

HUMORAL RESPONSES TO FOOT AND MOUTH DISEASE VACCINATION IN PIGS
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Injection of pigs with inactivated water in oil (w/o) foot and mouth disease (FMD) vaccines provokes the development of humoral antibodies and prevents infection. The purpose of this paper is to follow the development of neutralising activity in the serum and nasal mucus of pigs after vaccination and to establish the relationship between the serum antibody titres and protection.

A close correlation between the serum antibody titres (SN_{50}) and protection has been established in cattle, but in pigs there have been conflicting reports. Although some workers demonstrated a significant correlation between these two parameters (Fedida et al, 1971; Solyom et al, 1978) others claimed either that there was none (Turubatovic et al, 1972; Mitev et al, 1975) or that correlations were influenced by the virus strain under study (Bauer et al, 1975), the vaccination to challenge interval (Auge de Mello and Gomes, 1978), the method of challenge (de Leeuw, 1980) or the virus dose to which the animals were exposed (van Bekkum et al, 1978).

1. Serum antibody responses - Groups of 10 week old pigs were injected with w/o O₁ strain FMD vaccine and serum samples were taken periodically until the animals were 5 months old. The sera were fractionated on sucrose density gradients into heavy and light components and the virus neutralising activity of each was examined by metabolic inhibition tests. The response profiles are shown in Figure 1. After primary vaccination the whole serum (WS) titres rose to a peak at 10 to 14 days post vaccination (dpv) and, after limited subsidence, were maintained at plateau levels until the end of the observation period. The heavy fraction (HF) containing IgM antibodies was responsible for all the neutralising activity of the serum in the early stages after vaccination but activity in this component subsided by 28 days. From that stage onward, the antibody titre in whole serum was entirely due to the lighter, IgG-containing fraction (LF). When revaccination was carried out at 48 or 106 dpv a sharp increment in the antibody titres was noted, comprised of both IgG and IgM components.

2. Nasal mucus neutralising activity - Groups of 10 week old pigs were vaccinated or exposed to infection and nasal mucus was taken periodically using a vacuum pump and mucus extractor as described by Baskerville and Lloyd (1977). The neutralising activity in the nasal mucus was increased in both cases although the titres after infection were considerably higher than after vaccination. After infection the titres in the nasal mucus ran a course more or less parallel to those in the serum.

3. Relationship between the serum antibody titres and protection - In a series of tests carried out in three countries a total of 496 pigs were vaccinated and challenged by injecting O₁ subtype FMD virus 21 days later. Sera taken just before challenge, were examined for neutralising antibodies by metabolic inhibition tests using either IBRS-2 or BHK 21 cells as indicator system. Serum titres were correlated with protection and the titres protecting 50% of pigs were 1.44, 1.34 and 0.95 \log_{10} for tests done in England, Germany and Brazil respectively. Figures 2a and 2b show the English challenge results and a regression slope of proportions protected versus \log_{10} serum antibody titres based on a probit analysis.

4. Passive transfer of antiserum - The role of serum antibodies in providing protection was confirmed by passive transfer of antiserum. Six susceptible pigs were injected intraperitoneally with antiserum from convalescent pigs and challenged 24 hours later. At this stage their serum antibody titres ranged from 2.31 to 2.69 \log_{10} . All were protected from disease, whereas four control pigs injected with non-immune pig serum were not. This result agrees with the serum titre-protection correlation established above for the active immunisation responses.

5. Response of baby pigs to vaccination in the presence and absence of maternally derived antibody - Vaccination of pigs at 1, 3 or 5 weeks of age protected 18 out of 20 from challenge at 60 days. Roughly half of these were from vaccinated and half from unvaccinated dams. With regard to those vaccinated at 1 or 3 weeks the serum antibody titres were lower in the early stages in the groups from the vaccinated dams.

Conclusion

These results suggest that in pigs, as in cattle, serum antibodies were the principal mechanism of protection against FMD.

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