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Vaccination of chickens using raw rice coated with novel trehalose nano-organogels containing Newcastle disease (strain I-2) vaccine

Abstract

The formulation and evaluation of trehalose nano-organogels for storage and oral delivery of Newcastle disease (ND) strain I-2 vaccine to chickens were carried out in this study. Trehalose sugar was blended with vegetable oil to form nano-organogels where trehalose also acted as a stabilizer against thermal inactivation of I-2 ND virus. Results from infectivity titration assay indicated that the titre of $10^{7.5}$ EID_{50}/0.1 mL was maintained after 12 weeks of storage of nano-organogel I-2 vaccine at ambient room temperature. Serology results showed that 33% chickens which were vaccinated with nano-organogel I-2 vaccine after 14 days had HI antibody titres of ≥ 3.0 $\log_2$ with GMT of 2.3. Moreover, results showed 100% of chickens vaccinated with nano-organogel I-2 vaccine had the mean antibody titres of 3.4 and 3.7 $\log_2$ at 21 and 28 days after vaccination, respectively. All vaccinated chickens (100%) survived the challenge of virulent ND virus whereas all unvaccinated chickens succumbed to challenge and died of signs consistent with ND. The findings from this study showed that the nano-organogel I-2 vaccine was stable at room temperature, safe and produced protective antibody response in vaccinated chickens. Moreover the nano-organogel I-2 vaccine was used for oral administration and hence is suitable for mass vaccination. However, optimization of the formulation of trehalose nano-organogel vaccine is required in order to achieve its application potentials.

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ORIGINAL PAPER

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Abstract The formulation and evaluation of trehalose nano-organogels for storage and oral delivery of Newcastle disease (ND) strain I-2 vaccine to chickens were carried out in this study. Trehalose sugar was blended with vegetable oil to form nano-organogels where trehalose also acted as a stabilizer against thermal inactivation of I-2 ND virus. Results from infectivity titration assay indicated that the titre of $10^{7.5}$ EID_{50}/0.1 mL was maintained after 12 weeks of storage of nano-organogel I-2 vaccine at ambient room temperature. Serology results showed that 33% chickens which were vaccinated with nano-organogel I-2 vaccine after 14 days had HI antibody titres of ≥ 3.0 $\log_2$ with GMT of 2.3. Moreover, results showed 100% of chickens vaccinated with nano-organogel I-2 vaccine had the mean antibody titres of 3.4 and 3.7 $\log_2$ at 21 and 28 days after vaccination, respectively. All vaccinated chickens (100%) survived the challenge of virulent ND virus whereas all unvaccinated chickens succumbed to challenge and died of signs consistent with ND. The findings from this study showed that the nano-organogel I-2 vaccine was stable at room temperature, safe and produced protective antibody response in vaccinated chickens. Moreover the nano-organogel I-2 vaccine was used for oral administration and hence is suitable for mass vaccination. However, optimization of the formulation of trehalose nano-organogel vaccine is required in order to achieve its application potentials.

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Abbreviations

EID_{50}	median embryo infectious dose
HA	haemagglutination
HI	haemagglutination-inhibition
NDV	*Newcastle disease virus*

Introduction

Nanotechnology refers to a field of applied science and technology which deals with the control of matter on the molecular level in scales smaller than 1 micrometre, normally 1 to 100 nanometers (nm), and the fabrication of devices within that size range (Taniguchi 1974). In recent years there have been considerable interests in developing biodegradable nanoparticles effective as drug and vaccine delivery vehicles (Kiser et al. 1998; Yang and Wu 2005; Yu et al. 2006; Lee et al. 2007; Peek et al. 2008).

Sugars like trehalose and vegetable oils may be used to develop naturally-derived nanomaterials for vaccine storage and delivery (John et al. 2006). Research has

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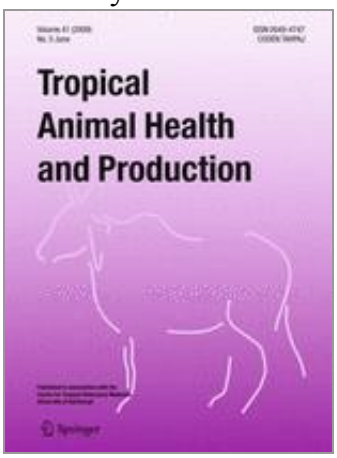

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