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Research Article

MOLECULAR MODELING OF FOWL ADENOVIRUS-4 PENTON PROTEIN

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ABSTRACT: Modelling of FAV-4 penton protein was done at SWISS-MODEL online and results viewed using spdbv 4.04 software. The penton protein was elongated structure with different groups, secondary structure and the structural details could be viewed.

Keywords: Modelling, fowl adenovirus-4, penton protein, FAV-4, SWISS-MODEL.

INTRODUCTION

SWISS-MODEL is developed by the Protein Structure Bioinformatics group at the SIB - Swiss Institute of Bioinformatics and the Biozentrum University of Basel. It is serving the modelling of molecules in excellent manner. Fowl adenovirus-4 penton is an important protein of the virus and structural details of this protein are lacking.

Ganesh *et al* (2002) carried out purification and characterization of the etiological agent of hydropericardium hepatitis syndrome from infected liver tissues of broiler chickens. Hydropericardium hepatitis syndrome in broiler chickens is an acute, infectious disease characterized by high mortality, excess pericardial fluid and multifocal hepatic necrosis. The aetiological agent was purified to homogeneity from infected liver tissues from field outbreaks. Electron-microscopic and serological confirmation of the virus was undertaken and the disease was reproduced experimentally in broiler chicks. The results indicated that an adenovirus, fowl adenovirus serotype 4, was alone responsible for the disease in the materials studied.

Shah *et al* (2012) prepared a subunit vaccine against hydropericardium syndrome using adenovirus penton capsid protein. Hydropericardium syndrome (HPS) is a disease of poultry that is caused by fowl adenovirus-4. Inactivated liver homogenate from diseased birds is still the choice of vaccine in some countries which disseminates numerous pathogens along with inactivated virus. Moreover incomplete attenuation or inactivation, reversion to virulence and the oncogenic potential/genetic instability of the

adenoviruses have prevented their use in routine vaccines. To address this problem an effort is made to develop a subunit vaccine. For this purpose penton base protein of HPS virus was expressed in Escherichia coli and used as subunit vaccine in broilers. Immunogenicity of the recombinant penton base protein and challenge protection test against pathogenic virus demonstrated the ability of recombinant penton base protein to confer (90%) protection. Results suggest that the recombinant penton base protein is a candidate for subunit vaccine against HPS. Mansoor (2011) prepared and evaluated a chicken embryo-adapted fowl adenovirus serotype 4 vaccine in broiler chickens. The current study was planned to develop an efficient vaccine against hydropericardium syndrome virus (HSV). Currently, formalin-inactivated liver organ vaccines failed to protect the Pakistan broiler industry from this destructive disease of economic importance. A field isolate of the pathogenic hydropericardium syndrome virus was adapted to chicken embryos after four blind passages. The chicken embryo-adapted virus was further serially passage (12 times) to get complete attenuation. Groups of broiler chickens free from maternal antibodies against HSV at the age of 14 days were immunized either with 16th passage attenuated HSV vaccine or commercially formalized liver organ vaccine. The antibody response, measured by enzyme-linked immunosorbent assay was significantly higher ($P < 0.05$) in the group immunized with the 16th passage attenuated HSV vaccine compared to the group immunized with liver organ vaccine at 7, 14, and 21 days post-immunization. At 24 days of age, the broiler chickens in each group were challenged with 10 (3.83) embryo infectious dose of pathogenic HSV and were observed for 7 days post-challenge. Vaccination with the 16th passage attenuated HSV gave 94.73% protection as validated on the basis of clinical signs (5.26%), gross lesions in the liver and heart (5.26%), histopathological lesions in the liver (1.5 ± 0.20), and mortality (5.26%). The birds inoculated with liver organ vaccine showed significantly low ($p < 0.05$; 55%) protection estimated on the basis of clinical signs (40%), gross lesions in the liver and heart (45%), histopathological lesions in the liver (2.7 ± 0.72), and mortality (35%). Birds in the unvaccinated control group showed high morbidity (84%), mortality (70%), gross (85%), and histopathological lesions (3.79 ± 0.14) with only 10% protection. In conclusion, this newly developed HSV vaccine proved to be immunogenic and has potential for controlling HSV infections in chickens.

Asthana (2013) reported that Hydropericardium syndrome (HPS) is a highly infectious disease caused by fowl adenovirus serotype 4 (FAV-4) affecting poultry, especially broiler birds. The disease occurs predominantly in broilers of the age group of 3-5 weeks, characterized by sudden onset of high mortality up to 80 %. The causative agent of HPS is fowl adenovirus 4. FAV-4 is non-enveloped and icosahedral in shape, measuring 70-90 nm in size and containing a linear dsDNA of approximately 45 kb in size as its genome. The livers of affected birds show necrotic foci and basophilic intranuclear inclusion bodies in the hepatocytes. The disease can be diagnosed from its gross and microscopic changes in the liver and by various serological tests, such as agar gel immunodiffusion, counter immunoelectrophoresis, indirect

hemagglutination, fluorescent antibody techniques, and ELISA. In the past few years, PCR has been used as a rapid diagnostic tool for the detection of fowl adenoviruses. The disease has been brought under control by the use of formalin-inactivated, attenuated or live vaccines in experimentally infected birds. Advancement in the field of computational immunology accelerates knowledge acquisition and simultaneously reduces the time and effort involved in screening potential epitopes, leading toward the development of epitope-based vaccines.

MATERIALS AND METHODS

Fowl adenovirus 4 penton protein sequence ACCESSION HQ331242 was downloaded from NCBI/Pubmed online.

MWGLQSPTSIPPPPPPTELTPSTYPAMVNGYP PPAASAQSCPSS GGQSELYMPLQRVMAPTGGRNSIKYRDYTP CRNTTKLFYVDNKASDIDTYNKDANHSN

FRTTVIHNQDLDADTAATESIQLDSRSCWGG DLKTAVRTNCPNVSSFFQSNSVRVRMM

WKRDPPTSTAPPSAVGSGYSVPGAQYKWYDL TVPEGNYALCELIDLLNEGIVQLYLSE

GRQNNVQKSDIGVKFDTRNFGLLRDPVTGLV TPGTYVYKGYHPDIVLLPGCAIDFTYS

This sequence was used for modelling at SWISS-MODEL workspace online at http://www.expasy.org/spdbv/ and the results obtained were analysed using spdbv 4.04. Different parameters and modelling tools have been developed and described for use at this site (Arnold *et al*,2006); Schwede *et al*, 2003; Guex and Peitsch,1996, 1997; Johansson *et al*, 2012; Guex *et al*, 1999,2009; Schwede *et al*, 2003; Guex, 1996; Weiner *et al*, 1984; Morris *et al*, 1992; Carson ,1987; Huang and Miller, 1991; Sippl, 1990; Schuettelkopf and Aalten, 2004; Kleywegt *et al*, 2004; Edgar, 2004).

RESULTS AND DISCUSSION

The results obtained are shown in Fig 2-5. It may be seen that modelling has revealed the groups, secondary structure and reacting sites of the fav4 penton protein.

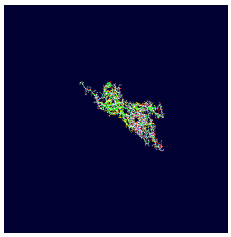

Fig 2. Fav4 penton protein color structure, spdbv 4.04.

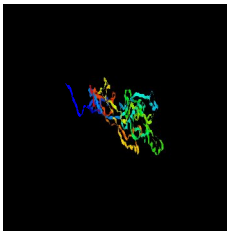

Fig 3. Fav4 penton protein color group ribbon, spdbv 4.04.

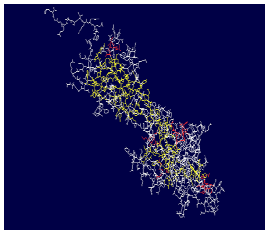

Fig 4. Fav4 penton protein color secondary structure 3D, spdbv 4.04.

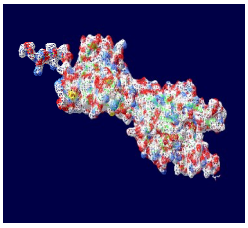

Fig 5. Fav4 penton protein color secondary structure loop, spdbv 4.04.

CONCLUSIONS

The modelling of fav4 penton protein revealed structural details and reacting groups of the protein.

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