Immunogenicity Assessment of EMV-Based VLP Vaccines Displaying Fel d 1 in Mice

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INTRODUCTION

Cat allergy is an **IgE-mediated hypersensitivity** to Fel d 1, the major cat allergen, causing asthma, rhinitis, and dermatitis. Current allergen-specific immunotherapy is the only curative option but requires years of repeated treatment and carries a risk of anaphylaxis.

Virus-like particles (VLPs) are non-infectious, repetitive nanoparticles that can present allergens in a highly immunogenic but low-reactogenic form, enabling rapid induction of protective IgG.

Based on this concept, we developed a novel **Eggplant Mosaic Virus (EMV)–Fel d 1 VLP vaccine**, produced in *E. coli*, and compared its immunogenicity with EMV alone and free Fel d 1 protein in a mouse model.

Our results show that EMV–Fel d 1 VLPs induce robust Fel d 1-specific IgG responses, supporting their potential as a safe and efficient immunotherapy for cat allergy.

METHODS

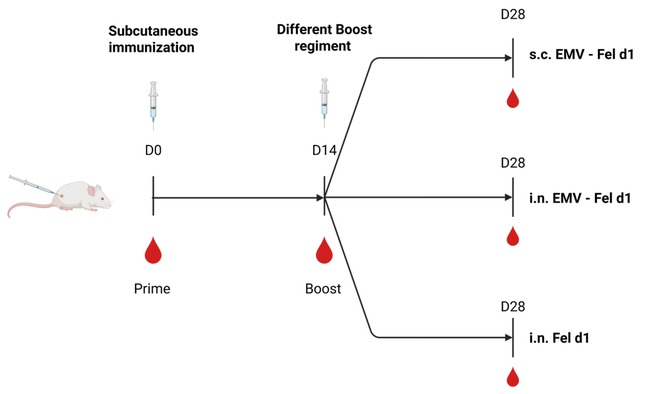
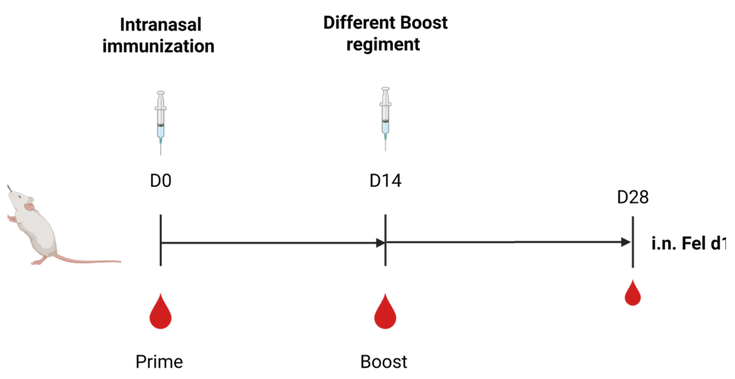


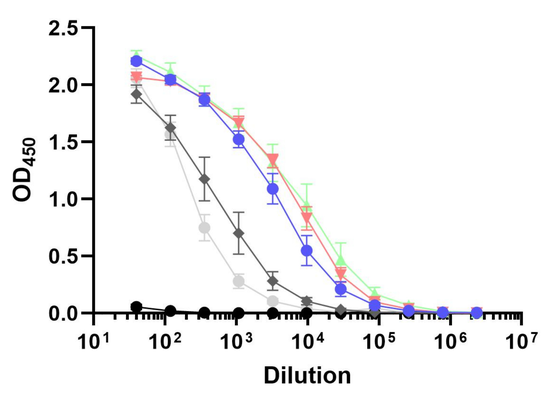
Figure 1: BALB/c mice were primed with EMV-Fel d1 on day 0 and boosted on day 14 using either homologous (EMV-Fel d1/EMV-Fel d1) or heterologous (EMV-Fel d1/Fel d1 protein or EMV-Fel d1/EMV control) regimens, administered s.c. or i.n.The other group of mice received homologous prime/boost with Fel d1 protein. Antibody titers, IgG subclasses, and IgG avidity were determined by ELISA.



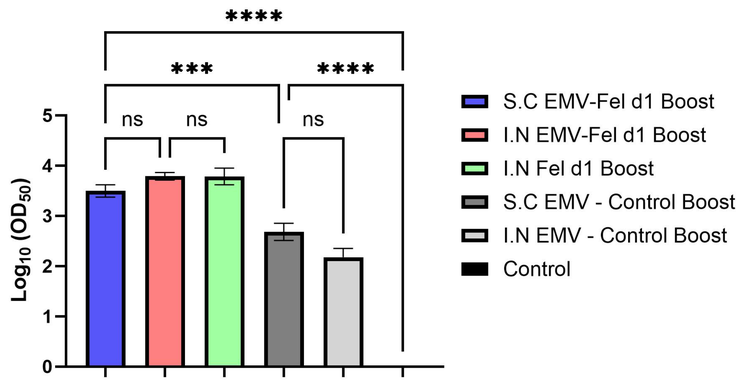
RESULTS

Day 28 Total Anti-Fel d1 Specific IgG in Sera

(A) OD_{450} Value Measurement:



(B) $\log_{10}(OD_{50})$ Measurement :



Total Anti-Fel d1 IgG Sub-classes and Avidity in Sera

(C) IgG Sub-Classes:

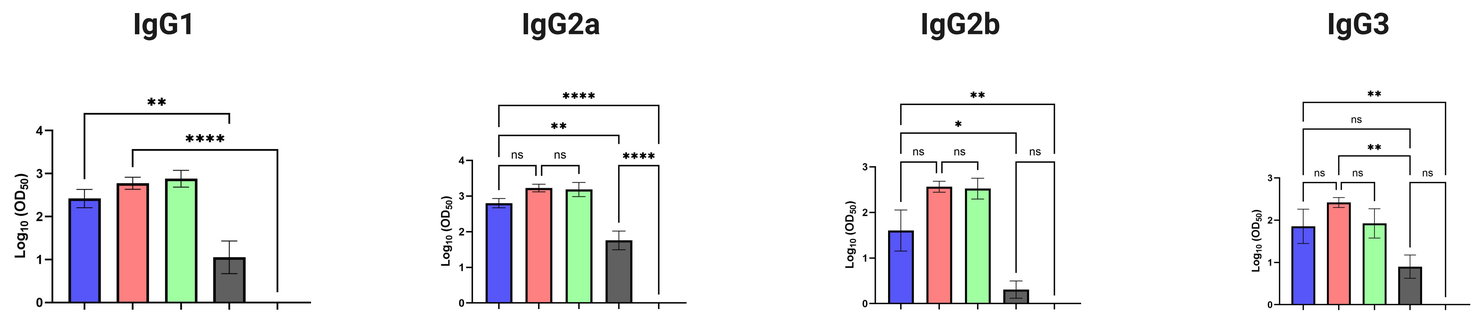
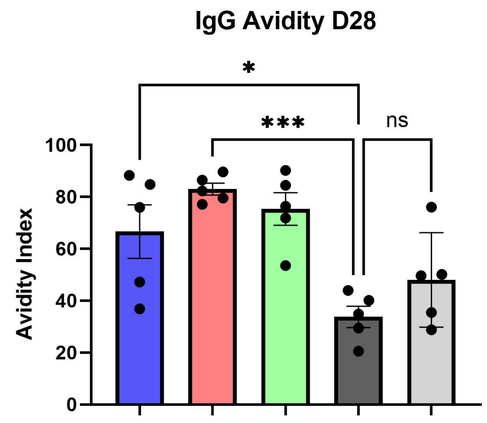


Figure 2: Fel d1 specific IgG titer on day 28 measured by ELISA . **A & B)** Total IgG on day 28: EMV-Fel d1 prime induced strong Fel d1-specific IgG responses. Boosting with s.c. EMV-Fel d1, i.n. EMV-Fel d1, or i.n. Fel d1 protein resulted in comparable titers, while EMV control boost showed reduced IgG induction, and EMV/EMV immunization showed no Induction of Fel d1 specific IgG. **C)** IgG subclasses: Prime-boost with EMV-Fel d1 or EMV-Fel d1/Fel d1 protein induced similar patterns across IgG1, IgG2a, IgG2b, and IgG3, confirming a broad subclass response. **D)** IgG avidity: High-avidity antibodies were detected, confirming that the induced response was of high affinity. Statistical Analysis(Mean± SEM) using one-way ANOVA comparison test. $p \leq 0.05$(*), $p \leq 0.01$(**), $p \leq 0.001$(***), $p \leq 0.0001$(****). All Groups n=5

(D): IgG avidity analysis:



Antibody Avidity Measurement in Sera

IgG avidity analysis:

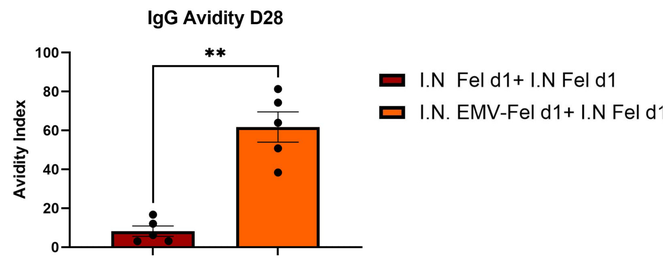


Figure 3: Antibody avidity Measurement after intranasal vaccination. Mice receiving **heterologous vaccination** (prime i.n. EMV-Fel d1, boost i.n. Fel d1) developed high-avidity antibodies, whereas **homologous vaccination** with i.n. Fel d1 alone (prime/boost) failed to elicit efficient Fel d1 Specific IgG antibody responses. These findings demonstrate that priming with conjugated EMV-Fel d1 is essential to induce strong and functional immunogenicity. Statistical Analysis (Mean± SEM) using one-way ANOVA comparison test. $p \leq 0.05$(*), $p \leq 0.01$(**), $p \leq 0.001$(***), $p \leq 0.0001$(****). All Groups n=5

CONCLUSION/OUTLOOK

EMV-Fel d1 VLPs efficiently induce strong Fel d1-specific antibody responses, independent of the boost regimen, and generate high-avidity antibodies across IgG subclasses. Priming with conjugated VLP is essential, as Fel d1 protein alone fails to elicit comparable immunogenicity. These results highlight the potential of EMV-Fel d1 VLPs as a promising vaccine platform for effective allergen immunotherapy.

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