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A Review on Banana Edible Vaccine against Hepatitis B

Mrugasha G. Desale, Jidnyasa S. Farde, Jagruti V. Kumbhar
Samarth Institute of Pharmacy, Belhe, Pune, Maharashtra, India

Abstract: *Hepatitis B is a disease which has caused major loss of life over the years. The treatment for the disease is very expensive and cure rate is less. Due to its high cost developing or underdeveloped countries are far out of reach from treatment to hepatitis B. There are vaccines produced against this disease but its cost has limited the use by the masses. In the recent years the plant based vaccines called edible vaccines which are cheap compared to the traditional vaccines have been current area of research. Due to its high cost devel-oping or underdeveloped countries are far out of reach of treatment to hepatitis B. There are vaccines produced against this disease but its cost has limited the use by the masses. In the recent years, the plant based vaccines called edible vaccines which are cheap compared to the traditional vaccines have been current area of research. Edible vaccines using banana have been prepared for Hepatitis B but in this hypothetical paper we have put forward our idea on preparing edible banana vaccine for Hepatitis B thorough a different methodology. We hypothesised to increase the expression level of the transgene by using pBIN19 as a vector instead of traditional Agrobacterium Ti plasmid. The paper also focuses on mechanism of the mode of action of vaccine along with advantages, disadvantages, challenges and future prospects of edible banana vaccine.*

Keywords: Hepatitis B, Banana Vaccine, Edible Vaccine, PBIN19.

I. INTRODUCTION

Hepatitis B has been one of the alarming dis-eases worldwide due to its poor prognosis. Al-though there is significant reduction in the number of deaths caused due to Hepatitis B. The treatment for the disease is expensive and the cure rate is low. End-stage liver carcinoma, hepatocellular carcinoma and morality are some of the major causes of Hepatitis B virus infection. Hepatitis B virus comes under the genus Orthohepadnavirus and Hepadnaviridae family. The Hepatitis B virus genome is circular and approximately 3.2 kb in length. The genome consists of four genes in total pol gene which codes for polymerase protein, C gene which codes for core and e antigen, S gene which codes for large, medium and small surface antigen protein and X gene which codes for X protein. rDNA technology has been implemented in the production of rDNA vaccines using yeast as an expression system. Vaccines are biological preparations that are used to improve or provide immunity to a particular disease. Current re-search has been about developing edible vaccine where a commonly consumed food is used as a carrier of the vaccines. This decreases the disease from spreading like hepatitis and diarrhea, especially in under-developed and emerging countries, where storage and administration of vaccines is a major concern. Edible vaccines are prepared based on the principles of genetic engineering. Edible vaccines are designed to target the mucosal layer of the epithelial tissue and hence stimulate systemic and mucosal immune response. Plant based production of vaccine using edible parts of the plant like fruits can act as a means to develop affordable vaccines. It can be used for mass immunization as it is economically feasible. Statistics have shown to vaccinate all children around the world and therefore there will be a need of 20,000 tonnes of banana every year. tonnes of banana every year [1]. A major problem in case of edible vaccine is the expression level. The level of expression of the surface antigen gene decides the level of immunization. Through this hypothesis we would like to put forward a novel technique for increasing the expression level of the gene for better immunization.

1.1 Benefits of Fruit Derived Edible Vaccine

The edible vaccines are cost-effective in bulk scale production/transportation. Eliminate requirements like cooking. Heat-stable, eliminate the condition of refrigeration. Enhanced compliance in children. Reduced requirement of medical personnel and sterile injection conditions. Storage at use-site and Sophisticated administration Constraints of edible

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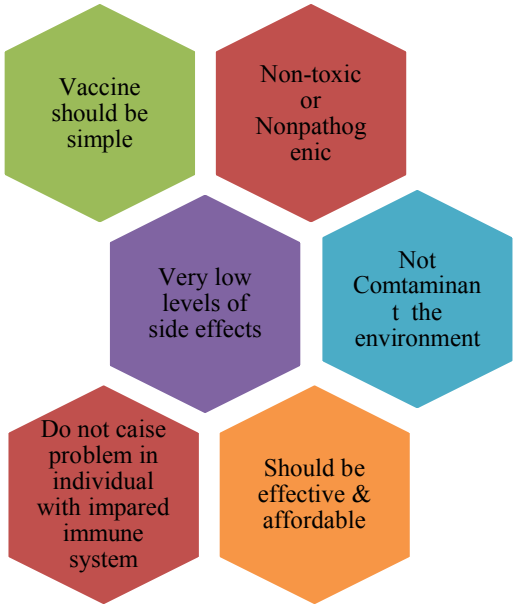
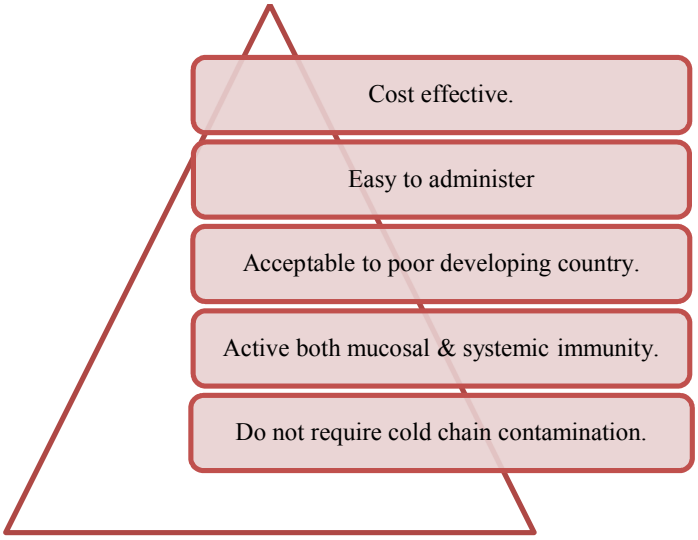
vaccine The fruit to fruit or plant-to-plant vaccine dosage is not compatible. The stability of the vaccine within the fruit is not known and Improved immune sensitivity to peptide or protein vaccine. The dosage of vaccine is variable and difficulty in plant selection. Another issue is sweetness and not suitable for infants. Ethical and ecological issues regarding GM plants is also a constraint of edible vaccines. The earliest fruit which uses for the plant transgenic programs banana is one of them banana. Papaya is an extensive tropical and semi-tropical fresh edible fruit. Papaya and banana are producing rapidly, cheap, commonly produces in emerging nations, high quantity of vitamin "A" is present and because of the sterile condition in banana the genes not transfer from one banana to another. A study stated that the expression of foreign proteins (vaccine) At the time of ripening in the banana fruit MaExp1 promoter could be an important tool . There are some drawbacks of banana using as an edible vaccine that it quickly spoils after ripening and the amount of protein contain very smaller.

1.2 Ideal Properties of Banana Vaccine



1.3 Advantages of Banana Vaccine



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II. MECHANISM OF EDIBLE BANANA VACCINE

The edible vaccines design targets the mucosal immune system as it is one of the primary targets for pathogen invasion. The mucosal immune system acts as a primary defense against most of the pathogens and lines the digestive tract, respiratory tract and urino-reproductive tract. The mucosal immune response begins with the recognition of antigen by the M-cells. These cells are present only in the mucosal membranes of lymphoid tissues like Peyer's patch. The M-cells serves as an entry for the antigen to pass to the lower region where the antigen is internalized by the antigen presenting cells. The antigen presenting cells present the antigenic epitope on its cell surface which is recognized by the TH cells and activates the B cells. These B cells now move to the lymph nodes where they mature to form plasma cells and travel to the mucosal epithelium to secrete immunoglobulin A (IgA). The secreted IgA acts on specific antigenic epitope and neutralizes the attacking pathogen. The next time when a patient is invaded by the virus the memory cells in circulation attack the pathogens, and elicit an immune response.

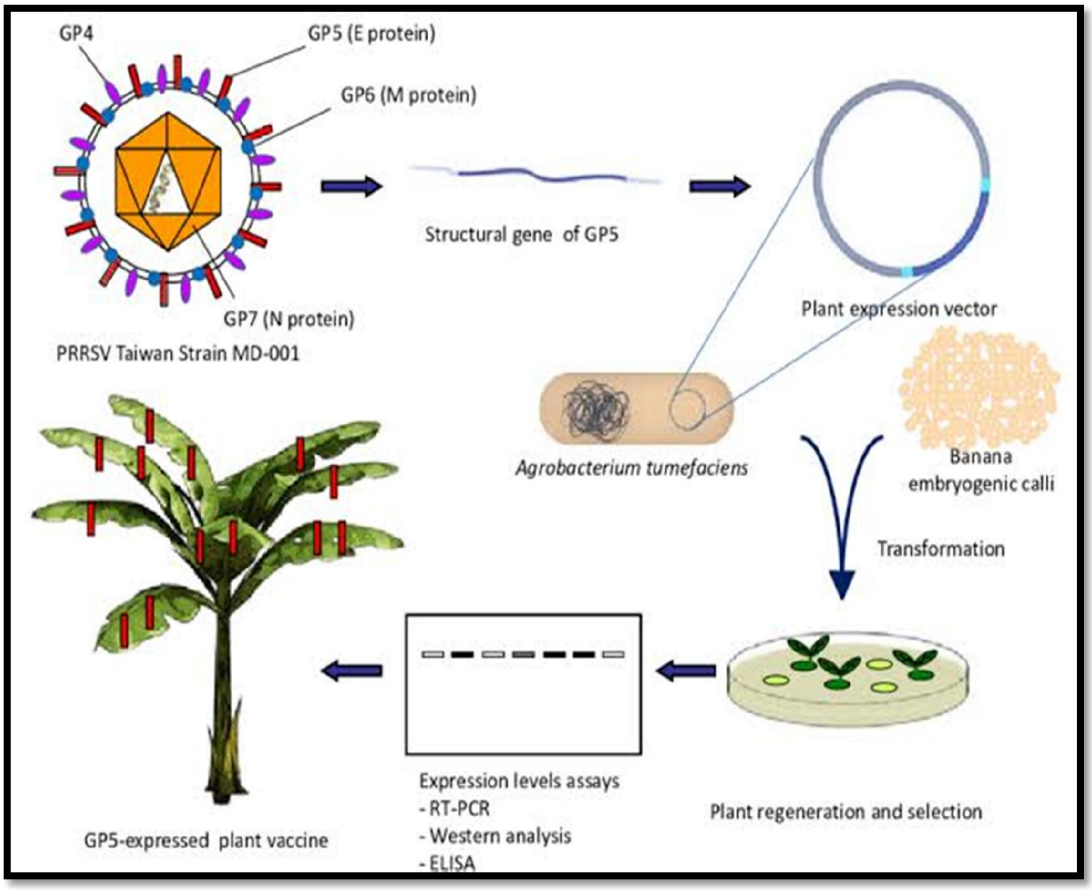

Fig.1 Mechanism of Banana Vaccine.

III. FUTURE USES OF BANANA VACCINE

Vaccines play a vital role in the prevention of many infectious diseases. The conventional methods of vaccine production and vaccination have certain obstacles. The concept of edible vaccines came into existence in the 1990s with the thought of overcoming the obstacles of the conventional method. The rDNA technology, particularly Agrobacterium-based transformation of plant cells is employed in the production of edible vaccines. Commercial crops such as banana, potato, rice, tomato spinach, and others have been genetically modified to express the antigen capable of eliciting an immune response. There is so much research progress in developing edible vaccines against pathogenic diseases such as measles, hepatitis B, diphtheria, tetanus, acute gastrointestinal illness, AIDS, anthrax, and cholera. Research on the second-generation edible vaccines in terms of multi-subunit antigen proteins targeting more than one disease simultaneously has

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also been initiated. Despite there are many advantages, edible vaccines are not without any limitations. There is hope for overcoming these limitations and in the future days, edible vaccines will be an effective strategy in the mass eradication of infectious diseases. disease such as hepatitis B, measles and cholera have been examined for edible vaccines. Furthermore, vaccines against autoimmune diseases such type-I diabetes were also studied Prodigene a biotech company (US) has a patent for edible vaccine against Hepatitis B disorder while college of Yale has a patent for Vaccine in opposition to invertebrates like insects and arachnids. Foot-and-mouth disease (FMD) is among the leading contagious viral illnesses of wild reflective and domestic animals. FMDV is a positive sense single stranded RNA virus that contain four capsid proteins VP1, VP2, VP3 and VP4. The VP1 protein is potential target to be used as edible vaccines via stimulating immune system to produce VP1-neutralizing antibodies necessary for immunization. The capability of such type vaccines such as a subunit PMV candidate, in tobacco, potato and tomato. Potato-based totally vaccine towards hepatitis B have reported that the amount of HBsAg wished for one dose will be accomplished in a unmarried potato. tiers of unique antibodies appreciably exceeded the protective level of 10 mIU/mL in humans.

It is problematic in this region of science to expect how rapidly new products turns into to be had and be well-known by way of the purchaser. In principle, now it's possible to transfer a gene of an organism into any plant, to express that new product in any part of the plant, be it seed, root, tuber or leaf. Progressively, food is being measured not just a basic nutrition source but slightly as a product with unique medicinal properties. So, known as "functional food'. as an instance, changes inside the basic composition of the kind deliberated above may be accompanied by means of more radical changes; influential human growth factors have been produced in fruit, and leaves and might be fairly easy to reduce the level of poisonous compounds for example oxalate, a compound that have to be averted by way of those stricken by urolithiasis the deposition of kidney and bladder stones. As we pass towards food with greater precise health benefits, and the opportunities created via such products, the issue of prediction lies no longer a lot in scientific world but as an alternative in estimating business fulfilment.

IV. CONCLUSION

For edible vaccination fruit act as a transporter having dual advantage, the one advantage is the producing immunization and the other advantage is giving the malnutrition. It's a substitute of painful immunization procedures. Fruit derived vaccine (edible vaccine) has many benefits as compared to traditional vaccine. Edible vaccine is inexpensive, needle free, attractive to children, may be stored nearby the place of usage, harmless, deliver the systematic and mucosal immunity. Fruit derived edible vaccine may additionally motive a destiny of more secure and greater effective vaccination if massive and important challenges may be overcome. There exist techniques for production of edible banana vaccine. Through the study we have concluded that banana vaccine is a cheap and the best way to produce edible vaccine against Hepatitis B. Banana being a commodity commonly consumed by many around the globe can be efficiently used as a vaccine. There are a few disadvantages of edible vaccines, but they can be ignored against the positive aspects of edible vaccine. Food plants can be manipulated to produce pharmaceutical products which come under traditional medicinal chemistry. Banana as an edible vaccine overcomes the common problems faced in the preparation of conventional vaccines, like manufacture and de-livery. Immunization by the use of edible plant parts is safer and effective.

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CONFLICT OF INTEREST

The author declared no conflict of interest.

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