

# Possible Sex Differences in the Susceptibility of Calves to Rotavirus Infection

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## ABSTRACT

The agar gel precipitation test was used to detect rotavirus antibodies in the serum of 562 calves and bovine rotavirus antigen in the feces of 347 calves. Significantly more females had rotavirus antibodies in the serum ( $P < 0.01$ ) and rotavirus antigen in the feces ( $P < 0.1$ ) than did male calves. Female buffalo calves were also found to be more susceptible than male buffalo calves to rotavirus infection.

**Key words:** Rotavirus infection, sex differences, calves, agar gel precipitation test.

## RÉSUMÉ

Cette expérience consistait à utiliser l'épreuve de la précipitation en milieu gélatiné pour détecter des anticorps contre le rotavirus bovin, dans le sérum de 562 veaux, et pour rechercher le virus précité, dans les fèces de 347 veaux. Un nombre significativement plus élevé de femelles que de mâles possédaient de tels anticorps ( $P < 0.01$ ) et éliminaient l'antigène correspondant dans leur fumier ( $P < 0.1$ ). Les génisses de bisons se révélèrent aussi plus susceptibles que leurs congénères mâles à une infection par le rotavirus.

**Mots clés:** infection par le rotavirus, différences entre les sexes, veaux, épreuve de la précipitation en milieu gélatiné.

Little attention has been paid to sex differences in infectious diseases of animals. Since the physiology of the

sexes differs in several respects and since our understanding of the factors affecting the pathogenesis of some diarrheal diseases (rotavirus-diarrhea) is incomplete (1), sex differences could play a role in the pathogenesis of rotavirus diarrhea.

Serum samples were collected from 562 cow-calves below six months of age. Fecal samples were collected from 347 cow-calves and from 46 buffalo calves; all calves were below two months of age. The fecal samples were processed following the method of Rhodes *et al* (2). The supernatant fluid containing the rotavirus antigen was tested against the standard rabbit antiovine rotavirus serum supplied by Dr. Marvin Rhodes, University of Nebraska, U.S.A. Concentrated rotavirus antigen for the detection of rotavirus antibodies in the serum was prepared employing the method of Bishop *et al* (3); the concentrated antigen was found to be specific when tested against the standard antiserum.

Rabbit antiovine rotavirus serum was prepared in our laboratory by injecting the concentrated antigen employing the method of Ellens *et al*

(4), and was subsequently absorbed against a normal bovine rotavirus antigen-negative fecal suspension in a ratio of 2:1. The prepared and absorbed antiserum was tested with the standard antiserum by agar gel precipitation test (AGPT) against rotavirus positive and negative fecal suspensions to ensure the specificity of the serological reaction. The reaction was found to be specific. The agar gel precipitation test used to detect both positive and negative fecal samples was performed according to the method by Kwapinski (5), on microscopic slides covered with 0.9% molten noble agar (Holsten Chemic, West Germany) in phosphate saline buffer pH 7.2. The slides were kept at 10°C for 24-48 hours.

Of the 562 serum samples (269 males plus 293 females) from cow-calves examined by AGPT for the presence of rotavirus antibodies 14.49% of the samples from male calves were positive for rotavirus antibodies, whereas 23.20% of the samples from female calves were positive (Table I). Three hundred and forty seven fecal samples (292 nondi-

TABLE I. Sex Distribution of Rotavirus Antibodies among Cow-Calves

Total Serum Samples Collected	No. Tested and (%) Positive	
	Males	Females
562	269 (14.49)	293 (23.20)

TABLE II. Sex Distribution of Rotavirus Antigen among Cow-Calves

Samples	Number Collected	No. Tested and (%) Positive	
		Males	Females
Nondiarrheic	292	146 (36.98)	146 (46.57)
Diarrheic	55	25 (36.00)	30 (46.66)
Total	347	171 (36.84)	176 (46.59)

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arrheic plus 55 diarrheic) from cow-calves were examined by AGPT for the presence of rotavirus antigen (Table II). Out of 55 diarrheic calves 23 were positive for rotavirus antigen; nine were males and 14 females. Forty-six fecal samples (39 nondiarrheic plus 7 diarrheic) from buffalo calves were also examined by AGPT for the presence of rotavirus antigen (Table III). Sex differences were also detected for both cow and buffalo calves regarding the number of diarrheic calves to the total number of positive calves as is shown in Table IV.

The agar gel precipitation test was used because it was found to be superior to both electron microscopy (2,6), and the fluorescent antibody technique (2). Bovine rotavirus infection seems to exist in female calves more than in male calves. Sex differences have been reported in human rotavirus infection (infantile gastroenteritis) by Krustak and Krustak (7); of 1200 patients suffering from acute gastroenteritis 58% were males and 42% were females.

The cause for the observed sex differences in animals and humans is still unknown. The level of lactase enzyme is highest in early life (8,9,10); it decreases as the age of the animal increases and it is also correlated with the age at which diarrhea occurs (8,9), but there is no mention in the literature about whether differences exist between the sexes in regard to their lactase enzyme concentration. If enzyme level differences did exist they could be related to differences in susceptibility since the lactase enzyme uncoats rotavirus in vitro (8) increases its infectivity in vitro (11) and as suggested by Holmes (8), it can perform a similar function in vivo in newborn animals, infants and also in

**TABLE III. Sex Distribution of Rotavirus Antigen among Buffalo Calves**

Samples	Number Collected	No. Tested and (%) Positive	
		Males	Females
Nondiarrheic	39	15 (20.00)	24 (41.66)
Diarrheic	7	2 (0.00)	5 (20.00)
Total	46	17 (17.64)	29 (37.95)

**TABLE IV. Sex Distribution of Diarrheic Cow and Buffalo Calves for Rotavirus Antigen among Total Rotavirus Positive Calves**

Calves	Fecal Samples Positive for Rotavirus Antigen	No. Positive and (%) Diarrheic Positive	
		Males	Females
Cow	147	63 (14.26)	84 (16.66)
Buffalo	14	3 (0.00)	11 (9.09)

adult humans. Humans bearing high levels of lactase enzyme in their intestines have been found to suffer from rotavirus infection.

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