-inducing factor-1 alpha (HIF-1α) as well as the activation of kynurenine pathway. Taken together, findings highlight further, the prospects of NPs as alternative source of anti-parasite agents.

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