Abstract: Vaccine is a substance that stimulates the production of specific antibody for protection against a specific disease. They would be more widely used especially in case of developing countries if their cost of production could be reduced and if they could be distributed without refrigeration. Edible vaccines hold great promise as a cost-effective, easy-to-administer, easy-to-store, fail-safe and socioculturally readily acceptable vaccine delivery system, especially for the poor developing birth control, cancer therapy, etc. Edible vaccines are currently being developed for a number of human and animal diseases. It involves introduction of selected desired genes into plants and then inducing these altered plants to manufacture the encoded proteins. Introduced as a concept about a decade ago, it has become a reality today. A variety of delivery systems have been developed. Initially thought to be useful only for preventing infectious diseases, it has also found application in prevention of autoimmune diseases.

Keywords: Edible vaccines, plants, transgenic, human pathogen

Advantages of Edible Vaccines

1) Much lower costs of production
2) Safety - no animal-related contaminations, no syringes and needles used
3) Higher stability (e.g. proteins in seeds can be preserved for years even at room temp.)
4) Easier compliance, especially for multi-dose vaccinations
5) Cost-effective and easier administration of vaccines for animals (livestock, pets etc.)
6) Especially suitable for less developed countries or regions.

Early developments in plant-derived vaccines

The first demonstration of expression of a vaccinogen in plants occurred in 1990 when Curtiss and Cardineau [P1] expressed the Streptococcus mutans surface protein antigen A (SpaA) in tobacco. After incorporation of the transgenic tobacco tissue into the diet of mice, a mucosal immuneresponse was induced to the SpaA protein. Although the mice were not challenged with the pathogen, the induced antibodies were demonstrated biologically active when they reacted with intact S. mutans. Reports have since followed of expression of a hepatitis antigen in tomato and lettuce [3, 4], a rabies antigen in tobacco [5], a cholera antigen in tobacco and potatoes [6, 7] and a human cytomegalovirus antigen in tobacco [8]. Animal trials demonstrating antigenicity of plant-derived vaccinogens include tobacco- and lettuce-derived hepatitis B surface antigen [9, 10], a tobacco- and potato-derived bacterial diarrhoea antigen [11], a potato-derived Norwalk virus antigen , and an Arabidopsis-derived foot-and-mouth disease antigen [11]. To date, the data obtained do not allow determination of protective immunity either because the animal model is not susceptible to the disease-causing agent, or because of strict containment issues with the pathogen (as in foot-and-mouth disease).

Recent developments in plant-derived vaccines

Recent research has concentrated on meeting the prerequisites for application of plant-derived vaccines to the human and animal health industries. Information on dosage, best delivery method and response type, strength and length has been acquired for pathogenics including Vibrio cholerae, HIV , Pseudomonas aeruginosa [9], murine hepatitis virus , and foot-and-mouth disease virus [12]. Further investigation
has examined the use of synthetic genes, targeting of vaccinogen expression to specific plant tissues, investigation of the induced immune response and progression to human clinical trials.

3. Conclusion

Edible vaccines hold great promise as a cost-effective, easy-to-administer, easy-to-store, fail-safe and socioculturally readily acceptable vaccine delivery system, especially for the poor developing countries. It involves introduction of selected desired genes into plants and then inducing these altered plants to manufacture the encoded proteins.

References


