Characterization of antibody neutralization response against Bovine Coronavirus as a platform for the designing of improved vaccine

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Abstract

Bovine coronavirus (BCoV) is an RNA virus that infects cattle and other ruminants, causing respiratory and intestinal infections and significant economic losses for the dairy and beef industry. Various commercial vaccines have been developed and used globally to mitigate these losses and improve animal welfare. In Israel, although it is not mandatory to vaccinate cattle against BCoV, it is recommended to vaccinate pre-calving cows to provide protective immunity to calves through the colostrum. Notably, despite the routine vaccination programs implemented in several dairy farms, recent field studies have indicated that many adult cows and calves in these farms continue to suffer from BCoV infections. Owing to these findings, we hypothesized that the BCoV strains infecting these animals are genetically distinct from the vaccine strains, and, therefore, the vaccinated cattle are not protected from BCoV infections. To investigate this claim, we conducted a large-scale molecular epidemiology investigation of BCoV in several large dairy farms across Israel. Our analysis revealed the presence of multiple variants of BCoV circulating in Israel, which were genetically distinct from the Mebus vaccine strain. To examine the effectiveness of currently used BCoV vaccines in protecting the cattle against these circulating BCoV variants, we vaccinated over 60 pre-calving cows with three different commercial vaccines, administering two doses each. We collected swabs (nasal and rectal), colostrum, and serum at various times to evaluate maternal immunity. RT-qPCR tests on the swabs indicated that some vaccinated cows were positive for BCov pre- and post-vaccination. Measurement of the total and neutralizing antibody levels in a few of the sera and colostrum samples revealed no increase in the BCoV-specific Ab response following vaccination. Later, we will employ high-resolution structural methods to characterize the neutralization epitopes in the viral envelope proteins targeted by neutralizing antibodies to design envelope proteins as antigens to develop improved vaccines against BCoV.