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A virus-like particle vaccine based on an A/ASIA/G-VII lineage strain offers cattle protection against homologous FMDV challenge

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Even though it has existed longer, the A/ASIA/G-VII lineage has been causing outbreaks since 2015. A/Asia/G-VII (A/G-VII) is also known as genotype 18. The aim of the work was to develop a virus-like particle (VLP) vaccine based on a FMDV strain belonging to the A/ASIA/G-VII lineage.

Reported Asian A/Asia/G-VII cases between 2010 and 2025, Source: openfmd.org FMDWatch accessed 10.8.2025

Virus-like particles (VLP) can be used as a vaccine. However, these VLP must be stabilized to keep them intact. Only intact capsids can induce a protective immune response. VLPs were modified with an amino acid substitution that confers enhanced thermostability.

ELISA specific for intact capsids demonstrates that capsid-stabilizing mutations improve the thermostability of VLPs

The thermostability of the VLPs was evaluated at 56 °C for 20min
→ High thermostability translates into a long shelf life

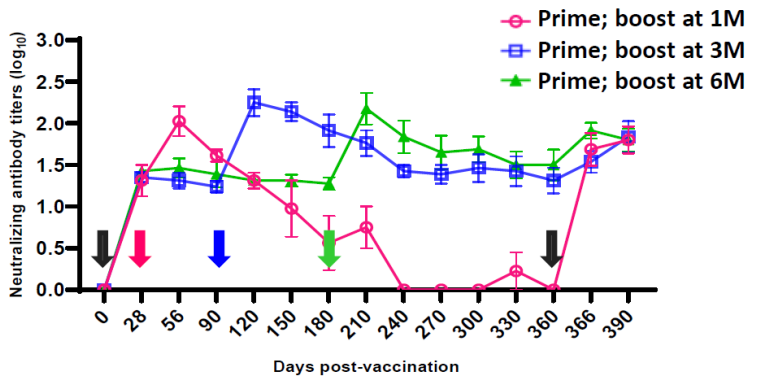
A dose response experiment was conducted in cattle. The study supported the selected 'normal' dose with 100% of animals protected against FMDV challenge post VLP vaccine vaccination.

Group (*n*=8)	Monovalent A/G-VII vaccine	VNT at 21 dpv (log_{10})	Protected against FMDV challenge	Rectal temp (at 2 dpv)	FMDV RNA-positive blood samples post challenge (1-3 dpc)
1	Low (25%)	1.8	7/8	40.5°C	17%
2	Medium (50%)	2.0	7/8	39.2°C	0%
3	Normal (100%)	2.1	8/8	39.9°C	4%
4 (controls)	-	0.0	0/2	41.3°C	100%

Published work[1,2,3] shows cross reactivity between A/G-VII and other A strains is poor, however the level of cross reactive VNTs post prime boost with a multivalent VLP vaccine is indicative of protection.

Strain	Topotype	Lineage	Sublineage	VNT (prime-boost)
Homologous	ASIA	G-VII	-	3.0
A/TAI/14/2022	ASIA	Sea-97	-	2.2
A/NEP/5/2021	ASIA	G-VII	-	2.1
A/IRN/6/2016	ASIA	Iran-05	SIS-10	1.6
A/PAK/1/2020	ASIA	Iran-05	SIS-13	1.8
A/PAK/4/2023	ASIA	Iran-05	FAR-11	1.5

A multivalent VLP vaccine was tested at multiple intervals to determine the optimal prime boost interval together with duration of immunity.
- After prime: at least 6 months
- After prime-boost: at least 12 months with optimal prime-boost strategy



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References
1 Waters et al. 2018, Vaccine
2 Dekker et al. 2020, Vaccine
3 Singanallur et al. 2022, Viruses

Conclusions
- The VLP technology allows the development of specific vaccines, such as those with the A/ASIA/G-VII strain → a quick response to new strains is feasible.
- Good homologous protection, and based on VN levels sufficient heterologous protection against A/ASIA/Sea-97 and A/ASIA/Iran-05 is expected
- Good duration of immunity