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Generation, characterization and application of monoclonal antibodies against foot-and-mouth disease virus serotype A

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Foot-and-mouth disease (FMD) is one of the most highly contagious diseases that affects cloven-hoofed animals such as cattle, pigs, sheep and goats. FMD is an economically devastating disease that severely constrains the international trade of animals. FMD virus (FMDV) has seven serotypes: O, A, C, Asia 1, SAT 1, SAT 2 and SAT 3based on serological tests. Among the seven serotypes of FMDV, O and A are the most widespread and currently found in Africa, the Middle East, Asia, limited area of South America and sporadically in Europe. The objective of this study was to generate and characterize monoclonal antibodies against foot-and-mouth disease virus serotype A. Using the produced mAbs develop a reliable and rapid competitive ELISA (cELISA) for the detection of antibodies to FMDV serotype A. A panel of FMDV/A specific mAbs were generated from this study. The binding epitopes of the mAbs were characterized. Two of the twelve mAbs' biding sites are located on VP2 and VP3 as previously identified antigenic site 3 using the monoclonal antibody resistant mutant selection method. These two mAbs clearly inhibited the binding of a FMDV/A polyclonal serum to FMD serotype A viruses. Thus acELISA for FMDV serotype A antibody detection was developed using the two serotype A-specific mAbs and the inactivated virus as the antigen. The cut-off value was set at <50% of inhibition based on the tested results of a total of 1,174 negative sera. Three of the 1,174 negative samples exceeded this cut-off value, which produced a diagnostic specificity of 99.7%. The antibody responses to FMDV/A in experimentally inoculated animals were examined using the A/cELISA. All samples demonstrated positive antibody responses starting at 5 days post inoculation (dpi) and remained positive until the end of the experiment (21-28 dpi). The results showed that the A/cELISA detected antibodies against FMDV/A in all tested animal species (cattle, pig and sheep). Serum samples from vaccinated (A22 Iraq) and challenged (A/Vietnam/13) sheep were examined using the A/cELISA and compared with the virus neutralization test (VNT) recognized by the OIE as a standard method. All sheep (100%) demonstrated a positive seroconversion at 10 dpc using A/cELISA and 60% of the sheep showed positive results using a VNT. The results showed that the performance of this A/cELISA was comparable or better than the VNT indicating the potential of this cELISA as an alternative assay to VNT. This A/cELISA is a simple, reliable test to detect antibodies against FMD serotype A viruses. The test will be a useful tool for surveillance, epidemiological study of FMD and monitoring immune responses following FMDV/A vaccination.

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