Typhoid & Paratyphoid Vaccine
TECHNOLOGY DETAILS

i. **About the Technology/Product/Process:**

The innovative technology described in this study focuses on the development of a **bivalent typhoidal Outer Membrane Vesicle (OMV)-based immunogen** to combat enteric fever, a disease caused by *Salmonella Typhi* and *Salmonella Paratyphi A*. Enteric fever remains a significant global health issue, with no existing combination vaccine to protect against both causative agents. This technology addresses this gap by formulating a novel vaccine candidate that shows promise in preclinical testing.

Key features of the technology include:

1. **Isolation and Characterization of OMVs**:
    - Outer Membrane Vesicles (OMVs) were isolated from *Salmonella Typhi* and *Salmonella Paratyphi A*.
    - These OMVs were comprehensively characterized to identify associated antigens, such as lipopolysaccharide (LPS) and Vi-polysaccharide.
2. **Immunization and Immune Response**:
    - Adult mice were immunized orally with three doses of the bivalent OMV-based immunogen (25 μg/200 μl).
    - The immunization induced robust humoral responses, including significant serum IgG levels against LPS and Vi-polysaccharide.
    - It activated specific immune cell populations, such as CD4, CD8, and CD19, in the spleen of immunized mice.
    - The vaccine also stimulated Th1 and Th17 cell-mediated immune responses.
3. **Protective Efficacy**:
    - Immunization with the bivalent OMVs provided protection against systemic infection caused by lethal doses of heterologous *Salmonella* strains in adult mice models.
    - The protective effect was found to be mediated by a combination of humoral and cell-mediated immune responses.
4. **Novel Mechanism of Protection**:
    - Anti-OMVs antibodies generated through immunization significantly inhibited bacterial motility and their ability to penetrate mucin layers.

Potential Impact

This bivalent OMV-based vaccine represents a promising candidate for preventing enteric fever caused by *Salmonella Typhi* and *Salmonella Paratyphi A*. By inducing comprehensive immune responses and inhibiting bacterial motility and mucosal penetration, it offers a novel and effective mechanism for protection. If successfully translated to clinical use, this technology could fill a critical gap in enteric fever prevention, particularly in endemic regions.

ii. **Need and utility of the Technology from Public health perspective:**

1. Addressing the Burden of Enteric Fever

- *Enteric fever*, caused by *Salmonella Typhi* and *Salmonella Paratyphi A*, is a significant public health concern in low- and middle-income countries, particularly in regions with inadequate sanitation and hygiene.
- It leads to substantial morbidity and mortality, with millions of cases reported annually worldwide.
- The emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) *Salmonella* strains has made treatment increasingly difficult, highlighting the urgent need for effective preventive measures.

2. Current Gaps in Vaccine Coverage

- Existing vaccines, such as the Vi polysaccharide vaccine and Typhoid Conjugate Vaccines (TCVs), primarily target *Salmonella Typhi* and do not offer protection against *Salmonella Paratyphi A*.
- There is no licensed combination vaccine capable of addressing both pathogens simultaneously, leaving populations vulnerable to *Salmonella Paratyphi A*.

3. Novel Bivalent Vaccine as a Solution

- The **bivalent OMV-based immunogen** offers protection against both *Salmonella Typhi* and *Salmonella Paratyphi A*, bridging the gap in current vaccine coverage.
- By inducing robust humoral and cell-mediated immunity, it promises comprehensive and long-lasting protection.

4. Public Health Benefits

- **Disease Reduction**: Widespread use of this vaccine can significantly reduce the incidence of enteric fever, alleviating the disease burden on affected communities.
- **Antimicrobial Resistance Mitigation**: Preventing infections will reduce reliance on antibiotics, slowing the spread of MDR and XDR *Salmonella* strains.
- **Economic Benefits**: Lower disease incidence will reduce healthcare costs associated with treatment, hospitalizations, and lost productivity.
- **Global Health Equity**: By addressing an unmet need, especially in underprivileged regions, this technology can contribute to achieving health equity goals.

5. Potential Applications in Public Health

- Inclusion in national immunization programs in endemic regions.
- Deployment in outbreak settings to contain the spread of both *Salmonella Typhi* and *Salmonella Paratyphi A*.
- Use in travelers' vaccines to protect populations visiting endemic areas.

Conclusion

The bivalent OMV-based vaccine technology is a transformative innovation that addresses critical gaps in enteric fever prevention. Its adoption has the potential to save lives, curb antimicrobial resistance, and strengthen global public health systems.

iii. **Technology Readiness level (TRL)**

TRL – 4/5

iv. **Validation Status and outcome:**

In-house validation was completed by ICMR -NIRBI. Third party validation is pending and to be done under this EoI (Phase I).

v. **IP Filing Status/Publications**

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