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Seroprevalence of swine influenza and porcine reproductive and respiratory syndrome in Korea

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Abstracts

A total of 501 serum samples were selected from blood samples that were submitted to Department of Veterinary Pathology, Kangwon National University from all provinces in Korea from September 2001 to August 2002. Their sera were examined for antibodies to swine influenza virus subtype H1N1 (SIV H1N1) and porcine repro-ductive and respiratory syndrome virus (PRRSV) according to the age of pig, season, and herd size using enzyme-linked immunosorbent assay. The seroprevalence of SIV H1N1, PRRSV, and dual infection were 39.12%, 61.48%, and 25.95%, respectively. The seroprevalence of SIV H1N1 according to herd size was not significant differences (p>0.05). The results showed that the PRRSV infection spread widely in swine herds throughout the country.

Key words: PRRS virus, Swine influenza virus, Seroprevalence, ELISA

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Introduction

Swine influenza (SI) is an acute, infec-tious, and respiratory disease of swine caused by type A influenza viruses and causes severe economic losses in swine herds. SI is characterized by a sudden onset, coughing, dyspnea, fever, and prostration, followed by a rapid recovery[1]. Currently three main subtypes of SI virus are circulating in different swine populations throughout the world: H1N1, H3N2, and H1N2. In Asia, North America, and Europe, viruses of the H1N1 subtype are the most commonly isolated[2, 3]. SIV H1N1 was first isolated

in Korea in 1996[4].

Porcine reproductive and respiratory syndrome (PRRS) is characterized by reproductive failure of sows and respiratory problems of piglets and growing pigs. PRRS occurs in most major pig-producing areas throughout the world[5]. This has caused serious economic loss to pig farming industries due to the decreased growth rate of weaning piglets and the reproduction failure of sows[6]. In Korea, antibodies against PRRS virus were detected in serum from pigs imported in 1985[7]. PRRSV was first isolated in Korea in 1993[8].

The purpose of this study was to investigate the seroprevalence of SIV H1N1 and PRRSV according to the age of pig, season, and herd size from September 2001 to August 2002 in Korea.

Materials and Methods

Serum samples

A total of 501 sera from 44 farms were used. These sera were randomly selected (using computer-generated list of random numbers) from blood samples that were submitted to Department of Veterinary Pathology, Kangwon National University from all provinces in Korea from September 2001 to August 2002. All farms in this study were farrow-to-finish operations. No herds were vaccinated against PRRSV. All sera were harvested by centrifugation for 15 min at 3,000 rpm and were heat-inactivated at 56℃ for 30 min and kept at −20℃ until used. The age of pig was divided into five categories; suckling piglets (≤ 21 day old pigs), weaned piglets (22-70 day old pigs), growing pigs (71-120 day old pigs), finishing pigs (≥121 day old pigs), and sows. The season was divided into four categories; spring, summer, fall, and winter. The herd size was divided into three categories depending on number of pigs; ≤1,000, 1,001-2,000, and ≥2,001. The sera were tested for SIV H1N1 and PRRSV antibody by enzyme-linked immuno sorbent assay (ELISA).

Serological tests

SIV: Sera were tested for antibodies to SIV by a commercially available SIV H1N1 ELISA kit (IDEXX Laboratories, Westbrook, USA) following the manufacturer' s instructions. Samples with S/P ratio equal to or greater than 0.4 were considered positive.

PRRSV: Serum samples were studied by means of a commercially available PRRSV ELISA kit (IDEXX Laboratories, Westbrook, USA) following the manufacturer' s instructions. If the S/P ratio is ≥ 0.4, the sample is classified as positive for PRRSV antibodies.

Statistical analysis

For statistical analysis, the Statistical Analysis System Version 8.2 (SAS Inst, Cary, NC) was used. The comparison between the seroprevalence of SIV H1N1 and PRRSV according to the age of pig, season and herd size was examined using chi-square. The antibody

prevalence in dual infection output a frequency. Significant differences were considered at $p \leq 0.05$.

Results

Antibodies to SIV H1N1 were found in 39.12% of the samples tested. The percentage of seropositive in suckling piglets, weaned piglets, growing pigs, finishing pigs, and sows were 47.17, 19.65, 36.27, 36.00, and 66.67, respectively (Table 1).

Table 1. Antibody rates of swine influenza virus subtype H1N1 according to age of pig in Korea

Ages	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Suckling piglets	53	25 (47.17)	28 (52.83)
Weaned piglets	173	34 (19.65)	139 (80.35)
Growing pigs	102	37 (36.27)	65 (63.73)
Finishing pigs	50	18 (36.00)	32 (64.00)
Sows	123	82 (66.67)	41 (33.33)
Total	501	196 (39.12)	305 (60.88)

($x^2 = 68.7$, df = 4, $p < 0.01$)

The highest prevalence of SIV H1N1 infection according to age of pig was detected in sows. The antibody positive rates in fall, winter, spring, and summer were 29.41%, 34.29%, 50.00%, and 47.22%, respectively (Table 2).

The highest seroprevalence of SIV H1N1 antibody according to season was observed in spring. The seroprevalence of SIV H1N1 antibody according to herd size was not significant differences ($x2 = 3.32$, df = 2, $p = 0.190$).

Table 2. Antibody rates of swine influenza virus subtype H1N1 according to season in Korea

Season	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Fall	170	50 (29.41)	120 (70.59)
Winter	105	36 (34.29)	69 (65.71)
Spring	118	59 (50.00)	59 (50.00)
Summer	108	51 (47.22)	57 (52.78)
Total	501	196 (39.12)	305 (60.88)

($x^2 = 16.6$, df = 3, $p < 0.01$)

Antibodies to PRRSV were found in 61.48% of the samples tested. The percentage of seropositive in suckling piglets, weaned piglets, growing pigs, finishing pigs, and sows were 45.28, 53.18, 83.33, 78.00, and 55.28, respectively (Table 3).

Table 3. Seroprevalence of porcine reproductive and respiratory syndrome virus according to age of pig in Korea

Age	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Suckling piglets	53	24 (45.28)	29 (54.72)
Weaned piglets	173	92 (53.18)	81 (46.82)
Growing pigs	102	85 (83.33)	17 (16.67)
Finishing pigs	50	39 (78.00)	11 (22.00)
Sows	123	68 (55.28)	55 (44.72)
Total	501	308 (61.48)	193 (38.52)

($x^2 = 39.2$, df = 4, $p < 0.01$)

The prevalence of PRRSV antibody according to age of pig was the highest in growing pigs. The antibody positive

rates in fall, winter, spring, and summer were 59.41%, 67.62%, 77.12%, and 41.67%, respectively (Table 4).

The highest seroprevalence of PRRSV antibody according to season was observed in spring. The results of antibody prevalence according to herd size were 51.28%, 74.77%, and 51.18% for ≤ 1,000, 1,001-2,000, and ≥ 2,001, respectively (Table 5). A peak of seropositivity for PRRSV antibody according to herd size appeared in 1,001-2,000.

Dual antibodies to SIV H1N1 and PRRSV were found in 25.95% of the samples tested. The percentage of seropositive in suckling piglets, weaned piglets, growing pigs, finishing pigs, and sows were 20.75, 9.83, 32.35, 34.00, 42.28, respectively (Table 6).

Table 4. Seroprevalence of porcine reproductive and respiratory syndrome virus according to season in Korea

Season	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Fall	170	101 (59.41)	69 (40.59)
Winter	105	71 (67.62)	34 (32.38)
Spring	118	91 (77.12)	27 (22.88)
Summer	108	45 (41.67)	63 (58.33)
Total	501	308 (61.48)	193 (38.52)

(x^2 = 32.0, df = 3, p <0.01)

Dual antibody prevalence of SIV H1N1 and PRRSV according to age of pig was the highest in sows. Dual antibody positive rates in fall, winter, spring, summer were 20.00%, 20.95%, 43.22%, and 21.30%, respectively (Table 7). Dual antibody prevalence of SIV H1N1 and PRRSV according to season was the highest in spring. The results of dual antibody prevalence according to herd size were 18.59%, 31.65%, and 25.20% for ≤ 1,000, 1,001-2,000, ≥ 2,001, respectively (Table 8). Dual antibody prevalence of SIV H1N1 and PRRSV according to herd size was the highest in 1,001-2,000.

Table 5. Seroprevalence of porcine reproductive and respiratory syndrome virus according to herd size in Korea

Herd size	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
≤ 1000	156	80 (51.28)	76 (48.72)
1001-2000	218	163 (74.77)	55 (25.23)
≥ 2001	127	65 (51.18)	62(48.82)
Total	501	308 (61.48)	193 (38.52)

(x^2 = 28.8, df = 2, p<0.01)

Table 6. Dual seropositiveness of swine influenza virus subtype H1N1 and porcine reproductive and respiratory syndrome virus according to age of pig in Korea

Ages	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Suckling piglets	53	11 (20.75)	42 (79.25)
Weaned piglets	173	17 (9.83)	156 (90.17)
Growing pigs	102	33 (32.35)	69 (67.65)
Finishing pigs	50	17 (34.00)	33 (66.00)
Sows	123	52 (42.28)	71 (57.72)
Total	501	130 (25.95)	371 (74.05)

Discussion

The SIV H1N1 and PRRSV infection in pigs were investigated by ELISA. Of the

501 sera tested, 39.12% had antibody to SIV H1N1. No commercial or autogenous vaccine against SIV is available in Korea.

Table 7. Dual seropositiveness of swine influenza virus subtype H1N1 and porcine reproductive and respiratory syndrome virus according to season in Korea

Season	Number of samples	Results of ELISA	
		Positive(%)	Negative(%)
Fall	170	34 (20.00)	136(80.00)
Winter	105	22 (20.95)	83 (79.05)
Spring	118	51 (43.22)	67 (56.78)
Summer	108	23 (21.30)	85 (78.70)
Total	501	130 (25.95)	371 (74.05)

Table 8. Dual seropositiveness of swine influenza virus subtype H1N1 and porcine reproductive and respiratory syndrome virus according to herd size in Korea

Herd size	Number of samples	Results of ELISA	
		Positive (%)	Negative (%)
≤ 1000	156	29 (18.59)	127 (81.41)
1001-2000	218	69 (31.65)	149 (68.35)
≥ 2001	127	32 (25.20)	95 (74.80)
Total	501	130 (25.95)	371 (74.05)

So it can be assumed that positivity of SIV antibody was due to natural infection. Seroconversion to SIV H1N1 occurred mainly in the growing pigs. Similar studies, performed by Olsen et al[9] in the north central United States from September 1997 through August 1998, reported that the seroprevalence of SIV H1N1 was 27.7%. In Spain rather similar prevalence of seropositivity (30.6%) have been found in finishing pigs[10]. In Korea, previously performed by Lyoo and Kim from May 1996 to April 1997, reported that the seroprevalence of SIV H1N1 was 35%[11].

A total of 308 pigs (61.48%) were seropositive to PRRSV. The antibody prevalence of PRRSV has increased since 1993[7, 12-16]. The highest prevalence of PRRSV according to the age of pig and season was detected in growing pigs (83.33%) and spring (77.12%). The results are similar to the previous serologic study[13]. Seroconversion to PRRSV occurred mainly in the growing pigs. Neither commercial nor autogenous vaccine against PRRSV was available at the time of the survey, therefore it can be assumed that positivity of PRRSV antibody was due to natural infection. The results showed the nearly complete spread of PRRSV across Korea.

The SIV and PRRSV can act as primary pathogens in the porcine respiratory disease complex[17, 18]. Dual infection of pigs with PRRSV and SIV causes more severe disease and growth retardation than single PRRSV or SIV infection[19]. The presence of dual antibodies against SIV H1N1 and PRRSV was detected. Dual infections with SIV and PRRSV seems to cause severe respiratory disease.

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