

SEROPREVALENCE OF HEPATITIS E VIRUS (HEV) IN DOMESTIC NON-COMMERCIAL PIGS REARED IN SMALL- SCALE FARMS AND WILD BOAR IN SOUTH OF BRAZIL

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Abstract

Hepatitis E is a zoonotic emerging disease distributed worldwide. The domestic swine and wild boars (*Sus scrofa*) are known as important reservoirs of HEV although HEV infections have been detected in other animal species. The southern region of Brazil has the largest swine productions in the country, ranging from highly-specialized commercial swine productions to small-scale non-commercial pig farms. The small-scale farms allow interactions between wild boars and domestic pigs, when occasionally pathogens transmission can occur between these populations. The aim of this study was to determine HEV seroprevalence in non-commercial domestic pigs and wild boars from two southern Brazilian states (RS: Rio Grande do Sul; SC: Santa Catarina), and discuss if the consumption of raw or undercooked meat from these animals is a potential risk to public health. Animals from RS and SC States were sampled. Serum was harvested from wild boar hunted between 2012 and 2016, and from non-commercial small-scale pig farms in 2014. Overall 249 wild boars (56 from RS and 193 from SC) and 382 pigs (261 from RS and 121 from SC) were tested to detect anti-HEV IgG antibodies using a commercial HEV antibody ELISA kit (Thermo fisher), specific for swine. Overall difference was observed ($P < 0.0001$) regarding HEV seroprevalence between wild boar 4.42% ($n=249$) and non-commercial domestic pigs 46.60% ($n=382$). In relation to wild boars samples, higher seroprevalence for Hepatitis E was observed in RS (14.29%; $n=56$) and lower in SC (1.55%; $n=193$; $P < 0.0004$). In relation to pigs, RS had also higher seroprevalence (53.26%; $n=261$) than SC (32.23%; $n=121$; $P < 0.0002$). Although interactions between wild boar and non-commercial domestic pigs are known to occur, the lowest antibody detection in wild boar suggest that these contact may not be sufficient to explain seroprevalence in studied populations. Our results indicate that non-commercial pigs are a more likely source of infection for the human population than wild boar.

Introduction

Hepatitis E is a zoonotic emerging disease distributed worldwide. The domestic swine (*Sus scrofa domestica*) and wild boars (*Sus scrofa scrofa*) are known to be an important reservoirs of HEV although infections have been detected in other animal species.

The southern region of Brazil has largest swine productions in the country, ranging from highly specialized commercial swine productions to small-scale non-commercial pig farms. Non-commercial pig farms are intended for subsistence food for

low-income households, where animals are slaughtered under precarious conditions, handled and consumed, often without the minimum safety care.

On the other hand, currently wild boar populations are present in all five Brazilian political regions, with the major concentration on the South and Southeast, where estimations of population density ranges from 0.22 to 22.3 individuals km⁻². Despite the increasing dispersion and density of this exotic invasive specie in several regions of the country, little is known about the health condition and the risks these animals pose to public health. Since the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) authorized population control (NI 03/2013) by hunters legally authorized, the collaboration of hunters allowed to access biological samples of wild boar populations for epidemiological studies. Then, recently the health monitoring became part of ongoing surveillance performed with collaboration of volunteers hunters legally authorized to kill wild boar for population control purposes.

The fragility of the facilities of small-scale pig farms often allow interactions between wild boars and domestic pigs, when occasionally pathogens transmission can occur between these populations. Though no study directly related HEV prevalence in pig farms to contact with wild boars, they may play a potential role in the swine HEV epidemiology in free-ranged pig production units. In our knowledge, to date, no study have been performed to evaluate the occurrence of HEV antibodies in non-commercial pigs reared in small-scale farms and free living wild boar from Santa Catarina and Rio Grande do Sul States, which could be a source for human infection.

The aim of this study was determine HEV seroprevalence in non-commercial domestic pigs and wild boars from two southern Brazilian states considering the potential risk to public health by consumption of their raw or undercooked meat and meat products.

Material and methods

Considering logistical limitations to access samples from target populations the serological study based on convenience sampling were performed.

Wild boar sampling

Blood samples were collect immediately after hunting by puncture in the cavernous sinus or heart, by exsanguination (cervical major veins) or from the thoracic cavity. Following, samples were placed in sterile tubes transported in cooler box to the laboratory for centrifugation, and stored at -20 ° C for serological analysis. Overall 249 wild boar samples, 56 from Rio Grande do Sul State (RS) and 193 from Santa Catarina State (SC) were obtained.

Since wild boar were killed for population control purposes, according Brazilian Agency for Environmental Protection (IN 03/2013 – IBAMA), no ethical approval was needed.

Domestic pig sampling

Serum samples from non-commercial pig farms previously harvested in 2014 on the context of official surveillance program to substantiate freedom from classical swine fever (CSF) were used. From the serum bank, we select regions with presence of wild boar according survey performed by official veterinary service in 2014. From each

municipality with wild boar were selected up to three pig non-commercial farms and serum of up to three pigs/farm were randomly sampled. A total of 382 samples from domestic pigs were obtained, 261 from RS and 121 from SC. Overall, we sampled 30 and 87 municipalities and 53 and 131 small-scale pig farms in SC and RS, respectively (Figure 1).

HEV-specific antibodies (HEV-Ab) were detected by a commercially available ELISA (PrioCHECK_ HEV Ab porcine) specific for swine, according to the manufacturer instructions. For comparison of the prevalence between different groups, Fisher's exact test was applied. Differences were considered significant at $P \leq 0.05$.

Results and discussion

Overall there was a significant effect ($p < 0.01$) of population category on the HEV seroprevalence, being 4.42% for wild boars and 46.60% non-commercial pigs. Samples from RS presented higher seroprevalence for HEV, both in wild boars and pigs compared to SC, 14.29% versus 1.55% for wild boars and 53.26% versus 32.23% for pigs, respectively, differing significantly ($p \leq 0.05$) by Fisher's exact test (Table 1). There was no significant effect of gender within each population category evaluated. Although interactions between wild boar and non-commercial domestic pigs are known to occur, the lowest antibody detection in wild boar suggest that these contact may not be sufficient to explain seroprevalence of studied populations. The marketing and distribution of wild boar meat and meat products originated from the hunt is banned in Brazil but the consumption of boar meat from population control is a common practice among hunters and their families. Our study showed that HEV seroprevalence in domestic non-commercial pigs are as prevalent in SC and RS as in other countries (4). We also detected that HEV circulates in wild boar populations in low seroprevalence differing of some countries where wild boar plays roles as HEV reservoir. Since the sanitary status of wild population can indicate the environmental health, including sympatric livestock and wildlife, ecological factors should be considered to understand the HEV seroprevalence of wild boars. The wild boar samples from RS were collected in regions of fields with few crops and vegetation scarcity favoring their carnivorous habits. The consumption of carcasses from dead animals in the field, both wild and livestock, is a common alimentary habit of wild boar in RS. In contrast, SC wild boar sera were obtained predominantly in forest areas characterized by abundant fauna and flora, and with large plantations in the surroundings. These environmental conditions can influence alimentary habits of wild boar and consequently their exposition to pathogens such as HEV, which is known to be a multispecies virus. Our results suggest that non-commercial pigs can play a more important role as an HEV reservoir than wild boars, and that non-commercial pigs are a more likely source of infection for the human population. However, HEV is also present in wild boar populations and variations in prevalence may occur according to the natural characteristics of the regions where they live.

Conclusion

Our results suggest that non-commercial pigs can play a more important role as a HEV reservoir than wild boars. Our results suggest that the non-commercial pigs can play a more important role as a HEV reservoir than wild boars. The non-commercial pigs are a more likely source of infection for the human population but also the risk on the consumption of wild boar meat exist and cannot be neglected.

Table 1. HEV seroprevalence in domestic non-commercial pigs collected in 2014 and wild boar collected between 2012 and 2016 in Santa Catarina (SC) and Rio Grande Sul (RS).

Animal category	Number tested/ positive serum samples	Seroprevalence %	95% CI		Fisher's P-value
Total swine	382/178	46.60	41.6	51.6	<0.0001
Total wild boar	249/11	4.42	1.8	7.0	
SC domestic non-commercial pigs	121/39	32.23	23.9	40.6	0.0002
RS domestic non-commercial pigs	261/139	53.26	47.2	59.3	
SC Wild boar	193/3	1.55	0.0	3.3	0.0004
RS wild boar	56/8	14.29	5.0	23.5	

HEV – hepatitis E virus; CI – confidence interval.; SC – Santa Catarina State; RS – Rio Grande do Sul State

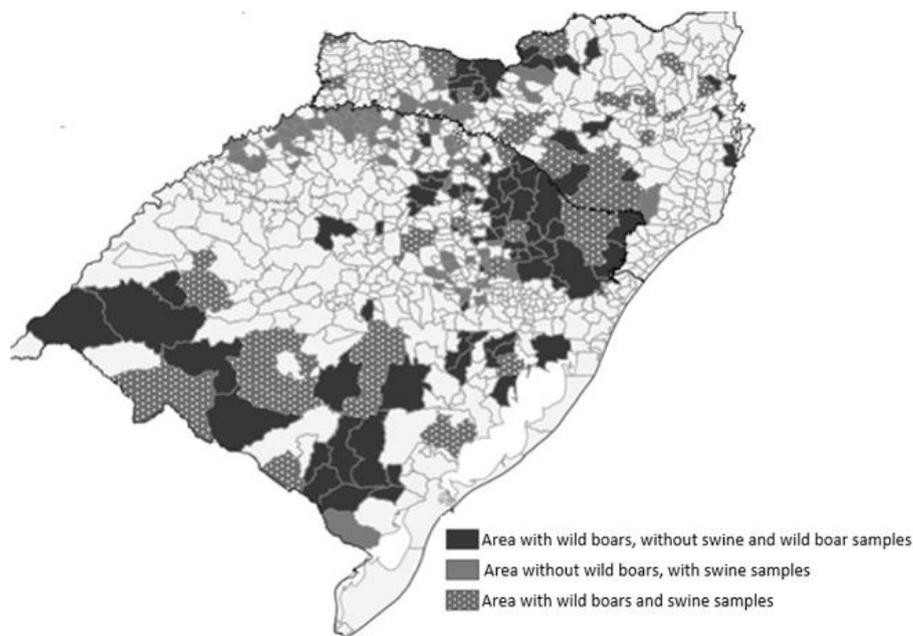


Figure 1. Distribution of municipalities with records of wild boar, and with or without swine serum samples.

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