

## THE DURATION OF MATERNAL IMMUNITY IN NEWLY BORN LAMBS OF EWES VACCINATED WITH FMD BIVALENT VACCINE

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Received: 21/03/2011

Accepted: 01/05/2011

### SUMMARY

The present study was designed to follow up the immune status of lambs born from ewes vaccinated with Alhydragel Bivalent Foot and Mouth Disease FMD vaccine 3 months before parturition. Estimation of antibody titer before parturition; at parturition and in colostrums of dams in addition to the acquired maternal antibodies in new born lambs was performed weekly till such titers declined to the nonprotective level using serum neutralization test (SNT) and enzyme linked immunosorbent assay (ELISA). The study suggested that it is necessary to vaccinate newly born lambs to ewes vaccinated with alhydragel bivalent Foot and Mouth Disease FMD vaccine on the second month of age to protect them against infection with FMDV strains "O" and "A".

### INTRODUCTION

Foot and Mouth Disease FMD is a highly contagious disease of all cloven footed animals including cattle, sheep, goats and pigs, also it affects wild animals as buffaloes and deer (Donaldson and Alexanderson, 2002).

The disease is in an enzootic area like Egypt, causes sever economic losses and mortalities among young animals (Moussa et al., 1984). The causative agent of Foot and Mouth Disease (FMD) is a member of genus Aphthovirus, family Picornaviridae (Franki et al., 1991 and Hofner et al., 1993). The causative serotype of FMD in previous outbreaks, in Egypt was mainly type "O" but the last outbreak was found to be due to the type "A" of FMD virus (Abd El - Rahman et al., 2006).

It is well known that vaccination is the basic step in controlling FMD (Bernardo, 2002). Most of FMD vaccines are made of Binaryethyleneimine (BEI)



inactivated virus that is adjuvanted with either Aluminumhydroxide gel and saponin (AS) or Oil adjuvant.

Oil adjuvants are generally preferred over Alhydrogel Saponin (AS) vaccines because they prolong the immune response and stimulate specific component of including humeral and cellular immune responses (Lombard et al., 2007).

Serum antibody titer of FMD in vaccinated ewes has been decrease in last month's before parturition and the colostrums had generally higher antibody titer than lamb serum. Serum antibody titer of newly born after feeding on colostrums shows as high levels as those of mothers (Larenwide et al., 1975 and Shankar and Uppan, 1981). It is a problem to achieve rapid and long lasting immunity in young animals to FMD (Ahi and Wittmann, 1986). Maternal derived FMD antibodies last for 4-6 months with significant individual variation in cattle (Burn et al., 1977 and El-Shehawy et al., 2004).

The absorption of immunoglobulin from colostrums occurs within 20-30 hours post suckling by means of an optical tubular system in the intestinal cell. All pregnant animals respond well to FMD vaccines with antibodies production without any adverse effects. The maximum antibody titer was noted 3-4 weeks after vaccination (Nair and Sen, 1994).

This study was carried out to follow up and determine the duration of the maternal antibodies of FMD in lambs newly born to vaccinated dams in order to determine the best time for vaccination such lambs.

## MATERIAL AND METHODS

### 1-Animals:

#### 1.1-Ewes:

Ten clinically normal Balady pregnant ewes free from FMD antibodies as proved by serum neutralization test (SNT) according to **Ferriera (1976)** and enzyme linked immunosorbent Assay (ELISA) according to **Hamblin et al (1986)** were vaccinated subcutaneously by 1ml/each with the local bivalent FMD vaccine 3 months before parturition.

#### 1.2-New born lambs:

Ten lambs newly born to such vaccinated dams immediately received the colostrums post birth for 20 hours.

#### 2-FMD virus strains:

Serotypes O1/3/93 and A/Egypt 2006 vaccinal strains of FMD virus were used in SNT.

#### 3-FMD Bivalent Alhydrogel vaccine:

It was inactivated by 3% Binary Ethylene Amine (BEA) using alhydrogel gel as adjuvant according to **Moussa et al (1976)**. This vaccine was supplied by the Department of Foot and Mouth Disease



Vaccine Research; Vet. Ser. Vac. Res. Inst. and used for vaccination of pregnant ewes with 2ml/ewe injected subcutaneous.

#### 4- Samples:

##### 1.1. Colostrum:

Colostrums samples were collected from recent parturated ewes (at the first day of parturition). These samples were stored at  $-20^{\circ}\text{C}$  until serologically tested for determination of FMD antibodies.

##### 1.2. Serum samples:

##### 1.2.1-Ewe Serum samples:

These samples were collected from pregnant ewes pre- and weekly after vaccination then stored at  $-20^{\circ}\text{C}$  until serologically tested for determination of FMD antibodies.

##### 1.2.2-New born lamb serum samples:

Serum samples were collected weekly from newly born lambs till the declination of antibodies titer in their sera than the minimal protective limit.

## RESULTS AND DISCUSSION

Table (1): Mean serum neutralizing and ELISA FMD antibody titers in pregnant ewes vaccinated with bivalent FMD Alhydrogel vaccine before parturition.

Weeks Post vaccination and before parturition	Mean antibody titer (log 10 /ml)			
	SNT		ELISA	
	FMDV "O1"	FMDV "A"	FMDV "O1"	FMDV "A"
1 <sup>st</sup> - week	0.6	0.75	0.9	1.2
2 <sup>nd</sup> -week	1.05	1.05	1.2	1.35
3 <sup>rd</sup> -week*	1.2	1.35	1.5	1.5
4 <sup>th</sup> -week	1.35	1.5	1.65	1.8
5 <sup>th</sup> -week	1.5	1.65	1.65	1.8
6 <sup>th</sup> -week	1.8	1.95	1.8	2.1
7 <sup>th</sup> -week	1.65	1.95	1.95	2.1
8 <sup>th</sup> -week*	1.8	2.1	1.95	2.1
9 <sup>th</sup> -week	1.8	1.95	2.1	2.4
10 <sup>th</sup> -week	1.65	1.8	2.00	2.1
11 <sup>th</sup> -week	1.5	1.5	1.8	1.8
12 <sup>th</sup> -week	1.35	1.5	1.5	1.65

Table (2): Mean serum neutralizing and ELISA FMD antibody titers in ewes serum at parturition and in their colostrums

Samples and sampling time	Mean antibody titer (log 10 /ml)			
	SNT		ELISA	
	FMDV "O1"	FMDV "A"	FMDV "O1"	FMDV "A"
Serum at parturition	1.65	1.5	1.5	1.65
Colostrums after 24 hours post parturition	1.35	1.2	1.05	1.8



**Table (3):** Mean serum neutralizing and ELISA FMD antibody titers in new born lambs to vaccinated ewes with bivalent FMD Alhydrogel vaccine.

Age of newly born lambs	Mean antibody titer (log 10 /ml)			
	SNT		ELISA	
	FMDV "O1"	FMDV "A"	FMDV "O1"	FMDV "A"
1 <sup>st</sup> - week	1.2	1.2	1.35	1.35
2 <sup>nd</sup> -week	1.5	1.65	1.5	1.5
3 <sup>rd</sup> -week	1.65	1.65	1.8	1.8
4 <sup>th</sup> -week*	1.65	1.95	1.8	2.1
5 <sup>th</sup> -week	1.5	1.65	1.8	2.00
6 <sup>th</sup> -week	1.5	1.5	1.8	1.8
7 <sup>th</sup> -week	1.2	1.65	1.65	1.8
8 <sup>th</sup> -week*	1.2	1.35	1.5	1.65
9 <sup>th</sup> -week	1.05	1.2	1.35	1.65
10 <sup>th</sup> -week	0.9	1.2	1.05	1.35
11 <sup>th</sup> -week	0.9	0.9	0.9	1.05
12 <sup>th</sup> -week	0.9	0.75	0.9	0.9

In Egypt vaccination programs against FMD are carried out every four months periodically for cattle, but sheep and ewes are vaccinated randomly. Therefore the present study aimed mainly to immunize ewes at the late stage of pregnancy (3 months pre-laboring) and transfer maternally derived antibodies to their newly born lambs.

Table (1) revealed that the mean serum antibody titers induced by bivalent alhydrogel FMD vaccine in vaccinated pregnant ewes were (1.2-1.35) log<sub>10</sub>/ml and (1.5-1.5) log<sub>10</sub>/ml by SNT and ELISA, respectively at the 3<sup>rd</sup>-week post vaccination then increased gradually reaching their peaks (1.8-2.1) log<sub>10</sub>/ml and (2.1-2.4) log<sub>10</sub>/ml by SNT and ELISA respectively at the 8<sup>th</sup>- & 9<sup>th</sup>-week post vaccination. These titers were declined reaching 1.35-1.5

log<sub>10</sub>/ml and 1.5-1.65 log<sub>10</sub>/ml by SNT and ELISA respectively at the 12<sup>th</sup>-week post vaccination on the parturition dates. These results are in agreement with **Mansour and Hegazi (2008)** who found that the highest FMD antibody titer induced by Alhydrogel FMD vaccine in sheep was obtained on the 6<sup>th</sup> to 8<sup>th</sup> weeks post vaccination. The observed elevation of antibody titers could be attributed to the improvement of concentration of the vaccine antigen (O1/3/93) and A/Egypt (2006) used in preparation of bivalent FMD vaccine. These results supported by the finding of **Abd El-Rahman et al (2006)** and **Farag et al (2008)**.

Table (2) showed the mean FMD antibody titers in the vaccinated dams at parturition time as (1.65- 1.5) log<sub>10</sub>/ml and (1.5- 1.65) log<sub>10</sub>/ ml by SNT and ELISA



respectively while those of colostrums after 24 hours post parturition were (1.35-1.2)  $\log_{10}/\text{ml}$  and (1.5-1.8)  $\log_{10}/\text{ml}$  by SNT and ELISA respectively. Similar respect parallel results were obtained by **Shanker and Uppal (1981)** and **El-Shehawy et al. (2004)** who reported that FMD antibody titers of colostrums was generally higher than those in their serum.

Table (3) shows that the highest FMD antibody titers in serum of newly born lambs from by Alhydrogel FMD vaccinated ewes (1.65-1.95)  $\log_{10}/\text{ml}$  and (1.8-2.1)  $\log_{10}/\text{ml}$  by SNT and ELISA respectively at the 4<sup>th</sup>-week of age then began to decline with protective levels (1.2-1.35) and (1.5-1.65) by SNT and ELISA respectively at the 8<sup>th</sup>-week of age. These results are in agreement with **Sadir et al. (1988)** who found that the colostral antibodies can provide a good protection to newborn for at least 60 days. Also **El-Shehawy et al. (2004)** and **Hegazi et al. (2008)** reported that FMD antibodies decreased in newborn lambs during the 3<sup>rd</sup>-months of age till reach to non protective levels.

In conclusion, vaccination of pregnant ewes at 3 months before parturition with FMD bivalent vaccine induces high maternal antibody titers to their lambs for about two months. Consequently, vaccination of newly born

lambs with FMD bivalent vaccine should be carried out on 3 months of age.

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## تحديد فترة المناعة الامية في الحملان حديثة الولادة من امهات محصنة بلقاح الحمى القلاعية ثنائي العترة

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معهد بحوث الأمصال و اللقاحات البيطرية - العباسية

تم خلال هذه الدراسة قياس المستوي المناعي للنعاج الحوامل المحصنة بلقاح الحمى القلاعية ثنائي العترة قبل الولادة بثلاثة اشهر حيث وجد أن عيارية الأجسام المناعية تزيد بين الأسبوع الثالث والرابع بعد التحصين. وعند قياس عيارية الأجسام المناعية في مصل النعاج أثناء الولادة كما تم قياس عيارية الأجسام المناعية في لبن السرسوب بعد الولادة بيوم واحد فوجد أنها في معدلات مرتفعة تكفي للحماية من الإصابة بمرض الحمى القلاعية واستمرت هذه المعدلات إلي أن بدأت في الانخفاض تدريجيا في الشهر الثالث بعد الولادة لذا ينصح بتحصين الحملان حديثي الولادة بلقاح الحمى القلاعية ثنائي العترة بعد شهرين من الولادة لضمان بقاء الحماية ضد الإصابة بمرض الحمى القلاعية بعترتيه.