EFFECT OF ALTERNATIVE VACCINATION OF CATTLE AGAINST BOVINE EPHEMERAL FEVER AND LUMPY SKIN DISEASE "USING SHEEP POX VACCINE"

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ABSTRACT

As the blood suckling insects reproduction starts with spring and summer seasons so the vaccination against arthropod born infections should be carried out before or at these seasons. The present study was aimed to evaluate the vaccination of cattle against bovine ephemeral fever (BEF) and lumpy skin disease (LSD). So, different groups of calves were vaccinated singly, alternative and simultaneously with locally produced inactivated BEF and live attenuated sheep pox vaccine (as a non-specific vaccine) used to protect cattle against LSD. Both cell mediated and humoral immunity were evaluated in such animals. It was found that the highest immune levels against BEF were obtained by 2 doses with 2 weeks in between or one dose followed the vaccination with sheep pox vaccine which reacted as a non-specific immunostimulant. It was also noticed that BEF vaccine did not antagonize the animal response to sheep pox vaccine.

INTRODUCTION

Bovine ephemeral fever (BEF) is a suddenly occurring epidemic disease, which sweeps through a herd causing fever, prostration, stiffness and lameness, occasional deaths and complication **(Hungerford (1990)**. It is an acute non-contagious arthropod born viral disease of cattle and water buffaloes. The disease occurs either in seasonal or epidemic forms **(Nandi and Negi, 1999 and Zaghawa et al., (2000)**. Control of BEF in Egypt is based on control of vectors and vaccination programs for susceptible host as recommended by **Daoud et al., (2001) and Zaghawa (2002)**.

Lumpy skin disease (LSD) is a serious disease of cattle that could be acute, subacute or chronic generalized skin eruptive viral disease which affects all ages and both sexes of cattle. It

is transmitted by biting insects **(Carn, 1993)** where natural transmission in the absence of insect vector is insufficient **(OIE, 2000)**. The disease is caused by the only strain of capripox that affects cattle **(Frank et al., 1993)** and it is closely allied to viruses of sheep and goat pox viruses **(Woods, 1988)** and cannot be distinguished from them **(OIE, 2000)**. This disease appeared in Egypt in summer 1988 and 1989 and **Abdel-Rahim et al. (2002)** recorded cases of LSD among non-vaccinated cattle during 1998.

In Egypt, quarantine measures and vaccination were used for controlling LSD, where sheep pox tissue culture vaccine was recommended to control LSD **(Saber et al., 1992 and Michael et al., 1994)**.

The aim of this work is to study the effect of sheep pox vaccine on the immune response of BEF vaccine where the time of vaccination against the two diseases is spring and summer.

MATERIALS AND METHODS

I. Vaccines:

1. Bovine ephemeral fever vaccine (BEF):

An inactivated cell culture BEF vaccine prepared according to **Daoud et al., (2001)** was used to vaccinate experimental calves in the present work. The dose was 2ml inoculated subcutaneously (S/C).

2. Sheep pox vaccine (SP):

A living attenuated lyophilized cell culture sheep pox vaccine "Kenyan strain" was used at the dose of 1ml inoculated intradermally (ID) in the test animals, where till now there is no available specific vaccine against LSD.

II. Viruses:

1- BEF virus cell culture adapted on BHK21 cell culture according to **Azab et al., (2002)**, was used in serum neutralization test (SNT). It has a titre of 10^7 $TCID_{50}$/ml "Tissue Culture Infective Dose".

2- Sheep pox virus cell culture adapted on Vero cell culture was used in SNT with a titre of $10^{5.5}$ $TCID_{50}$/ml. The virus titres were calculated according to **Reed and Muench (1938)**.

III. Serum neutralization test (SNT):

It was performed according to **Burgess (1974)**.

IV. Evaluation of cell mediated immunity (CMI) using lymphocyte transformation or

blastogenesis test:

It was applied according to method adapted by **Lucy (1977) and Charles et al., (1978)** using phytohaemagglutinin A (PHA) as a mitogen. This PHA was supplied by "Biochromk-1224, Berlin, Germany". Heparinized blood samples were taken on 3, 7, 14, 21 and 28 days post vaccination.

V. Calves vaccination:

Eighteen native breed calves of about 6-8 month old were used in the present work. They were tested to antibodies against BEF and LSD using SP virus before vaccination by SNT. These animals were divided into 6 groups each consisted of 3 animals and vaccination was carried out as follows:

Group (1): vaccinated with 2 doses of BEF vaccine with two weeks in between.

Group (2): vaccinated with sheep pox vaccine.

Group (3): vaccinated with sheep pox and after two weeks with BEF vaccine.

Group (4): simultaneously vaccinated with sheep pox and BEF vaccines.

Group (5): vaccinated with BEF vaccine and two weeks later with sheep pox vaccine.

Group (6): was kept as un-vaccinated control.

Serum samples were collected on 7, 14, 21, 28, 60, 90, and 120 days post vaccination for SNT.

RESULTS AND DISCUSSION

Ruminant constitute a significant integer of the national animal wealth. Infectious diseases are major constraints to the development of improved livestock production, to which the solution must be the prevention by means of effective immunization program and eradication of vectors **(Tizard, 2000)**.

BEF and LSD are two diseases that cause high economic losses on milk, meat production and hide quality control of both diseases is conducted by vaccination **(Anon, 1985)**.

The results obtained in table (1) revealed that the mean SN antibody titres of vaccinated calves by sheep pox vaccine when used solely (group 2), simultaneously (group 4), or before or after BEF vaccine (groups 3 and 5) induced antibody titre detectable by the 1st week and began to increased gradually till the 4th week post vaccination where the titre was 85.3 (1.9 $\log_{10}$). Titre could be considered a protective one where the neutralizing index for sheep pox was found to be ≥1.5 (32) which is sufficient to protect animals against lumpy skin disease according to

Gottral (1978) and Saber et al., (1992). These results proved that the BEF vaccine did not affect the immune response of sheep pox vaccine. The results obtained by vaccination of calves with sheep pox vaccine against LSD were similar to those obtained by **Saber et al., (1992) and Michael et al., (1994) and (1996)**

On the other hand the SN-BEF antibody titre were significantly different in different groups. It was noticed that the titres in calves of group (3) in which sheep pox vaccine inoculated before BEF vaccine and in group (1) which inoculated by 2 doses of BEF vaccine were higher than that obtained in groups (3) and (5). These results agree with that recorded by **Sambyal and Singh (1980) and Mayer (1981)** who mentioned that pox viruses induce para-immunity by activation phagocytosis stimulate lymphocytes in vitro and in vivo and induce formation and release of endogenous interferon. Also, these results agree to those obtained by **Abdel-Samae et al., (1994); Abeer (1996); Hussien et al., (1996) and Samir et al., (1999)** who used sheep pox vaccine with other viral vaccines. It was found that SN antibody titre of BEF in group (5) was the lowest one where BEF given before sheep pox. That means that it s preferable to inoculate sheep pox vaccine before using BEF vaccine.

Evaluation of cell mediated immunity by lymphocyte blastogenesis test in vaccinated calves as shown in table (2) showed an increase in the lymphocyte from the 3rd day till the 14th day post inoculation and it was found that sheep pox vaccine stimulate lymphocyte more than that PHA mitogen reached to highest value and began to decrease after that. These results agree with that mentioned by **Mayer (1981) and Amira (1997).**

The CMI of BEF vaccine as shown in table (3) showed an increase in Delta optical density (DOD) in all groups vaccinated with BEF vaccine beginning from the 3rd day post vaccination till the 14th day post vaccination and reached the highest reading 0.394 in group (3) in which animals vaccinated with sheep pox, then BEF vaccine followed by that in group (4) in animals vaccinated simultaneously with the two vaccines (0.381) DOD. Our results are similar to that obtained by **Soliman (2004)** when vaccinate calves with BEF vaccine.

From the above results, it could be concluded that sheep pox vaccine initiated the immune response of calves. However, the most preferable vaccination of cattle against BEF is the use of 2 doses or followed the vaccination with sheep pox vaccine (as a non-specific vaccine against LSD).

Table (1): Results of mean serum neutralizing antibody titre in vaccinated calves with BEF and sheep pox vaccine

Animal Groups	Mean SN antibody titre *													
	Before vaccination		7 DPV		14 DPV		21 DPV		28 DPV		2 months		3 months	
	BEF	SP	BEF	SP	BEF	SP	BEF	SP	BEF	SP	BEF	SP	BEF	SP
G1	0	0	3.4	0	6.7	0	21.3	0	53.3	0	64	0	64	0
G2	0	0	0	13.3	0	53.3	0	85.3	0	85.3	0	85.3	0	85.3
G3	0	0	0	10.3	0	42.7	12.0	74.7	37.7	85.3	64	85.3	64	85.3
G4	0	0	3.3	12.0	6.6	53.3	10.7	85.3	42.7	85.3	53.3	85.3	53.3	85.3
G5	0	0	3.4	0	6.7	0	16	10.7	21.3	26.7	21.3	53.3	21.3	85.3
G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

G1: Calves vaccinated with 2 doses of BEF.
G2: Calves vaccinated with sheep pox vaccine
G3: Calves vaccinated with sheep pox followed by BEF vaccines
G4: Calves vaccinated with simultaneously with BEF and sheep pox.
G5: Calves vaccinated with BEF followed by sheep pox.
G6: Unvaceinated control.
Titre was expressed as reciprocal of the highest dilution that inhibit the appearance of CPE by 100-200 $TCID_{50}$/ml of sheep pox and BEF.

Table (2): Sequence of cell mediated immune response expressed as delta optical density (ΔOD) in calves vaccinated with sheep pox.

Animal Groups	Days Post Vaccination													
	0		3		7		10		14		21		28	
	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus
G2	0.159	0.155	0.197	0.251	0.235	0.350	0.261	0.420	0.290	0.443	0.280	0.418	0.256	0.391
G3	0.152	0.151	0.210	0.280	0.241	0.351	0.263	0.461	0.302	0.490	0.293	0.431	0.211	0.401
G4	0.150	0.156	0.201	0.271	0.232	0.330	0.259	0.463	0.292	0.481	0.284	0.429	0.260	0.395
G5	0.161	0.143	0.203	0.250	0.230	0.303	0.252	0.341	0.291	0.360	0.299	0.390	0.380	0.402
G6	0.156	0.159	0.161	0.162	0.163	0.164	0.167	0.161	0.165	0.164	0.163	0.162	0.161	0.162

PHA: Phytohemagglutinin.
G2: Calves vaccinated with sheep pox vaccine
G3: Calves vaccinated with sheep pox followed by BEF vaccines
G4: Calves vaccinated with simultaneously with BEF and sheep pox.
G5: Calves vaccinated with BEF followed by sheep pox.
G6: Unvaccinated control.

Table (3): Sequence of cell mediated immune response expressed as delta optical density (ΔOD) in calves vaccinated against BEF disease.

Animal Groups	Mean SN antibody titre *													
	0		3		7		10		14		21		28	
	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus	PHA	Virus
G1	0.156	0.153	0.198	0.249	0.231	0.301	0.250	0.343	0.280	0.361	0.296	0.392	0.281	0.380
G3	0.156	0.149	0.230	0.263	0.246	0.315	0.271	0.362	0.305	0.394	0.315	0.418	0.303	0.391
G4	0.162	0.139	0.203	0.241	0.221	0.302	0.248	0.338	0.286	0.351	0.280	0.374	0.271	0.340
G5	0.160	0.139	0.203	0.241	0.221	0.302	0.248	0.388	0.286	0.351	0.280	0.374	0.271	0.340
G6	0.156	0.152	0.161	0.154	0.163	0.153	0.167	0.159	0.165	0.168	0.163	0.165	0.161	0.168

PHA: Phytohemagglutinin.
G1: Calves vaccinated with 2 doses of BEF.
G3: Calves vaccinated with sheep pox followed by BEF vaccines
G4: Calves vaccinated with simultaneously with BEF and sheep pox.
G5: Calves vaccinated with BEF followed by sheep pox.
G6: Unvaccinated control.

REFERENCES

Abdel-Rahim, I. H. A.; El-Balal, S. and Hussein, M. (2002) : "An outbreak of lumpy skin disease among cattle in Upper Egypt (Elmenia governorate). 2nd Sci. Cong. Fac. Vet. Med. Minufya University, P. 185-200.

Abdel-Samea, M.; Khairat, Elian and Gihan Kamel. M. (1994) : The effect of RVF and sheep pox vaccines on the immune response of sheep. J. Egypt. Vet. Med. Ass., 54(2): 129-136.

Abeer, E. M. (1996) : Effect of using FMD vaccine in combination on the immune status of farm animals. M. Vet. Sci. Thesis, Fac. Vet. Med., Cairo University.

Amira, A. Said (1997) : Evaluation of lumpy skin disease virus vaccine using cell mediated immune parameters. M.V.Sc. Microbolgy, Cairo University.

Anon (1985) : World animal health statistics. Vol. I, New animal disease outbreaks, P.G. Office International des Epizooties, Paris, France.

Azab, A. M.; Khodeir, M. H.; Attyat, M. Kotb and El-Gallad, S. B. (2002) : Susceptibility of different cell culture to bovine ephemeral fever virus. 6th Vet. Med., Zag. Conf., 7-9: 41-55.

Burgess, G. W. (1974) : A micro-titre serum neutralization test for bovine ephemeral fever virus. Aust. J. Exp. Bio. Med. Sci. Oct, 52(5): 851-855.

Carn, V. M. (1993) : Control of capripox virus infection. Vaccines, 11: 1275-1279.

Charles, R.; Carpenter, M. and Bodse, I. R. (1978) : CMI suppression of the mitogen stimulated blastogenic response during reticuloend otheliosis virus induced origensis. J. Immunol., 20(4): 1313-1320.

Daoud, A. M.; Soad M. Soliman; Azab, A. M. and Taha, M. (2001) : Preparation of inactivated bovine ephemeral fever vaccine in Egypt. Beni-Suef Vet. Med. J., Vol. XI, Mo. (2) Oct., 619-626.

Frank, J.; Fenner, F.; Paul, J. Gibbs; Frederick, A. Murphy; Rudolf Rott; Michael, J. Studdert and David, O. White (1993) : Veterinary virology. 2nd Ed., Academic Press, Inc. USA.

Gottral, G.E. (1978): "Pox viruses". In manual of standardized methods for the Vet. microbiology, P. 273-291.

Hungerford, T. G. (1990) : Diseases of livestock. 9th Edition, McCrew Hill Book, 372-373.

Hussien, M.; Abdel Samae, M. M.; Sabbagh, M. and Samira Said (1996) : The effect of sheep pox and combined inactivated respiratory disease vaccine on the immune response of calves. Beni-Suef Vet Med. Res., Vol. VI, No. I, Jan. 47-55.

Lucy, F. Lee (1977) : Chicken stimulation by mitogen; a micro assay with whole blood culture. Avian Dis., 22(2): 296-307.

Mayer, A. (1981) : Induction of para-Immunity in biological product of viral disease. Edited by P.A. Bachmann, Taylor Francis, London, PP. 201-207.

Michael, A.; Soliman, S. M.; Saber, M. S.; Fayed, A. A.; Hussien, N. A. and Mousa, A. A. (1994) : Vaccination of cattle against LSD with tissue culture sheep pox vaccine. J. Vet. Med. Assiut, Egypt, PP. 536-541.

Michael, A.; Saber, M. S.; Soad, M. Soliman; Mousa, A. A.; Salama, A. A.; Fayed, A. A.; Monira, I. Nassar and House, A. J. (1996) : "Control LSD outbreak in Egypt with Romanian sheep pox vaccine". Asslut Vet. Med. J., 36(71): 173-180.

Nandi, S. and Negi, B. S. (1999) : Bovine ephemeral fever. A Review Comparative Immunology, Microbiology, and Infectious Diseases, 22: 81-91.

OIE (2000).: Lumpy skin disease. In manual of standards (2000), chapter 2: 1-7.

Reed, L. J. and Muench, J. (1938) : "A simple method of estimating fifty percent end point". Am. J.H., 27: 493-497.

Saber, M. S.; Michael, A.; Fayed, A. A.; Salama, S. A.; Mousa, A. A.; Shalaby, M. A.; Nafie, E. K.; Ayoub, N. N.; Nassar, M. I. and Reda, I. M. (1992) : Vaccination of cattle against LSD with Romanian strain sheep pox vaccine. 4th Annual Report on Scientific Programs of PL-480.

Sambyal, D. S. and Singh, I. P. (1980) : A short note on sheep pox virus soluble antigens studied by immunodiffusion. Zentralblatt fur Veterinar Medizin, 27B(4): 340-343.

Samir, S. S; Wafaa, A. Zaghloul; Soad M. Soliman; Nahed A. Kamel and Mouaz, M. A. (1999) : Trials for vaccination of small ruminants using a combined PPR and sheep pox vaccines. Alex. J. Vet. Med., Vol. 15, No. 4 Oct., 721-731.

Soliman, A. F. (2004) : Trial for preparation combined vaccines against some microbial diseases in bovine. M. These "Microbiology", Suez Canal University.

Tizard (2002) : Veterinary immunology. 6th Ed. Saunders Company.

Woods, J. A. (1988) : LSD, a review. Trop. Anim. Hlth. Prod., 20: 11-17.

Zaghawa, A. (2002) : Bovine Ephemeral Fever: A review. Manufia Vet. J., 2nd Vet. Cong., 22-24 April, 345-360.

Zaghawa, A.; Akela, Khoder, A. M. and Hassan, H. Y. (2000) : An outbreak of bovine ephemeral fever in Egypt during 2000, clinical and epidemiological investigation. 4th Sci. Cong. Fac. Vet. Med. Assiut University, Egypt, 364-353.

الملخص العربي

تأثير التحصين التبادلى ضد كل من حمى الثلاثة أيام والجلد العقدى فى الأبقار باستخدام "لقـــاح جـــدرى الأغنـــام"

المشتركون فى البحث

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نظراً لبداية تكاثر الحشرات خاصة الماصة منها فى فصلى الربيع والصيف وأخذاً فى الاعتبار الأمراض التى تنتقل عن طريق هذه الحشرات، كان من الضرورى دراسة مدى إمكانية تحصين الأبقار ضد اثنين من هذه الأمراض ألا وهما حمى الثلاثة أيام والجلد العقدى.

أستخدم فى هذه الدراسة لقاح حمى الثلاثة أيام النسيجى المثبط ولقاح جدرى الأغنام (كلقاح غير نوعى يستخدم لوقاية الأبقار ضد مرض الجلد العقدى) المنتجين محلياً حيث تم تحصين مجموعات من الأبقار بهذين اللقاحين بصورة أحادية وتبادلياً وتلازمياً.

وقد أوضحت نتائج الإختبارات السيررلوجية والمناعة الخلوية أن أفضل التحصينات تكون بإعطاء جرعتين من لقاح حمى الثلاثة أيام أو تسبق الجرعة الأولى منه لقاح جدرى الأغنام حيث أن الأخير يعمل كمنشط غير نوعى للمناعة، كما لم يحدث لقاح حمى الثلاثة أيام أى تأثير ضد إستجابة الحيوانات للقاح جدرى الأغنام.