Innovative Strategies in Malaria Prevention

Source: TH

Why in News?

Recent advancements in **malaria prevention** have shifted focus from genetically modified mosquitoes to **genetically modified malaria-causing parasites.** This innovative approach aims to enhance immune system priming during the liver stage of the parasite's life cycle, potentially leading to more effective **malaria** vaccines.

How do Genetically Modified Parasites Help Prevent Malaria?

- **Genetically Modified Parasites:** Malaria causing parasites were genetically altered to study their behavior, prevent diseases, or deliver treatments. They are designed to **prime the immune system** in the liver, preventing disease before entering the bloodstream.
    - Malaria-causing parasites cause infection and symptoms begin to show only when they move into the bloodstream from the liver stage.
    - This method allows for better protection against malaria when exposed to unaltered parasites later, improving overall vaccine efficacy.
        - Additionally, genetically modified mosquitoes can spread resistance to malaria by mating with wild mosquitoes.
    - **Immune priming** is a process by which a host improves its immune defences following an initial pathogenic exposure, leading to better protection after a subsequent infection with the same – or different – pathogens.
- **Trial Efficacy:** In the trial conducted, 89% of participants exposed to late-arresting genetically modified parasites (*p falciparum*, in this case) were protected from malaria compared to only 13% for early-arresting parasites.
    - Early-arresting refers to killing the parasite on day 1 of entering the liver whereas late-arresting refers to killing it on day 6.
- **Comparison with Traditional Methods:** Traditional methods, such as radiation-sterilized mosquitoes and radiation-attenuated **sporozoites** (the infective stage of malaria parasites), require significantly higher exposures (up to 1,000 mosquito bites) for similar protection levels.

What is Malaria?

- **About:**
    - Malaria, a life-threatening disease caused by **Plasmodium parasites**, is transmitted by **female Anopheles mosquitoes**. Of the five species infecting humans, ***P. falciparum*** and ***P. vivax*** are the most dangerous.
    - After biting an infected person, a **mosquito transmits malaria parasites to the next person** it bites. The parasites travel to the **liver**, mature, and then **infect** **red blood cells** .
- **Highlights of Malaria in India:**
    - According to the **National Vector Borne Disease Control Programme (NVBDCP)**, malaria remains a significant public health challenge in India, with approximately **1 million cases reported annually.**
    - Approximately 95% of the population lives in malaria-endemic regions, with 80% of cases

occurring in tribal, hilly, and inaccessible areas that house 20% of the population.
    - **In 2022, India** represented **66% of malaria cases** in the **WHO South-East Asia Region,** with ***Plasmodium vivax*** responsible for nearly **46% o**f these cases.
- **Treatment:**
    - **WHO**-recommended malaria vaccine like **RTS,S/AS01** and **R21/Matrix-M**
- **Global Initiatives:**
    - **World Malaria Day – 25th April** (launched in **2007**)
    - **WHO Global Malaria Programme (GMP)** (launched in **2015**)
- **Government Initiatives Related to Malaria:**
    - **National Malaria Control Programme (NMCP)** – **1953**
    - **National Vector-Borne Disease Control Programme** – **2003**
    - **Malaria Elimination Research Alliance-India (MERA-India)** – Launched on the eve of **'World Malaria Day' in 2019.**
    - **National Strategic Plan: Malaria Elimination 2023-27**

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Widespread resistance of malarial parasites to drugs like chloroquine has prompted attempts to develop a malarial vaccine to combat malaria. Why is it difficult to develop an effective malaria vaccine? (2010)

(a) Malaria is caused by several species of Plasmodium

(b) Man does not develop immunity to malaria during natural infection

(c) Vaccines can be developed only against bacteria

(d) Man is only an intermediate host and not the definitive host

Ans: (b)