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Monosaccharide Profiling of Lipopolysaccharide: A Novel Approach for Identification of Antigenically Similar Leptospira and Its One Health Implications

Leptospirosis is a globally significant zoonotic disease, and accurate identification of Leptospira serovars is critical for effective surveillance, treatment, and vaccination strategies in both human and veterinary medicine. Traditional serological methods for serovar identification are limited by their reliance on animal-derived antisera and monoclonal antibodies, which are not only resource-intensive but also raise ethical concerns. Here, we present a novel, animal-free approach for distinguishing antigenically similar Leptospira serovars using high-performance liquid chromatography (HPLC) to analyse the monosaccharide composition of the bacterial lipopolysaccharide (LPS). This "sugar fingerprinting" method generates unique compositional profiles for each isolate, enabling discrimination even among serovars with high antigenic similarity that are otherwise indistinguishable by classical serology. Application of this technique to cattle pathogens from two species (L. interrogans and L. borgpetersenii, both serovar Hardjo) revealed subtle but reproducible differences in LPS composition, while phylogenetic analysis of glycosyltransferase genes implicated in LPS biosynthesis provided insights into the molecular mechanisms underlying antigenic similarity and the role of horizontal gene transfer in serovar evolution. By enabling precise, ethical, and scalable serovar identification, this approach supports One Health strategies - facilitating integrated surveillance, targeted vaccination, and improved outbreak response across human, animal, and environmental health sectors. Monosaccharide profiling thus represents a transformative tool for advancing leptospirosis control, reducing reliance on animal testing, and deepening our understanding of pathogen evolution at the human-animal-environment interface.

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Keywords

leptospirosis, serovar identification, lipopolysaccharide profiling, monosaccharide analysis, One Health, zoonosis

Biography

I am an assistant professor at the Agricultural University in Krakow and an equine veterinarian with a PhD in molecular cell biology from the University of Cambridge. As a clinician-scientist, I am combining research and teaching commitments with clinical engagement in the field of equine internal medicine and large animal infectious diseases. In my research, I am trying to translate and apply advances in molecular biology to develop new diagnostic and therapeutic methods that can be used in both, human and veterinary medicine.

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