

IMMUNE RESPONSE OF CATTLE INFESTED WITH EXTERNAL PARASITES TO RINDERPEST VACCINE

(With 5 Tables)

By

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الاستجابة المناعية للقاح الطاعون البقري في الأبقار المصابة بطفيليات خارجيه

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تستهدف هذه الدراسة معرفة التأثير الذي قد يحدثه في عجول الأبقار التي يجري لها التحصين بلقاح الطاعون البقري النسيجي وهي مصابة بطفيل القراد من فصيلة هياالوما الشائعة في البيئة المصرية وقد أسفرت هذه الدراسة عن النتائج التالية -
أن مستوى الأجسام المناعية المعادله لفيروس الطاعون البقري عند المعدل الطبيعي في العجول المحصنه بلقاح الطاعون البقري النسيجي والمصابة بطفيل القراد من الفصيله المذكوره سواء كانت الاصابه عند التحصين أو بعده بسبعة أيام أو بعد التحصين ب ٢١ يوم من التحصين بلقاح وهو نفس المعدل الذي وجد في العجول المحصنه وغير المصابه بالطفيل وأن مستوى الأجسام المناعية المعادله لفيروس الطاعون البقري والمكتسبه من التحصين في العجول المصابه بالقراد يدور حول المعدل الطبيعي خلال فترة أختبارات طولها ١٢ شهر عقب التحصين ولم يحدث تثبيط لهذا المستوى خلال هذه الفترة الزمنية ثم تحدث أعراض أكلينيكيه جانبية نتيجة التحصين بلقاح الطاعون البقري النسيجي في العجول المصابه بالقراد وكانت درجات الحرارة اليوميه عاديه ولمدة ٢١ يوم بعد التحصين. ويلاحظ أن مستوى الأجسام المناعية المعادله لفيروس الطاعون البقري في العجول المصابه بطفيليات الدم من نوع Babesia, Theileria يدور حول المعدل الطبيعي في هذه العجول المصابه ويمثل المستوى الذي يتواجد في العجول غير المصابه بطفيليات الدم. وخلال هذه الدراسه أن إصابة العجول البقري بطفيل القراد من فصيلة هياالوما لا يؤثر على مستوى الأجسام المناعية المعادله لفيروس الطاعون البقري والمكتسبه من تحصين هذه الحيوانات بلقاح الطاعون البقري النسيجي وكذلك لا يحدث تغير في هذا المستوى نتيجة إصابة العجول البقري ببعض الطفيليات الدمويه.

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SUMMARY

Tick experimentally infested calves and vaccinated with TCRPV. by the time of infestation, 7 days post infestation or 21 days after infestation responded normally to vaccination. The level of the serum rinderpest neutralizing antibody titres acquired through vaccination was identical to that detected in non infested vaccinated animals. These results were obtained regardless the degree of tick infestation mild, moderate, or heavy. Field cattle harbouring Babesia, Theileria or Anaplasma responded to vaccination with the tissue culture rinderpest vaccine as non harbouring animals and serum rinderpest neutralizing antibody titres were identical and this regards to the chronicity of these blood parasites in Egypt.

INTRODUCTION

Cattle and buffaloes are known to constitute an important part of the animal wealth in Egypt. External parasites, particularly ticks are considered as the most dangerous group of parasitic arthropodes affecting cattle and buffaloes causing with tickborne blood parasites great losses among these animals.

In regard to the endemicity of rinderpest disease in Egypt, intensive vaccination campaigns for cattle and buffaloes were performed through the last ten years using the TCRPV to control the last outbreak of the disease which appeared in early 1982 (OSMAN, 1987).

Hence, the aim of the present study was to evaluate the antibody response to TCRPV in tick-infested and piroplasm infected cattle to find out if this response might be affected in these animals or not.

*: TCRPV Tissue culture Rinderpest Vaccine.

MATERIALS AND METHODS

1- Animals:

Twenty two rinderpest susceptible calves of about six months old were divided into 11 groups as follows:

- Group 1,2 and 3 were vaccinated with TCRPV by the time of

Group 2: moderately (15 ticks/ calf) and Group 3: heavily infested (30 ticks/calf).

- Group 4, 5 and 6 were vaccinated with TCRPV 7 days post infestation (DPI). Group 4: mildly, Group 5: moderately and Group 6: heavily infested.

- Group 7, 8 and 9 were vaccinated with TCRPV 21 DPI before infestation. Group 7: mildly, Group 8: moderately and Group 9: heavily infested.

- Group 10 were non-infested vaccinated controls.

- Group 11 were non-infested non-vaccinated controls. Animals were fed similarly and were kept under daily observation.

2- Field animals:

Two hundred field cattle from different localities in Upper and Lower Egypt were blood sampled from "New Valley", Assiut, Giza, Al-Garbia, Al-Dakahlia, Ismailia, El-Behera and Alexandria. They were grouped as follows: 50 mildly, 50 moderately, 75 heavily infested cattle and 25 non-infested cattle as controls. These animals were vaccinated with TCRPV.

3- Ticks:

Experimental calves were artificially infested with the tick species *Hyalomma anatolicum-anatolicum* (Ixodoidea: Ixodidae). Ticks infesting field cattle were identified according to the keys of *HOOGSTRAAL and KAISER (1958 & 1959)*.

- Serum neutralization test (SNT):

The technique was that of *LOWRRIGHT and FERRIS (1959)* to detect antibodies against rinderpest virus in sera of animals.

- Tissue culture:

Primary monolayers of bovine kidney cells were prepared according to the method described by *LOWRRIGHT and FERRIS (1959)* and modified by *SINGH and OSMAN (1970)*, and *OSMAN et al. (1985)*.

- Virus (TCRPV):

Live tissue culture adapted kabete O₉₉ strain of rinderpest virus passed in calf kidney cell culture till 101 passage, was used according to the technique recommended by *SINGH et al. (1967)*.

- Vaccination:

Ten groups, of animals each of two (infested and non

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infested) as well as the field animals were vaccinated. with TCRPV (200 TCID₅₀)/1 ml. subcutaneously in the neck region.

RESULTS

- 1- Immune response of tick-experimentally infested calves vaccinated with TCRPV by the time of infestation: The results are described in table No. (1).
- 2- Immune response of tick-experimentally infested calves vaccinated with TCRPV by 7 DPI: The results are described in table No. (2).
- 3- Immune response of tick experimentally infested calves vaccinated with TCRPV by 21 days before infestation: The results are described in table No. (3).
- 4- Clinical picture of tick-experimentally infested calves vaccinated with TCRPV: It was found that neither symptoms nor side effects were detected through an observation period of 21 days post vaccination. The experimental calves as well as the controls showed normal (daily) temperature ranging between 38.4 °C and 38.8 °C.
- 5- Immune response of tick naturally infested cattle vaccinated with TCRPV: The results are described in table No. (4).
- 6- Immune response of field cattle naturally infested with blood parasites to vaccination with tissue culture rinderpest vaccine: The results are described in table No. (5).

DISCUSSION

The TCRPV produced in Egypt (*OSMAN et al.*, 1985) was the basic corner stone on which the last outbreak of rinderpest was successfully and promptly put under control (*ANON*, 1986).

The ticks as ectoparasites were still enzootic in Egypt and cattle in different localities were reported to be mildly, moderately or heavily tick infested (*LIEBISCH et al.*, 1984).

Concurrently, tick-infested calves were subjected to rinderpest vaccinations through the overwhelming vaccination campaigns.

Hence, the aim of the present study was to evaluate the immune response of tick-infested calves vaccinated with the TCRPV.

The experiments were designed in the present study in such a manner that groups of tick experimentally infested calves were concomitantly rinderpest vaccinated by the time of infestation and 7 days post infestation. Another group of test animals were vaccinated 21 days before infestation. Different degrees of tick infestation were taken in consideration to

simulate as much as possible natural infestation in the field. In this view, the most common tick species (*H. anatolicum antatolicum*) was used for experimental infestation.

The results obtained revealed that rinderpest immunity was equally afforded in both tick infested and non infested calves. The serum rinderpest neutralizing antibody titres were found to be within the range usually obtained through vaccination with the TCRPV, i.e. 25-75; the same results of serum rinderpest neutralizing antibodies titres were also reported by SINGH et al., (1967 a). SINGH and OSMAN 1970 and OSMAN et al. (1985). These observation were found in groups of experimental calves either vaccinated by the time of infestation or 7 days post infestation. Animals vaccinated 21 days before infestation revealed approximately the same results.

The fluctuation in serum rinderpest neutralizing antibody titres among rinderpest vaccinated animals as 25, 50, 75 were noteworthy common and had been previously observed by several authors (PLOWRIGHT and TAYLOR, 1967 and PLOWRIGHT, 1984).

The conclusion withdrawn from these studies was that even tick heavily infested calves respond immunologically to vaccination with TCRPV in terms of serum rinderpest neutralizing antibody in a titre indifferent to that acquired in non-infested animals.

The filed samples collected from tick infested cattle which were reported to be vaccinated revealed successful vaccination as shown by the only sporadic 5 samples which were found to be susceptible from 200 samples even though these 5 samples might be from calves of regressed immunity that was acquired through colostrum.

The field samples collected from tick infested and vaccinated cattle were found to be immune, a result which confirmed the safety of the use of the TCRPV in vaccination campaigns under various field conditions.

The response of cattle infested with blood parasites was immunologically similar to the non-infested controls to TCRPV as indicated by the obtained serum rinderpest neutralizing antibody titres in both groups. This result was of interest as it might be attributed to the chronicity of infestation, and can confirm the findings of RAMYAR (1968) who reported the safety and immunogenicity of TCRPV in 250 cattle although infested with *Theileria annulata*, *Babesia bigemina* and *Anaplasma marqinal*.

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However, WAGNER *et al.* (1975) reported a significant abatement of rinderpest neutralizing antibody occurred in cattle undergoing severe East Coast fever but RUNANGIRAW *et al.* (1980) could not detect such effect.

In this respect it was also reported that insignificant reduction in the antibody response to Foot and Mouth Disease vaccine was found in cattle infested with *Theileria annulata* (SHARPE and LANGLEY, 1983).

It can be generally concluded that the use of the tissue culture rinderpest vaccine is safe and immunogenic in tick-infested cattle and provokes an immune response indifferent to that acquired in non-infested cattle. Thus the procedure of mass intensive vaccination even with tick infestation among cattle is of value in facing rinderpest outbreaks. In addition, a new confirmation could be obtained for the safety and immunogenicity of the TCRPV under the local Egyptian field conditions.

The results obtained could not nullify the necessity of combating external and blood parasites infesting cattle to prevent other subsequent losses.

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Table 1- Immune response of tick-experimentally infested calves vaccinated with tissue culture rinderpest vaccine by the time of infestation.

Group No.	Animal No.	Degree of tick infestation.	(1) Rinderpest neutralizing antibody titre													
			(Interval post vaccination).													
			(2) 7d		(3) 21d		3m		4m		5m		6m		12m.	
I	1	mild (20 males & 20 females).	-	25	75	75	50	50	50	50	50	50	50	50	50	50
	2	Moderate (40 males & 40 females).	-	5	50	50	50	50	50	50	50	50	50	50	50	50
II	3	heavy (100 males & 100 females).	-	5	75	75	75	75	75	75	75	75	75	75	75	75
	4	non-infested vaccinated	-	5	25	25	25	25	25	25	25	25	25	25	25	25
III	5	controls.	-	25	75	75	75	75	75	75	75	75	75	75	75	75
	6	non-infested non vaccinated	-	25	50	50	50	50	50	50	50	50	50	50	50	50
X	19	controls.	-	5	25	25	25	25	25	25	25	25	25	25	25	25
	20	controls.	-	25	75	75	75	75	75	75	75	75	75	75	75	75
XI	21	controls.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	22	controls.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1= Titres were expressed as the reciprocal of the last dilution of serum that inhibits the CPE of 100-200 TCID₅₀ / 0.1 ml. of TCRPV.

2= days post vaccination. 3= months post vaccination.

Table 2- Immune response of tick- experimentally infested calves vaccinated with tissue culture rinderpest vaccine by 7 days post infestation.

Group No.	Animal No.	Degree of tick infestation.	Rinderpest neutralizing antibody titre (Intervals post vaccination).										
			7d	14d	21d	28d	3m	4m	5m	6m	12m		
IV	7	mild (20 males & 20 females).	-	5	25	25	25	25	25	25	25	25	25
	8		-	25	25	25	25	25	25	25	25	25	25
	9	moderate	-	25	50	50	50	50	50	50	50	50	50
V	10	(40 males & 40 females).	5	25	75	75	75	75	75	75	75	75	75
	11	heavy	-	25	50	50	50	50	50	50	50	50	50
VI	12	(100 males & 100 females).	-	50	50	50	50	50	50	50	50	50	50
X	19	non-infested vaccinated	-	25	50	50	50	25	25	25	25	25	25
	20	controls.	-	5	50	50	50	50	50	50	50	50	50
XI	21	non-infested non vaccinated	-	-	-	-	-	-	-	-	-	-	-
	22	controls.	-	-	-	-	-	-	-	-	-	-	-

1= Titres were expressed as the reciprocal of the last dilution of serum that inhibits the CPE of 100-200

TCID₅₀ / 0.1 ml. of TCRPV.

2= days post vaccination .

3=months post vaccination.

Table 3- Immune response of tick-experimentally infested calves vaccinated with tissue culture rinderpest vaccine by 21 days before infestation.

Group No	Animal No.	Degree of tick infestation.	(1) Rinderpest neutralizing antibody titre (Intervals post vaccination).										
			7d	14d	21d	22	30	40	50	60	120		
VII	13	mild (20 males & 20 females).	-	25	50	50	50	50	50	25	25	25	25
	14		-	25	50	50	50	50	50	50	50	50	40
	15	moderate	-	25	50	50	50	50	50	50	50	50	50
VIII	16	(40 males & 40 females).	-	5	25	25	25	25	25	25	25	25	25
	17	heavy	-	25	50	50	50	50	50	50	50	50	25
IX	17		-	25	75	75	75	75	75	50	50	50	50
	18	(100 males & 100 females).	-	25	75	75	75	75	75	50	50	50	50
X	19	non infested vaccinated	-	25	50	50	50	50	50	25	25	25	25
	20	controls:	-	25	75	75	75	75	75	50	50	50	50
XI	21	non infested non vaccinated	-	-	-	-	-	-	-	-	-	-	-
	22	controls:	-	-	-	-	-	-	-	-	-	-	-

1-titres were expressed as the reciprocal of the last dilution of serum that inhibits the CPE of 100-200 TCID₅₀/0.1ml of TCRPV.
 2-days post vaccination.
 3-months post vaccination.

Table (4): Immune response of tick-naturally-infested cattle vaccinated with tissue culture rinderpest vaccine

Group No.	No. of animals	Degree of tick infestation	R.P immune response		Rinderpest serum neutralizing antibody titer	
			No. of immune	No. of susceptible	Range	Mean
I	50	mild	49	1	25-75	45.0
II	50	moderate	48	2	10-75	47.0
III	75	heavy	74	1	5-100	45.0
IV	25	non-infested controls	24	1	5-100	45.0

R.P. = Rinderpest.

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Table (5): Immune response of field cattle naturally infested with blood protozoa to vaccination with tissue culture rinderpest vaccine

Group No.	No. of animals	Blood protozoal infestation	RP immune response		R.P. serum neutralizing antibody titer	
			No. of immune	No. of susceptible	Range	Mean
I	13	Babesia spp.	13	-	25-75	43.0
II	19	Theileria spp.	18	1	25-75	46.0
III	3	Anaplasma spp.	3	-	25-75	50.0
IV	10	Non infested control	10	-	25-75	45.0

R.P. = Rinderpest .