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Development of Foot and Mouth Disease Vaccine Formulation in Egypt by Using Nanoparticles as Adjuvant and Immunogenic

Thesis presented
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VI. Summary

Foot and mouth disease is a contagious viral disease affect all cloven hoofed animals. It leads to many economic losses affect national and international trade. Vaccination programme consider a vital role to control disease and it used a specific FMDV serotype in vaccine for the present serotype in the country. So, this study was performed for evaluation silver nanoparticles as adjuvant with FMD inactivated oil adjuvant vaccine in Egypt.

Size of Silver nanoparticles are ranged from 5.8 to 28.1 nm using TEM , concentration of silver in solution 43.25 ppm and wave length using ultraviolet visible spectrophotometer is (450-460 nm).

Forty Five Guinea Pigs about 500-600 gram body weight were used in this study. These selected guinea pigs were free from antibodies against FMDV serotypes (A, O and SAT2) by SNT. This study started at 7/5/2019 till 10/6/2019 classified into five groups: **Group I (n=10):** vaccinated by trivalent inactivated FMDV oil adjuvant vaccine serotypes (A, O, SAT2 2012 and SAT2 2018) plus AgNPs as adjuvant. **Group II (n=10):** Vaccinated by trivalent inactivated FMDV oil adjuvant vaccine serotypes (A, O, SAT2 2012 and SAT2 2018). **Group III (n=10):** Injected by trivalent inactivated FMDV (A, O, SAT2 2012 and SAT2 2018) with AgNPs as adjuvant. **Group IV (n=10):** Injected by AgNPs only. **Group V (n=5):** Control group injected by normal saline.

By measuring cell mediated immunity lymphocytes proliferation test using MTT kit the results revealed that mean delta optical density appear at 3rd 0.4534± 0.026 day still increase till 28th day 0.972±0.019 in group I , it consider the highest group comparing to other groups. In contrast in group II titer appear late and reach to highest at 21th day 0.823±0.007. in group III titer appear early at 3rd day 0.443± 0.021 but decrease early after 14th day 0.633± 0.016, while group IV reach to highest at 14th day and decrease rapidly. Control group there was no increase in titer.

Measuring humoral immunity using SNT the results revealed that mean antibodies titers for serotypes (O, A, SAT2 2012 and SAT2 2018) were reach to protective value at 14th day (1.47, 1.35, 1.62, 1.56) there were increase in titer till 4 week (2.04, 2.28, 2.13, 2.10) for group I. While group II was reach to protective values at 21 day (1.5, 1.41, 1.47, 1.44) at 4 weeks the titer was reach to (1.71, 1.56, 1.65, 1.71). In group III the titer was reach to protective at 21 day (1.41, 1.56, 1.50, 1.59) for serotypes (O, A, SAT2 2012 and SAT2 2018) respectively. Group IV was not give titer in humoral immunity.

Twenty five cattle were used in this study about 3 years, 300-350 kg body weight apparently healthy. These selected cattle were free from antibodies against FMDV serotypes (A, O and SAT2) by SNT. This study started at 28/6/2019 till 24/10/2019 classified into four groups: **Group I (n=5):** vaccinated by trivalent inactivated FMDV oil adjuvant vaccine serotypes (A, O, SAT2 2012 and SAT2 2018) plus AgNPs as adjuvant (3 ml subcutaneously). **Group II (n=5):** Vaccinated by trivalent inactivated FMDV oil adjuvant vaccine serotypes (A, O, SAT2 2012 and SAT2 2018) (3 ml subcutaneously). **Group III (n=5):** Injected by trivalent inactivated FMDV (A, O, SAT2 2012 and SAT2 2018) with AgNPs as adjuvant plus media (3 ml subcutaneously). **Group IV (n=5):** Injected by AgNPs only plus media (3ml subcutaneously).

Measuring cellular immunity using bovine interleukin-6 (IL-6) kit the results revealed that group I was reach to the highest titer at 14th day 1597±400.19 and begun to decrease while group II was reach to the highest at 21th day 1007±168.8 and begun to decrease. Group III was appear early (1351±305.4 at first week) and decrease rapidly. Group IV at first week was reach to (954± 97) and begun to decrease. There were highly significant differences between groups $p< 0.001$.

Measuring humoral immunity using SNT along four months the results showed that titer was reach to protective values at 14th day in group I (1.62, 1.53, 1.50, 1.50) at 120th day titers were reached to (2.46, 2.40, 2.25, 2.22) for serotypes O,A ,SAT2 2012, SAT2 2018 while in group II it was reached to protective values at 21th days and at four months titers were reach to(2.25, 2.13, 2.01, 2.04) for serotypes O,A ,SAT2 2012, SAT2 2018 , in group III it was reach to protective level at 21th day while titers were reach to(0.69,

0.72, 0.66, 0.66) for serotypes O,A ,SAT2 2012, SAT2 2018 . Group IV there were no increase in titers for serotypes O, A, SAT2 2012, SAT2 2018.

Finally, in this study using inactivated FMD oil adjuvant vaccine with silver nanoparticles as adjuvant the results were showed that silver nanoparticles give early immunity and long lasting immunity in guinea pigs and cattle groups.