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SEROLOGICAL SCREENING FOR INFECTOUS CATTLE DISEASES. III. CHOICE OF SENTINEL ANIMALS.

LEVANTAMENTO SOROLÓGICO DE DOENÇAS INFECCIOSAS DE BOVINOS. III. ESCOLHA DE ANIMAIS SENTINELAS.

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SUMMARY

A herd of Cattle (Holstein-Zebu crosses) was screened bimonthly for two years by ELISA for IgG antibodies to infectious disease agents. The herd was composed of 3 age groups: Young animals (< 4 months of age), developing animals (4-36 months of age) and producing animals (> 36 months of age). All young animals received colostrum within two hours after birth. The overall consistency of ELISA results, i.e agreement between two consecutive tests was about the same for the three age groups and was lowest for infections of intermediate prevalence (40-50%). The interpretation of changes in seroprevalence is most straight forward for young animals. Young animals positive at their first test reflect the immune status of their mothers while young animals born seronegative but seroconverting reflect the incidence rate. It is concluded that young animals when tested repeatedly are the best sentinel animals.

Key words: ELISA, seroconversion, young, sentinels, infectious diseases.

RESUMO

Um rebanho bovino (cruza Holandês-Zebu) foi amostrado a cada dois meses durante dois anos pela prova do ELISA para a detecção de anticorpos para doenças infecciosas. O rebanho era composto de três grupos etários: animais jovens (menos de 4 meses de idade); animais em desenvolvimento (4-36 meses de idade); e animais em produção (mais de 36 meses de idade). Todos os animais jovens receberam colostro dentro das duas primeiras horas após o nascimento.A consistência total dos resultados do teste ELISA, isto é, a concordância entre dois testes consecutivos foi praticamente a mesma para os três grupos e foi menor para infecções com prevalência intermediária (40-50%). A interpretação de alterações de soroprevalência em animais jovens é simples. Animais jovens positivos ao primeiro teste refletem o "status imunológico" de suas mães, enquanto que, animais jovens que nascem soronegativos mas soroconvertem, refletem a taxa de incidência. Conclui-se que animais jovens testados repetidamente são os melhores animais sentinelas.

Palavras-chave: ELISA, soroconversão, jovens, sentinelas, doenças infecciosas.

INTRODUCTION

Serological screening for antibodies to disease agesnts can be a very tool in determining the health of a herd of some other population. There are however difficulties in interpretation of test results because, among other things, the test results are influenced by pregnancy status age, season and the prevalence of the infection in the herd. (BARAJAS-ROJAS et al, 1993a, 1993b, 1993c. In the present study we evaluate the usefulness of selecting a certain age group in this case young animals, as sentinels for infections occurring in a herd.

MATERIAL AND METHODS

The study was conducted in a cattle herd at the Center for Research, Teaching and Extension in Tropical Livestock (Centro de Investigación y Extensión en Ganadería Trópical-CIEEGT) of the Faculty of Veterinary Medicine of the National Autonomous University of Mexico. The Center is located in the tropics

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of Mexico, in the North-Central part of the state of Veracruz. Blood samples were collected bimonthly and the sera subjected to ELISA for infectious disease agents as described earlier (BARAJAS-ROJAS, 1993a). Three age groups of animals were tested: Young animals (< 4 months of age), developing (4-36 months of age) and producing animals (> 36 months of age).

RESULTS

The consistency of serological results was evaluated by comparing consecutive tests (2 months apart). The tests may agree or a positive test may turn negative and vice versa. Positivity and negativity was defined by the cut off point for the ELISA values. The number of test reversals expressed as percent of total mumber of tests performed are shown in table I and the absolute number of reversals from negative to positive and from positive to negative are shown in table II. The ratio of reversals positive to negative and negative to positive over the two year testing period is a measure of trends in prevalence and agrees fairly well with earlier estimates (BARAJAS-ROJAS et al, 1993a).

The percent of reversals in both directions are plotted for all animals against percent prevalence in Figure 1 which suggests that the frequency of reversals is a function of prevalence of positive tests. In other words the highest agreement between neighbor tests is found when the prevalence is either high or low. Since most of prevalences for young animals fall below 35% and there are rather few in the mid range (Figure 2) there are indications that this group of animals yield the most consistent results especially when compared to producing (adult) cattle (Figure 3).

Figures 4-7 show how well incidence respectively prevalence at birth, in young animals predict prevalences among developing animals (Figures 4 and 5)

Table I. Reversals of consecutive tests in percent of total tests performed in cattle from the tropics of Mexico. 1988, 1989.

AGENT	YOUNG	DEVELOPING	PRODUCING
Bovine Viral Diarrhea virus	2.94	6.12	14.64
Rotavirus	16.67	26.17	39.71
Infectious Bovine Rhinotracheitis virus	2.45	0.25	4.14
Parainfluenza 3	16.67	15.89	38.79
Haemophilus somnus	9.80	20.56	21.64
Listeria monocytogenes	15.69	26.76	38.67
Mycobacterium paratuberculosis	13.24	26.O8	36.00
Campylobacter fetus	10.78	23.53	36.14
Leptospira interrogans serovar hardjo	25.00	23.36	29.29
Bluetongue virus	19.12	5.78	15.57
Mycoplasma bovis	19.12	25.40	25.14
Anaplasma marginale	25.98	24.38	34.86
Coxiella burnetii	13.73	19.80	29.64
Toxoplasma gondii	19.61	30.76	38.57
Salmonella typhimurium	14.22	26.68	26.79
Chlamydia psittaci-trachomatis	13.73	27.70	28.50
Pasteurella multocida	14.22	15.80	27.21
Salmonella dublin	26.96	31.61	38.93
Bovine Respiratory syncytial virus	28.43	29.82	35.14
Borrelia burgdorferi	27.94	34.32	45.21

Table II. Number of changes from positive to negative and vice versa on consecutive tests in cattle from the tropics of Mexico. 1988, 1989.

	YOUNG (1)		DEVELOPING (2)		PRODUCING (3)	
AGENT	Pos->Neg	Neg->Pos	Pos->Neg	Neg->Pos	Pos->Neg	Neg->Pos
Bovine Viral Diarrhea virus	5	1	36	36	102	103
Rotavirus	15	19	162	146	308	248
Infectious Bovine Rhinotracheitis virus	5	0	1	2	29	29
Parainfluenza 3	16	18	87	100	273	270
Haemophilus somnus	8	12	106	136	149	154
Listeria monocytogenes	18	14	141	174	265	268
Mycobacterium paratuberculosis	13	14	140	167	246	258
Campylobacter fetus	8	14	113	164	232	274
Leptospira interrogans serovar hardjo	32	19	121	154	202	208
Bluetongue virus	21	18	32	36	114	104
Mycoplasma bovis	16	23	109	190	134	218
Anaplasma marginale	24	29	123	164	225	263
Coxiella burnetii	14	14	103	130	187	228
Toxoplasma gondii	14	26	156	206	260	280
Salmonella typhimurium	12	17	145	169	166	209
Chlamydia psittaci-trachomatis	9	19	139	187	188	211
Pasteurella multocida	19	10	71	115	188	193
Salmonella dublin	28	37	177	195	267	278
Bovine Respiratory syncytial virus	27	31	152	199	237	255
Borrelia burgdorferi	28	29	199	205	323	310

(1) Young (83 animals with 204 tests)
(2) Developing (194 animals with 1177 tests)
(3) Producing (181 animals with 1400 tests)

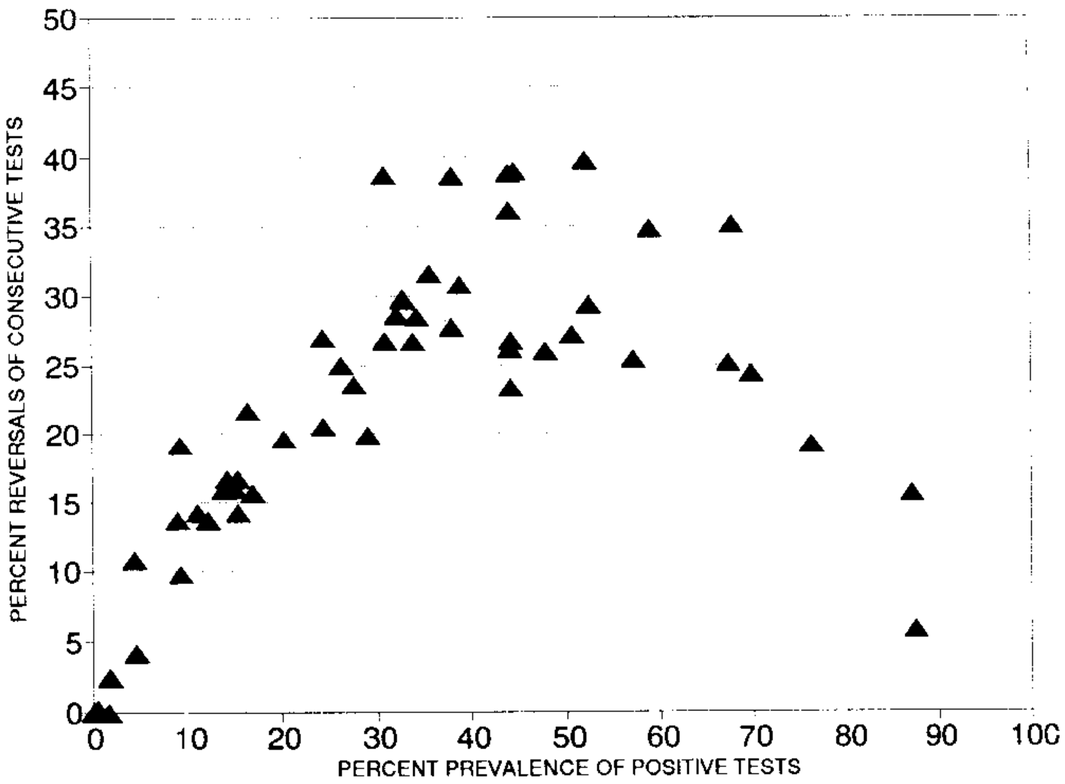

Figure 1. Association between prevalence of positive ELISA tests for 20 antigens and frequency of reversals of consecutive tests for all age groups.

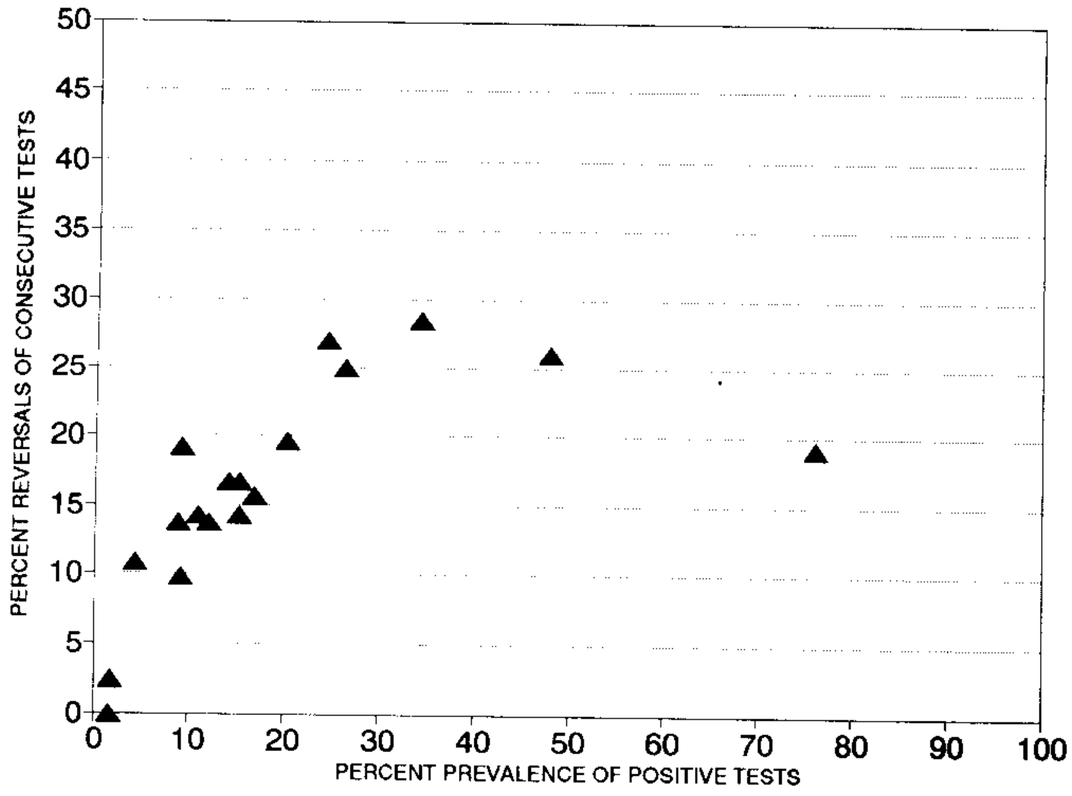

Figure 2. Association between prevalence of positive ELISA tests for 20 antigens and frequency of reversals of consecutive tests for young animals.

Figure 3. Association between prevalence of positive ELISA tests for 20 antigens and frequency of reversals of consecutive tests for producing animals.

and among producing animals (Figures 6 and 7).

Table III shows number of young animals (not number of tests) that are seropositive shortly after birth or seroconvert within a period of 4 months. Table IV is based on the same data but allows for more easy comparisons. Prevalence rate at birth represents the immune status of the mothers and is thus a measure of period prevalence of infection among the mothers with the length of the period undefined. Four months incidence durings the beginning of life represents

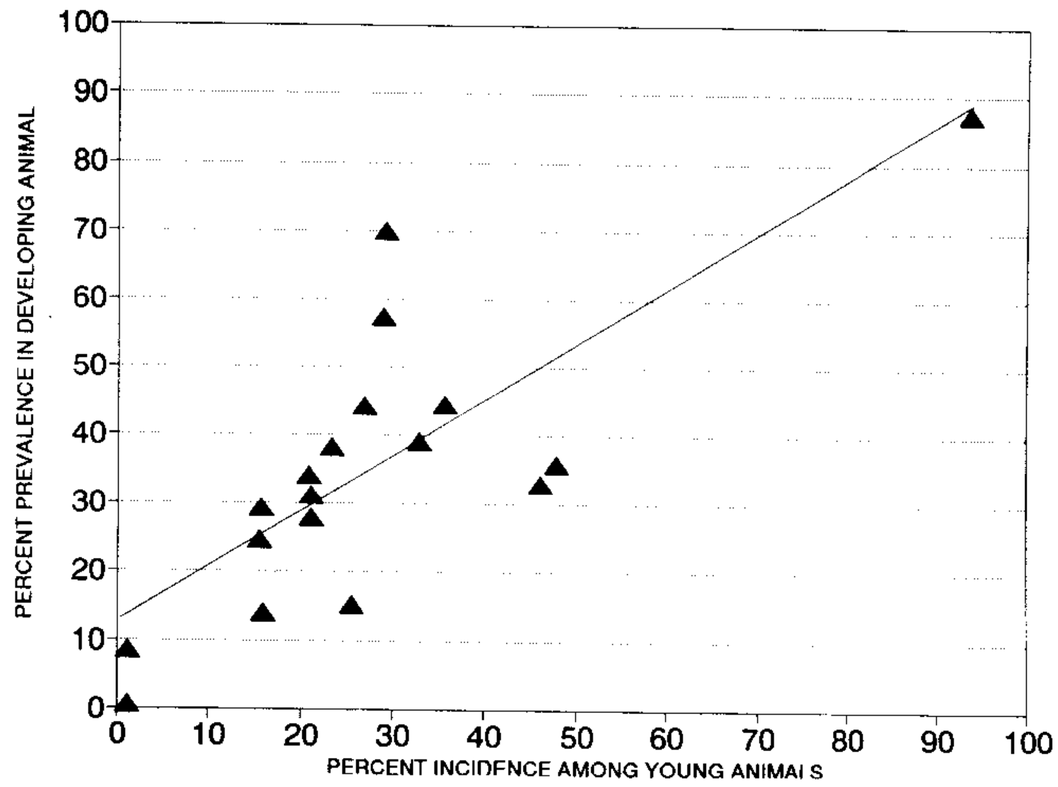

Figure 4. Regression of percent positive tests among developing animals on incidence of positive tests in young animals (<4 months of age). 1988/1989.
$\hat{y} = 12.74 + 0.80x$; $R^2 = 0.61$

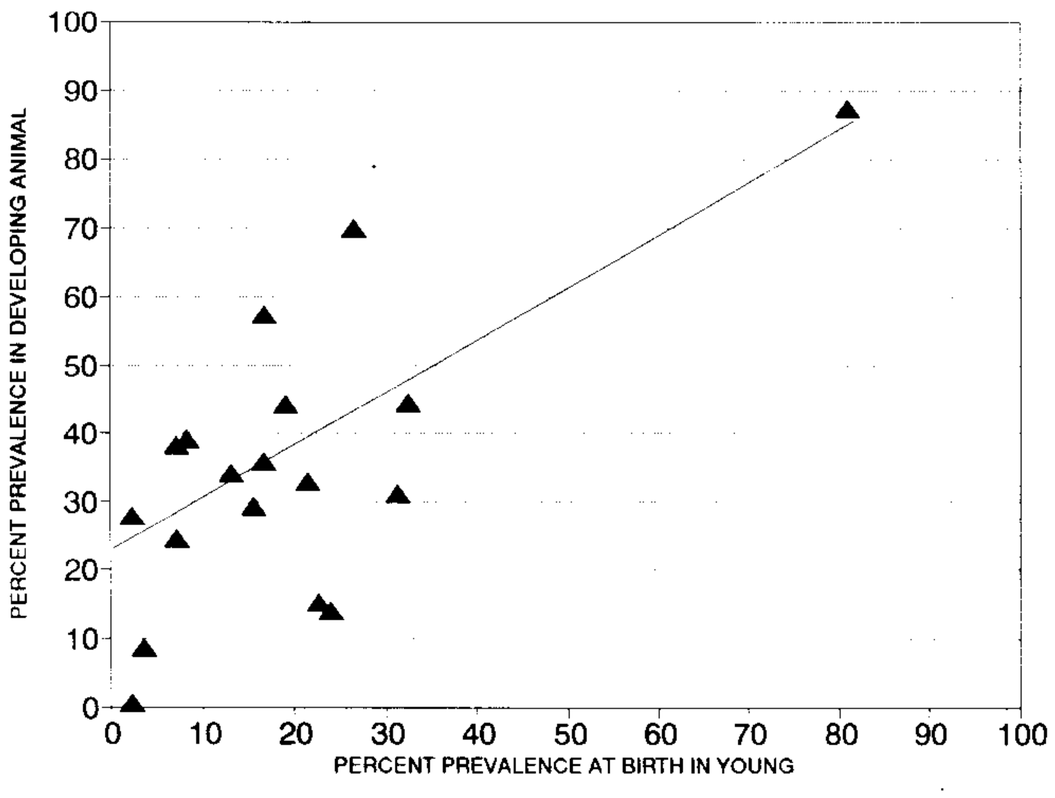

Figure 5. Regression of percent positive tests among developing animals on prevalence of positive tests in newborn. 1988/1989.
$\hat{y} = 19.07 + 0.82x$; $R^2 = 0.49$

incidence. The relative incidence among young suggest different degrees of activity of agents during the time period involved.

DISCUSSION

It is not surprising that young animals turn out to be the best sentinels of herd infection; they exhibit

Table IV. Percent prevalence at birth and percent incidence during first four months of age among young animals from the tropics of Mexico. 1988, 1989.

AGENT	PERCENT PREVALENCE AT BIRTH	PERCENT FOUR MONTH INCIDENCE
Bovine Viral Diarrhea virus	3.61	1.27
Rotavirus	19.28	26.87
Infectious Bovine Rhinotracheitis virus	2.41	<1.23
Parainfluenza 3	22.89	25.56
Haemophilus somnus	7.23	15.58
Listeria monocytogenes	31.33	21.05
Mycobacterium paratuberculosis	13.25	18.06
Campylobacter fetus	2.43	21.05
Leptospira interrogans serovar hardjo	32.53	35.71
Bluetongue virus	80.72	93.75
Mycoplasma bovis	16.87	28.99
Anaplasma marginale	26.51	29.41
Coxiella burnetii	15.66	15.71
Toxoplasma gondii	8.43	32.89
Salmonella typhimurium	13.25	20.83
Chlamydia psittaci-trachomatis	7.23	23.38
Pasteurella multocida	24.10	15.87
Salmonella dublin	16.87	47.83
Bovine Respiratory syncytial virus	21.69	46.15
Borrelia burgdorferi	27.71	40.00

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