

EVALUATION OF MATERNAL ANTIBODY IN CALVES BORNE FROM COW DAM VACCINATED WITH INACTIVATED PNUMO-5 VACCINE

El-Bagoury, G.F.^a, El-Nahas, E.M.^a, Maha R. Abd-Elfadiel^b and Ghaley, H.M.^b

^a Departments of Virology, Faculty of Veterinary Medicine, Benha University, ^b Veterinary Serum and Vaccine Research Institute, Abbassia, Cairo.

ABSTRACT

Forty Pregnant cows were vaccinated with combined inactivated respiratory viruses' vaccine from BVD genotype 1 and BVD genotype 2, IBR, PI-3 and BRS viruses (Pneumo-5) under field condition. Post-delivery, the colostrum and sera from their offspring's were collected for follow up the maternal immune response using Serum neutralization test (SNT) and ELISA. Results revealed that antibodies in colostrum persisted at their higher level till the 3rd day post calving for all reference viruses contained in the vaccine. The maternal antibodies were gradually decreased from 1st day post-delivery till reached lower level at 4 month post-delivery for all reference viruses contained in the vaccine as measured by SNT but the maternal antibodies were detected for 6th month post-delivery by ELISA. It could be concluded that colostrum should be taken at first three days post-calving and the maternal antibodies were persisted till 4th month of age for all reference viruses contained in the vaccine under field conditions

Key Words: ELISA, Maternal antibodies, Pneumo-5, SNT

(BVMJ 23(2): 87-92, 2012)

1. INTRODUCTION

Bovine respiratory diseases (BRD) have an important and serious impact on the beef and dairy cattle industry, both for stocker and feedlot entities. Economic losses result from death, decreased performance of diseased cattle, lowered weight gain, increased cost of gain, reduced carcass value and treatment costs [4].

Pathogens associated with BRD include bovine viral diarrhea virus types 1 and 2 (BVDV-I and BVDV-2), bovine herpes virus type 1 (BHV-I), parainfluenza virus type 3 (PIV-3) and bovine respiratory syncytial virus (BRSV) [12].

Abortion, cerebellar hypoplasia, ocular lesions, still birth, weakness and diarrhea occurred particularly with infection in the period of gestation. For these reasons, vaccination of pregnant cows with

combined inactivated respiratory viruses' vaccine is usually recommended at last stage of pregnancy in cow calf operations of both the beef and dairy industries [2]. Antibodies help protect against clinical disease caused by BHV-1 [7], BVDV [10], PI-3 [1], and BRSV [15].

Nowadays, the use of inactivated vaccines against these respiratory diseases produces good results for protection of calves from pneumo-enteritis and death [6]. Inactivated virus vaccines have an advantage in that vaccine virus dose not replicate in the host tissues. So, there has been interest in replacing MLV with inactivated ones, largely because of safety issues.

The present study was designed to spot the light on the field evaluation of humeral immune response in colostrum of cow dam vaccinated with Inactivated combined

inactivated respiratory viruses vaccine from BVD (genotype 1 and 2), IBR, PI-3 and BRS viruses (pneumo-5) and sera of their calves.

2. MATERIALS AND METHODS

2.1. *Tissue culture inactivated pneumo-5 vaccine:*

It was prepared from BVDV genotype-1 (Egyptian BVDV cytopathic, Iman strain of a titer $10^{6.5}$ TCID₅₀/ml), BVDV genotype-2 (cytopathic strain 125 of a titer $10^{6.5}$ TCID₅₀/ml), BHV-I (A local Abou Hammad strain of a titer $10^{7.5}$ TCID₅₀/ml), PIV-3 (Reference Egyptian strain "strain 45" of a titer $10^{8.0}$ TCID₅₀/ml) and BRSV (Reference strain "375L" of a titer $10^{6.5}$ TCID₅₀/ml) according to [16]. The vaccine was produced and provided by department of the Rinderpest like diseases, Veterinary serum and vaccines research institute (VSVRI).

2.2. *Pregnant dam under field condition:*

Unvaccinated apparently healthy pregnant Friesian cows (n=50), aged 4-5 years, 350-450Kg B. Wt., at last 2 month of gestation, belonged to private farm located in El-Dear, Wadi El-Natroon, Behera governorate. Forty cows were vaccinated with inactivated pneumo-5 vaccine and ten pregnant cows were kept as non-vaccinated control animals. The colostrum and sera from their offspring's were collected for follow up the maternal immune response of the pneumo-5 vaccine.

2.3. *Colostrum samples:*

Milk samples from cow dams in the first three days after parturition then centrifuged at 3000 rpm for 15min till several time till obtained clear whey for detection of specific antibodies for BVDV-1, BVDV-2, IBRV, PIV-3 and BRSV using SNT and ELISA.

2.4. *Serum samples:*

Serum samples were collected from cows offspring's after ingestion of colostrum

[post-colostral samples]. Then, calves were periodically examined for 4-6 months post-delivery. The sera were inactivated at 56°C for 30 minutes, and then stored at -20°C.

2.5. *Serum neutralization test (SNT):*

It was performed on MDBK cell line using the micro technique as described by [11].

2.6. *Enzyme Linked Immunosorbent Assay (ELISA)*

It was carried out according to [14] to determine antibodies against BVDV-1, BVDV-2, IBRV, PI3V and BRSV using ELISA.

3. RESULTS

3.1. *Field evaluation of humeral immune response in colostrum of cow following vaccination with inactivated pneumogen-5 vaccine:*

It was observed that, neutralizing antibodies in colostrum persist at their higher level till the 3rd day post calving for all reference viruses contained in the vaccine as measured by SNT. The control non-vaccinated group showed no neutralizing antibody response table (1), the results of mean ELISA titre were confirmative and correlated to that of SNT table (2).

3.2. *Maternal immune response of offspring from vaccinated dam with pneumogen-5 inactivated vaccine:*

The mean neutralizing antibodies were gradually decreased from 1st day post-delivery till reached lower level at 4 month post-delivery (4th month of age) for all reference viruses contained in the vaccine as measured by SNT. The control non-vaccinated group showed no neutralizing antibody response (table 3 and fig. 1). Results of mean ELISA titer were confirmative and were correlated to that of SNT but the antibodies were detected for 6th month post-delivery (table 4 and fig. 2)

Evaluation of maternal antibody in calves

Table 1 Serum neutralizing antibody titer of BVD (genotype 1& 2), IBR, PI-3 and BRS viruses in colostrum of cow dam following vaccination with inactivated pneumogen-5 vaccine

Viruses	Serum neutralizing AB titers (log10)	
	1dpd*	3dpd
BVD virus -1	2.1	2.0
BVD virus -2	2.15	2.1
IBR virus	2.3	2.25
PI-3 virus	2.4	2.34
BRS virus	2.1	2.05
Control	0.0	0.0

AB: antibody. *dpd: day post- delivery

Table 2 ELISA antibody titer of BVD (genotype 1 and 2), IBR, PI-3 and BRS viruses in colostrum of cow dam following vaccination with inactivated pneumogen-5 vaccine

Viruses	ELISA antibody titers	
	1dpd*	3dpd
BVD virus -1	2.3	2.1
BVD virus -2	2.23	2.2
IBR virus	2.29	2.25
PI-3 virus	2.35	2.32
BRS virus	2.17	2.11
Control	0.0	0.0

*dpd: day post delivery

Table 3 Neutralizing antibody titer of BVD (genotype 1&2), IBR, PI-3 and BRS viruses in sera of calves born to vaccinated dam with inactivated pneumogen-5 vaccine

Time post – delivery	Mean serum neutralizing antibody titers expressed in log10					
	BVDV-1	BVDV-2	IBR	PIV-3	BRSV	control
1dpd*	1.9	1.95	2.1	2.2	1.8	0.0
3 dpd	1.85	1.93	2.07	2.17	1.76	0.0
1 wpd	1.82	1.9	2.05	2.15	1.75	0.0
2 wpd	1.8	1.85	2.0	2.1	1.7	0.0
1 mpd	1.7	1.75	1.9	1.9	1.6	0.0
2 mpd	1.5	1.5	1.55	1.7	1.4	0.0
3 mpd	1.2	1.22	1.25	1.5	1.15	0.0
4 mpd	0.9	0.99	0.95	1.25	0.9	0.0

*dpd: day post-delivery, wpd: week post-delivery, mpd: month post-delivery.

Table 4 ELISA antibody titer of BVD (genotype 1 and 2), IBR, PI-3 and BRS viruses in sera of calves born to vaccinated dam with inactivated pneumogen-5 vaccine

Time post - delivery	Mean ELISA antibody titers					
	BVDV-1	BVDV-2	IBR	PIV-3	BRSV	control
1dpd*	2.0	2.1	2.15	2.2	2.04	0.0
3 dpd	1.98	2.07	2.1	2.07	2.0	0.0
1 wpd	1.94	2.05	1.04	2.05	1.97	0.0
2 wpd	1.9	2.0	1.97	1.95	1.87	0.0
1 mpd	1.87	1.9	1.83	1.85	1.72	0.0
2 mpd	1.83	1.72	1.69	1.65	1.61	0.0
3 mpd	1.69	1.42	1.45	1.45	1.45	0.0
4 mpd	1.42	1.22	1.2	1.2	1.1	0.0
5 mpd	1.05	1.0	0.91	0.95	0.82	0.0
6 mpd	0.69	0.79	0.61	0.6	0.58	0.0

*dpd: day post-delivery, wpd: week post-delivery, mpd: month post-delivery

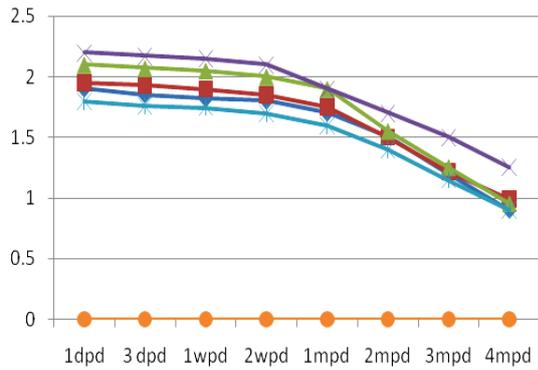


Fig. 1 Level of maternal antibody for BVD (genotype-1 (◆) & -2 (■)), IBR (▲), PI-3 (×) and BRS (✱) viruses in sera of calves born to vaccinated dam with inactivated pneumogen-5 vaccine as assessed by SNT. (●) control.

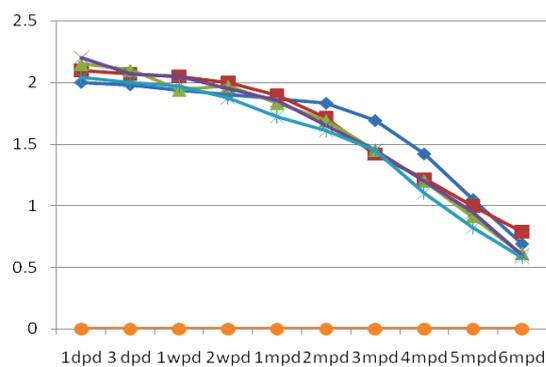


Fig. 2: Level of maternal antibody for BVD (genotype-1 (◆) & -2 (■)), IBR (▲), PI-3 (×) and BRS (✱) viruses in sera of calves born to vaccinated dam with inactivated pneumogen-5 vaccine as ELISA. (●) control.

4. DISCUSSION

Type of placenta of animals species is constructed and specified by which the method of maternal immunity could be transferred from dams to offspring hence, the type of placenta of ruminants is of syndesmochorial type, which there is no direct contact between maternal circulation and their fetuses. So, the whole maternal immunity was transferred to off spring via colostrum [13].

The titer of neutralizing antibodies which was detected in the colostrum of vaccinated cow is much increased than the titer of serum neutralizing antibodies at the time of parturition (table 1). These results agreed former study [8] reported that the main construal Neutralizing antibodies titer was almost double than that of the blood.

Active immunity by natural infections or vaccinations may prolong persistence of maternally derived antibodies. Vaccination and induction of protective immunity in calves at the earliest age is ideal for prevention of future disease. [3].

The estimated average half-life of maternal antibodies against viruses in young calves is approximately 3 weeks [3]. Calves had undetectable levels of maternal antibodies by 2 to 10 months of age for BHV-1 [3], by 3 to 8 months for BVD [9], by 6 months for PI-3 and 7 months for BRSV [5].

The serum neutralizing antibodies of off springs born to vaccinated cows with pneumogen-5 inactivated vaccine (table, 3) showed that serum neutralizing antibodies of off springs at one week of age at the same titer of their dams at the time of delivery and remain in the same level of dams till 6th weeks of age, then titer begin declined and remain in protective level till 6th month of age. These results are agreed with previous author [11] concluded that the maternal antibodies of calves that were developed as a result of vaccination of their dams with inactivated vaccine may persist for 6th month.

Under field conditions in this experiment, the results showed that there was only double fold increase between the mean titers of calves born from vaccinated and non-vaccinated dams. This may be attributed to the time of delivery in some dams. Furthermore, some calves may not receive the colostrum at parturition from their dams at optimum time.

It was noticed that ELISA results showed higher values beside detection of antibodies in collected sera for 6th month post-delivery (table 2& 4) than that of SNT. This may be attributed to ELISA considered sensitive serological test, used for determination both the neutralizing and non-neutralizing antibodies.

It could be concluded that the maternal antibodies were persisted till 4 month post-

delivery (4th month of age) for all reference viruses contained in the vaccine.

5. REFERENCES

1. Bryson, D.G., Adair, B.M., McNulty, M.S., Mc Aliskey, M., Bradford, H.E.L., Allan, G.M., Evans, R.T., Forster, F. 1999. Studies on the efficacy of intranasal vaccination for the prevention of experimentally induced parainfluenza type 3 virus pneumonia in calves. *Vet. Rec.* **145** : 33-39.
2. Donkersgoed, J. van, Hurk, J.V. van Den., McCartney, D. Harland, R.J., Van, Donkersgoed, J. and Van den Hurk, J.V. 1991. Comparative serological responses in calves to eight commercial vaccines against infectious bovine rhinotracheitis, parainfluenza-3, bovine respiratory syncytial and bovine viral diarrhea viruses. *Can. Vet. J.* **32**: 727-733.
3. Fulton, R. W., Briggs, R. E., Payton, M. E., Confer, A. W., Saliki, J.T., Ridpath, J. F., Burge, L. J. and Duff, G. C. 2004. Maternally derived humoral immunity to BVDV1a, BVDV1b, BVDV2, BHV-1, PI3V, BRSV, Mannheimia haemolytica and Pasteurella multocida in beef calves, antibody decline by half-life studies and effect on response to vaccination. *Vaccine.* **22**: 643-649.
4. Fulton, R.W., Ridpath, J.F., Saliki, J.T., Briggs, R.E., Confer, A.W., Burge, L.J., Purdy, C.W., Loan, R.W., Duff, G.C. and Payton, M. E. 2002. Bovine viral diarrhea virus (BVDV) 1b: predominant BVDV subtype in calves with respiratory disease. *Can J Vet Res.* **66**:181-190.
5. Kirkpatrick, J.G., Fulton, R.W., Bürge, L.J., Dubois, W.R. and Payton, M.E. 2001. Passively transferred immunity in newborn calves, rate of antibody decay, and effect on subsequent vaccination with modified live virus vaccine. *Bovine Pract.* **35**: 47-55.
6. Knezevic, N., Kosanovic, P. and Rogan, D. 1990. Immunoprophylaxis of respiratory diseases of cattle with inactivated vaccine. III. Study of the immunogenicity of a bivalent inactivated oil vaccine against IBR and PI3. *Vet. Glas.* **44**: 503-512.
7. Lemaire M, Weynants V, Godfroid J, Schynts, G. Meyer, J.J. Letesson, and Thiry, E. 2000. Effects of bovine herpesvirus type 1 infection in calves with maternal antibodies on immune responses and virus latency. *J. Clin. Microb.* **38**: 1885-1894.
8. Maglione, E., Tomatis, W., and Valent, G. 1984. IBR/IPV neutralizing antibodies in serum of pregnant cows, calves and colostrum. *Attidella Docleta Itallana di Bulataria* **15**: 499-511.
9. Muñoz-Zanzi, C., Thurmond, M.C., Johnson, W.O., and Hietala S.K. 2002. Predicted ages of dairy calves when colostrum-derived bovine viral diarrhea virus antibodies would no longer offer protection against disease or interfere with vaccination. *J. Am. Vet. Med. Assoc.* **221**: 678-685.
10. O'Connor, A., Martin, S., and Nagy. E. 2001. The relationship between the occurrence of undifferentiated bovine respiratory disease and titer changes to bovine Coronavirus and bovine viral diarrhea virus in 3 Ontario feedlots. *Can. J. Vet. Res.* **65**: 137-142.
11. Rossi, C.R. and Kiessel, G.K. 1971. Microtitre tests for detecting antibody in bovine serum to PI3V, IBRV and BVDV. *Microbiol.* **22**: 32-36.
12. Samira, S.T., El-Sabbagh, M.M.A. and Ghaly, H.M. 2001. Preparation of combined inactivated BVD, IBR, PI3 and respiratory syncytial virus (BRSV). *J. Egypt. Vet. Med. Ass.* **61**: 251-263.
13. Tizard, I.R. 2009. *Veterinary Immunology: An Introduction*. 8th Edition. Saunders, Elsevier, St. Louis, Missouri.
14. Voller, A., Bidwell, D.E. and Annbarlett, M. 1976. Enzyme immuno assays in diagnostic medicine, theory and practice. *Bull. World Health. Organ.* **63**: 55-65.
15. West, K., Pétrie L., Konoby C., Haines D. M., Cortese V., and Ellis J. 2000. The efficacy of modified-live bovine respiratory syncytial virus vaccines in experimentally infected calves. *Vaccine.* **18**: 907-919.
16. Zeidan, S.M., Samira S.T., El-Sabbagh, M.M., Ghally, H.M., Kassem, I. K.A. and El-Kholy, A.A. 2005. Trails for preparation of combined inactivated respiratory virus vaccine containing BVDV-1, BVDV-2, IBRV, PI3V, and BRSV. 4th Int. Sci. Conf., Mansoura, 5-6 April.



تقييم المناعة الامية للعجول المولودة من امهات الابقار المحصنة بلقاح النيمو-5 المثبط

جبر فكرى الباجورى¹، إيهاب مصطفى النحاس¹، مها رافت عبد الفضيل²، حسين متولى غالى²
¹قسم الفيروسولوجيا - كلية الطب البيطرى - جامعة بنها، ²معهد بحوث الامصال واللقاحات البيطرية بالعباسية-القاهرة

الملخص العربى

تم تحصين 40 بقرة عشار بلقاح جماعي مثبط للفيروسات التنفسية يحتوي علي فيروس الإسهال البقرى المعدي النوع الجينى-1، فيروس الإسهال البقرى المعدي النوع الجينى-2، فيروس إلتهاب القصبة الهوائية الرغامى المعدي، فيروس البارإنفلونزا-3، و فيروس الأبقار السنسيتي التنفسي (نيمو-5) تحت الظروف الحقلية. تم جمع عينات السرسوب من الامهات و عينات مصلية حقلية من اولادها لتتبع الاستجابة المناعية الامية باستخدام اختبارى المصل المتعادل والاليزا. اظهرت النتائج وجود الاجسام المضادة للفيروسات المحضر منها اللقاح فى السرسوب باعلى مستوى حتى اليوم الثالث بعد الولادة. الانخفاض التدريجى للمناعة الامية فى العجول الصغيرة من اليوم الاول بعد الولادة واستمرت حتى الشهر الرابع بعد الولادة كما قيست بواسطة اختبار المصل المتعادل ولكن استطاع اختبار الاليزا الكشف عن تلك الاجسام المضادة حتى الشهر السادس بعد الولادة. ويستنتج من ذلك ضرورة اعطاء السرسوب خلال 3 ايام من الولادة واستمرار المناعة الامية فى العجول الصغيرة حتى الشهر الرابع من الولادة.

(مجلة بنها للعلوم الطبية البيطرية: عدد 23(2)، ديسمبر 2012: 87-92)