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Exploring signature proteins to design a novel multi-epitope vaccine candidate against Mycobacterium tuberculosis: An in-silico approach

Haleema Fayaz
Sharda University, Greater Noida, Uttar Pradesh, India

Mycobacterium tuberculosis (M.tb), a highly infectious bacterium, remains a major global health threat, causing tuberculosis, a disease responsible for millions of deaths annually. The emergence of drug-resistant strains has further complicated efforts to control this deadly infection. While the Bacillus Calmette-Guérin (BCG) vaccine is the only available option, its efficacy in preventing adult pulmonary tuberculosis is limited. To address this pressing need, we have proposed a novel multi-epitope vaccine (MEV) strategy. This approach involves the combination of epitopes from four key M.tb proteins that are known to elicit robust immune responses. Two MEV constructs were designed, each paired with a different TLR-binding adjuvant: Laterosporulin (TLR-4) and PorB (TLR-2). Computational analysis of the MEV constructs revealed favorable physicochemical properties and strong interactions with TLR receptors, suggesting their potential to trigger a robust immune response. Immunological simulations further supported this prediction. To enhance the vaccine's efficacy, codon optimization and in-silico cloning were employed. The study's findings indicate that the MEV holds promise as a potential solution to combat M.tb. However, rigorous in-vitro and in-vivo validation is essential to assess its safety, efficacy, and immunogenicity before it can be considered for clinical trials and widespread deployment. In conclusion, this study presents a promising approach to combat TB by developing multi-epitope vaccines. Further research is necessary to translate these computational designs into tangible solutions for global health.

Biography

Haleema Fayaz is a dedicated PhD researcher at the Department of Basic Sciences, Sharda University, Greater Noida, Uttar Pradesh, India, actively contributing to cutting-edge studies in molecular and cancer biology under the guidance of Nasreen Zafar Ehtesham's lab. Haleema's investigations span cancer biology, infectious disease mechanisms, and advanced molecular techniques. Mechanisms and prospects of piezoelectric materials as smart delivery vehicles in cancer treatment– A review published in Drug Discovery Today, detailing the use of piezoelectric nanomaterials for targeted drug delivery in cancer therapy. Haleema is listed as a lead author from Sharda University's Department of Life Sciences

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