Foot and Mouth Disease Virus (FMDV) Vaccine Antibodies and ELISA Kits

FMD affects millions of farm animals (cow, buffalo, pigs, sheep, goat, etc) in the world that are of great economic concerns. ADI now offers the most comprehensive selection of individual FMD recombinant proteins (strucutral and non-structural), antibodies for research use. FMD antibody ELISA detection tests in various animals (Cow, Bufflao/Bison, Pig, Sheep, Goat, and Deer).

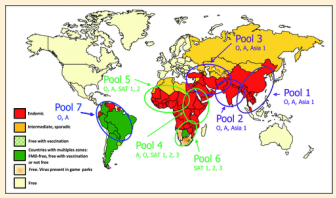
Our ELISA kits offers the following advantages:

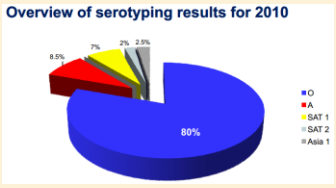
Convenience: ELISA kit conatins all necessary reagents. Tests are conducted at room temp. for convenience.
Speed: Test results obtained in 60-90 mins, fastest in industry.
Economy: Recombivirus ELISA platfors employ highly purified recombinant proteins so there is no need to test sample in control viral extracts (50% savings in cost, samples, and time).
Safety: Recombivirus ELISAs do not contain any live or dead virus or viral derived proteins. No safety issues.
Highthruput: ELISA kits are avaiable in standard 96-wells strip plates (8 well strips x12) or 1 plate of 480-wells for high thryput testing. Saves, samples, labor and cost.
Easy testing options: ELISA kits are available for individual serotypes (O, A, A1, SAT 1-3) or Combo (O+A+A1) or O+A+SAT1-2.
Advanced Testing: New DIVA tests based upon 3ABC, 3D, 2ABC will offer better DIVA options. These NSP DIVA tests are applicable to FMD serotypes.

FMD disease is a viral disease that affects cloven-hoofed animals, including domestic and wild bovids. The causative agent is **FMDV,** a picornavirus. The virus causes a high fever followed by blisters inside the mouth and on the feet that may rupture and cause lameness. FMD has severe implications for animal farming, since it is highly infectious and can be spread by infected animals. Its containment demands considerable efforts in vaccination, strict animal monitoring (diagnosis), trade restrictions, quarantines, and occasionally the killing of animals.

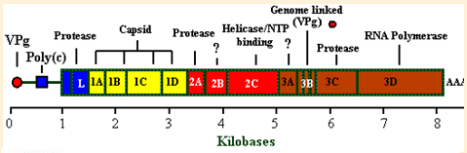
Global impact of FMD outbreak has been estimated tens of bilions $ in direct and indirect costs. In a recent estimate, with a focus on the pork industry, an estimated economic impact $128 billions over 10-years. For a potential outbreak in California alone may incur loss of $3 to $69 billions. Ten States in the US have populations in excess of 5 millions and 4 States have more than 10 million animals.

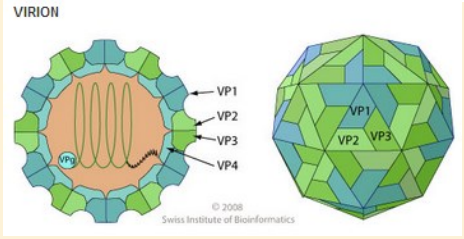
FMD susceptible animals include cattle, water buffalo, sheep, goats, pigs, antelope, deer, and bison. In laboratory experiments, mice, rats, and chickens have been successfully infected by artificial means, but they are not believed to contract the disease under natural conditions. Humans are very rarely infected because FMD is sensitive to stomach acid, it cannot spread to humans via consumption of infected meat. **Effective vaccines** and stringent control measures have enabled FMD eradication in most developed countries, which maintain unvaccinated, seronegative herds in compliance with strict international trade policies. However, the **disease remains enzootic in many regions of the world**, posing a serious problem for commercial trade with FMD-free countries. **Endemic areas** include parts of Asia, Africa, Midde east and South America.





Of the **seven FMD serotypes** of this virus, A, C, O, Asia 1 and SAT3 appear to be distinct lineages; SAT 1 and SAT 2 are unresolved clades. **FMD serotypes are not uniformly distributed in the regions of the world** where the disease still occurs. For example, the cumulative incidence of FMD serotypes show that six of the seven serotypes of FMD (O, A, C, SAT-1, SAT-2, SAT-3) have occurred in Africa, while Asia contends with four sero-types (O, A, C, Asia-1), and South America with only three (O, A, C). Periodically there have been incursions of Types SAT-1 and SAT-2 from Africa into the Middle East. **FMD serotytpe O is the most common**. In India, FMD serotypes O accounts for 50-60%, Asia 1 (15-20%) and A (10-15%) outbreaks. A recent FMD world survey of 38 countries in 2010 reported 80% samples of serotype O, A (8.5), SAT-1 (7%), SAT-2 (2%), and Asia-1 (2.5%, only in India), Serotypes C and SAT-3 are very rare.





The **FMDV genome** is ~ 8,2Kb. It is a small nonenveloped virus with a pseudo T=3 icosahedral capsid made up of 60 copies of four structural (SP) proteins. P1 of the genome encodes for the capsid proteins (VP1-4) while P2 encodes non-structural proteins (NSP2A/2B/2C) and P3 region (NSP3A/Vpg/3Cpro, and 3D pol). VP1-3 are on the surface, and VP4 is internal. **VP1 is the major antigen** of FMDV capsid protein that contains the major B-cell epitope, which is the major immunodominant epitope eliciting protective humoral immunity. Upon virus entry into a cell, the viral genome is rapidly translated into a polyprotein which is co- and posttranslationally cleaved by viral proteinases into several partially cleaved, likely functional, intermediates and ultimately into 12 mature protein.

Diagnosis of FMDV is based upon virus isolation, presences of FMD antigens or nucleic acid but the presence of serotype specific atnibodies in the serum remains the method of choice due to its speeed, efficieny and economy. Antibodies to FMD-VP1 may arise due to vaccination or infections. VP1 proteins are highly variable among different serotypes so it is necessary to have serotype specific VP1 antibody ELISA. Antibodies to NSPs, are induced mostly due to natural infection by some vaccine may contain residual NSPs and repeated immunization may make it difficult to distinguish infected from vaccinated animals (DIVA test). Therefore, it is necessary to have NSP tests based upon multiple NSPs (3ABC, 3D, 2ABC etc). NSPs are highly conserved (95-100%) in various serotypes making it posssible to detect all serotypes NSP antibodies using a single kit.

All curtently approved **FMD Vaccines** employ **killed FMD viruses** (Monovalent or a combination of various serotypes); FMD virus grown in BHK-21 (baby hamster kidney cells (BHK) or epithelial cell culture and then killed using chemicals (binary ethylamine or BEI). Most vaccines contain Alum or oil adjuvants. **Worldwide, tens of billion doses of FMD vaccine** are administered every year. Endemic countries like India manufacture mono, bi and trivalent vaccines **BioFMD-Oil™** (Biovet), FUTVAC™ (Brilliant Biopharma). **Raksha** (Indian Immunological) against strains O, A, Asia 1. Other manufacturers of FMDV vaccine are Bayer, Merial, and Intervet.

Drawbacks of current FMD Vaccines: Most inactivated (killed) vaccines may still contain residual live virus; and it creates great danger in releasing the highly infectitous virus into non-infected animals. Current vaccines have short shelf life and require cold chain for storage and distribution, a great problem in developmign countries. They also also contain small but siginificant concentrations of NSP (3ABC, 2ABC etc) that is sufficient to make antibodies in vaccinated animals. **New generation of subunit vaccines**: ADI is developing and testing several **reocmbinant FMD antigenic proteins** that will provide better protection than current killed FMD vaccines. Ideally, there is a need for **an universal FMD vaccine**, based upon single or a combination of FMD proteins from 3-7 FMD serotypes with unique DIVA tests.

Alpha Diagnostic Intl Inc., USA; **Email**: service@4adi.com; ☎ (800) 786-5777; (210) 561-9515; **Web**: www.4adi.com

List of FMD ELISA Kits available from ADI.

Product details, data sheets, and pricing available (http://4adi.com/commerce/catalog/spcategory.jsp?category_id=2786

Items Description	Kit Type	Species	ELITSA Cat#
RecombiVirus FMDO VP-1 IgG ELISA Kit, **FMD Serotype O, VP1, Quantitative For vaccinated or infected animals**	Antibody (O, VP1)	Bovine	RV-400100-1
		Pig	RV-400110-1
		Goat/Sheep	RV-400120-1
RecombiVirus FMD A VP-1 IgG ELISA Kit, **FMD Serotype A, VP1, Quantitative For vaccinated or infected animals**	Antibody (A, VP1)	Bovine	RV-400200-1
		Pig	RV-400210-1
		Goat/Sheep	RV-400220-1
RecombiVirus FMD A1 VP-1 IgG ELISA Kit, **FMD Serotype A1 (Asia-1), VP1, Quantitative For vaccinated or infected animals**	Antibody (A1, VP1)	Bovine	RV-400300-1
		Pig	RV-400310-1
		Goat/Sheep	RV-400320-1
RecombiVirus FMDO VP-1 IgG ELISA Kit, **FMD Serotype O, A, A1 (Combo), VP1, Quantitative For vaccinated or infected animals**	Antibody (O/A/A1, VP1)	Bovine	RV-400400-1
		Pig	RV-400410-1
		Goat/Sheep	RV-400420-1
RecombiVirus FMDO VP-1 IgG ELISA Kit, **FMD Serotype, SAT-1, VP1, Quantitative For vaccinated or infected animals**	Antibody (SAT-1, VP1)	Bovine	RV-400500-1
		Pig	RV-400510-1
		Goat/Sheep	RV-400520-1
RecombiVirus FMDO VP-1 IgG ELISA Kit, **FMD Serotype, SAT-2, VP1, Quantitative For vaccinated or infected animals**	Antibody (SAT-2, VP1)	Bovine	RV-400600-1
		Pig	RV-400610-1
		Goat/Sheep	RV-400620-1
RecombiVirus FMDO VP-1 IgG ELISA Kit, **FMD Serotype O, SAT 1-2 (Combo), VP1, Quantitative For vaccinated or infected animals**	Antibody (O/SAT1-2, VP1)	Bovine	RV-400700-1
		Pig	RV-400710-1
		Goat/Sheep	RV-400720-1
RecombiVirus FMD 2ABC IgG ELISA Kit, **All FMD Serotype, Quantitative 2ABC DIVA test for infected animals**	Antibody (2ABC/DIVA)	Bovine	RV-401100-1
		Pig	RV-401110-1
		Goat/Sheep	RV-401120-1
RecombiVirus FMD 3ABC IgG ELISA Kit, **All FMD Serotype, Quantitative 3ABC DIVA test for infected animals**	Antibody (3ABC/DIVA)	Bovine	RV-401200-1
		Pig	RV-401210-1
		Goat/Sheep	RV-401220-1
RecombiVirus FMD 3D IgG ELISA Kit, **All FMD Serotype, Quantitative 3D DIVA test for infected animals**	Antibody (3D/DIVA)	Bovine	RV-401300-1
		Pig	RV-401310-1
		Goat/Sheep	RV-401320-1
FMD Antibody Rapid Test, 50 tests new	FMD Ab Rapid test strip	RTA-2070-50 (swine) RTA-2075-50 (bovine)	

List of FMD reagents available from ADI.

Product details, data sheets, and pricing available (http://4adi.com/commerce/catalog/spcategory.jsp?category_id=2786

FMD Serotype	Product Type	Catalog#	Product Description
A1 (Asia-1)	Antiserum	FMDA1VP11-S	Anti-Foot and mouth disease, serotype A1, viral protein 1 (FMDA1-VP1) protein antiserum
	Rec. Protein	FMDA1VP15-R-10	Recombinant (E. coli) Purified FMD, serotype A1 viral protein 1 (FMDA1-VP1) (>95%)
A	Antiserum	FMDAVP11-S	Anti-FMD, serotype A, viral protein 1 (FMDA-VP1) protein antiserum
	Rec. Protein	FMDAVP15-R-10	Recombinant (E. coli) Purified FMD, serotype A viral protein 1 (FMDA-VP1) (>95%)
C	Pure peptide	FMDCVP11-P	FMD, serotype C, VP1 (FMDC-VP1) GH loop Control/blocking peptide
	Antiserum	FMDCVP11-S	Anti- FMD, serotype C, VP1 (FMDC-VP1) GH loop peptide antiserum
O	Antibodies	FMDO2A11-A	Anti- FMD, serotype O, 2A (FMDO-2A) peptide IgG, aff pure
	Antigen Peptide	FMDO2A11-P	FMD, serotype O, 2A (FMDO-2A) Control/blocking peptide
	Antiserum	FMDO2A11-S	Anti-FMD, serotype O, 2A (FMDO-2A) peptide antiserum
	Antiserum	FMDO2B11-S	Anti-FMD, serotype O, 2B (FMDO-2B) protein antiserum
	Rec. Protein	FMDO2B15-R-10	Recombinant (E. coli) Purified FMD, serotype O, 2B (FMDO-2B) (>95%)
	Antiserum	FMDO2C11-S	Anti-FMD, serotype O, 2C (FMDO-2C) protein antiserum
	Rec. Protein	FMDO2C15-R-10	Recombinant (E. coli) Purified FMD, serotype O 2C (FMDO-2C) (>95%) GST tag
	Antiserum	FMDO3AB11-S	Anti-FMD, serotype O, 3AB (FMDO-3AB) protein antiserum
	Rec. Protein	FMDO3AB15-R-10	Recombinant (E. coli) Purified FMD, serotype O, 3AB (FMDO-3AB) (>95%)
	Antiserum	FMDO3C11-S	Anti-FMD, serotype O, 3C (FMDO-3C) protein antiserum
	Rec. Protein	FMDO3C15-R-10	Recombinant (E. coli) Purified FMD, serotype O, 3C (FMDO-3C) (>95%)
	Antiserum	FMDO3D11-S	Anti-FMD, serotype O, 3D (FMDO-3D) protein antiserum
	Rec. Protein	FMDO3D15-R-10	Recombinant (E. coli) Purified FMD, serotype O, 3D (FMDO-3D) (>95%)
	Antiserum	FMDOVP11-S	Anti-FMD, serotype O, viral protein 1 (FMDO-VP1) protein antiserum
	Rec. Protein	FMDOVP15-R-10	Recombinant (E. coli) Purified FMD, serotype O viral protein 1 (FMDO-VP1) (>95%)

Alpha Diagnostic Intl Inc., USA; **Email**: service@4adi.com; ☎ (800) 786-5777; (210) 561-9515; **Web**: www.4adi.com