



# The potential of plant-based vaccines

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## Dear Editor,

Plants are cost-effective biological delivery carrier. Plant-based vaccines are more reliable due to the lack of human pathogen or endotoxin, and oncogenic DNA. Plant cells are low-cost factories that are able to produce adjuvant component (immunostimulant), an inevitable component of vaccine. In addition, plant cells can synthesize proteins with post-translational modifications that can be purified easily and safely.

Song et al reported the trimer ectodomains of haemagglutinins (tHAs) of influenza viruses in plant cells. The authors recommended to directly bind the plant to *Lactococcus* without further purification to produce more low-cost vaccines. This subunit, adjuvant-free vaccine potently induced vigorous immune responses in mice and chickens (1).

Genetic engineering strategies have been utilized to produce recombinant vaccines in plant cell. The gene of target antigen transfects host plant cells using efficient delivery system such as plant specific viruses (pathogens). Several post-translational modifications can occur in plant cells. In addition, the Ag needed to post translation modification can correctly produce in nuclear or chloroplast of plant cells. Until now, several plants such as carrot, papaya, lettuce, and tobacco have been used to express complex parasite Ag. The variable parts and composition of Ag may affect the efficiency of vaccine. For example, subunit expression of *Fasciola hepatica* in lettuce is more immunogenic when combined with hepatitis B virus core protein (HBcAg). The oral administration of this plant-based vaccine could introduce high levels of antibodies against *F. hepatica* in rats. Interestingly, single

intramuscular injection of purified malaria Ag made in tobacco induced strong human immune responses (2). Some of the vaccines have been designed to administer through mucosal routes to stimulate mucosal immune system. For example, nuclear expression of SARS-CoV-1 S protein (S1) in tomato induced oral immunization in mice. Using transgenic tomato as food could induce production of IgA (mucous specific Ab) against SARS-CoV-1 S protein (3).

Vaccination is one of the efficient ways to protect humans against various types of pathogens. Numerous studies have shown the potential of plant cells as a low-cost source to develop effective vaccines.

## Conflict of Interest Disclosures

The author declares that there is no conflict of interests.

## Ethical Approval

Not applicable.

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