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Hygiene and restraint of pigs is associated with absence of *Taenia solium* cysticercosis in a rural community of Mexico

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Vázquez-Flores S, Ballesteros-Rodea G, Flisser A, Schantz PM.
La higiene y el confinamiento de cerdos están asociados con la ausencia de cisticercosis por *Taenia solium* en una comunidad rural de México.
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Abstract

Objective. To determine the prevalence and risk factors associated to pig cysticercosis in a rural community of Veracruz, Mexico. **Material and Methods.** Swine cysticercosis was diagnosed by tongue palpation and circulating antibodies in pigs kept in 178 household backyards. Risk factors were assessed by interviewing owners to collect information on pig breeding conditions and demographic characteristics. **Results.** None of the 53 pigs studied showed cysts in the tongue, nor antibodies against *Taenia solium* in Western blot assays. Latrines were available in 91% of the houses and pigs were kept in restrained areas. **Conclusions.** The present study shows that pig breeding under restraint with basic hygiene and sanitary conditions, may be effective and practical interventions to restrain *Taenia solium* in rural communities. The English version of this paper is available too at: <http://www.insp.mx/salud/index.html>

Key words: cysticercosis; swine; risk factors; *Taenia solium*; Western Blotting; Mexico

Resumen

Objetivo. Determinar la prevalencia y factores de riesgo asociados con cisticercosis porcina en una población rural de Veracruz, México. **Material y métodos.** Se diagnosticó cisticercosis porcina por medio de palpación lingual y anticuerpos circulantes en cerdos de traspatio en 178 casas. Se analizaron los factores de riesgo mediante una encuesta a los dueños respecto a las condiciones de crianza de los cerdos y sus características demográficas. **Resultados.** Los 53 cerdos estudiados fueron negativos al metacástodo de *Taenia solium* por palpación lingual y para la presencia de anticuerpos contra este agente por inmunoelectrotransferencia. El 91% de las casas contaban con letrinas y los cerdos estaban confinados en zonas restringidas. **Conclusiones.** Este estudio muestra que el confinamiento de cerdos puede explicar la ausencia de *Taenia solium* en comunidades rurales, y sugiere que es factible y práctico establecer medidas de intervención. El texto completo en inglés de este artículo también está disponible en: <http://www.insp.mx/salud/index.html>

Palabras clave: cisticercosis; porcinos; factores de riesgo; *Taenia solium*; inmunoelectrotransferencia; México

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Cysticercosis due to *Taenia solium* is a parasitic disease typically associated with underdevelopment in communities with limited economic resources. In these communities, pigs are raised in primitive conditions. Moreover, people defecate outdoors, live in overcrowded households, and lack sanitary education and adequate environmental health conditions.^{1,2} Commonly, humans get infected with the intestinal tapeworm by ingesting it in the larval stage (cysticercus) in the meat of infected pigs. Both humans and pigs can develop cysticerci by ingesting eggs of the adult tapeworm via fecal contamination.³ *Taenia solium* infection has been studied intensely in Mexico,⁴ where education has been promoted as a control measure to decrease neurocysticercosis in rural communities. Prevention and control measures target the parasite cycle and include hygiene, health measures, avoidance of humans and pigs sharing the household, control of pig slaughtering, and the use of cestocidal drugs against taeniosis in humans.^{4,5} Studies in two rural communities in Mexico showed that the prevalence of cysticercosis in pigs examined by tongue palpation ranged from 1.2 to 2.6% and that anti-cysticercus antibodies were detected in 4.8 to 5.2%.^{6,7} The purpose of the present study was to determine infection rates of cysticercosis in the pig population of Coapeche, Veracruz. Detection methods were tongue palpation and Western blot assays. An additional objective was to identify risk factors that contribute to the presence of cysticercosis in the pig population.

Material and Methods

The rural community of Coapeche, Veracruz was selected to participate in a parasite surveillance study in the human population, conducted during the summer of 1997. All 178 households were visited, identifying a total of 88 pigs; each pig was identified by house number, along with a sequential number depending of the number of pigs per household. Swine older than 3 months of age, non-pregnant, non-lactating, and not bred recently, were examined by palpation of the tongue to identify cysticerci nodules, as described by González *et al.*⁸ Following examination, blood samples were obtained from the ear venules; blood samples were collected in individual filter papers, which were air dried, identified with the household number and the assigned pig number, and kept for future analysis. Risk factors were assessed by interviewing owners for pig breeding conditions, pig breeding within the household and demographic characteristics of pigs. Blood spot filter papers were

analyzed by Western blot for cysticercosis, as described previously.^{9,10}

Results

The whole pig population had a distribution by gender of 41% males; none of the 53 pigs examined by tongue palpation and Western blot gave positive results. The survey showed that 91% of the households had latrines and all pigs were kept in restrained areas. Also, questionnaire data confirmed that the whole community was aware of basic disease prevention measures such as boiling water, washing hands, disinfecting fresh fruits and vegetables for human consumption, and using drugs to control human and animal intestinal parasites. Tongue palpation and circulating antibodies have been shown to be useful for field studies, since both tests may be used to study risk factors for acquiring *Taenia solium* infections.^{4,6,8}

Discussion

Tongue palpation and circulating antibodies confirmed the absence of swine cysticercosis in Coapeche. Furthermore, during the present study, no *T. solium* eggs were detected in single stool exam for eggs and parasites in the human population of the community (unpublished data). Seroprevalence of cysticercosis in humans in the state of Veracruz was 0.53% in a national serological survey conducted in 1984¹. National notification of human diseases showed 187 and 251 cases of taeniosis and 14 and 30 of cysticercosis for 2000 and 1999, respectively, for the state of Veracruz.¹¹ Unfortunately, it was not possible to identify the communities where these cases were reported.

The lack of this parasitic infection in Coapeche may then be attributable to: 1) local regulations to keep pigs restrained, 2) latrines inside or outside all households, 3) awareness of personal hygiene and proper food preparation, 4) avoidance of ingestion of infected pork 5) rejection by local butchers of gaunt pigs or those with palpable cysticerci, and 6) awareness of the population that they should not defecate in the open. Nevertheless, while performing interviews, a child from one of the poorest areas of the community was observed to defecate near a herd of pigs. This situation highlights the importance of continuing enforcement of sanitary education. We believe that the risk of environmental contamination was low because most households were aware of the importance of avoiding outdoor defecation. Furthermore, a study performed in a community in Peru, where pigs used to tether in

rice fields, showed that by changing this practice, a dramatic decrease of swine cysticercosis occurred.¹² Probably the main message that has to be transmitted to field veterinary personnel and to community leaders, is that if pigs are kept confined without access to human feces and to garbage, they will not acquire cysticercosis, thus the price at which pigs can be sold in abattoirs and to pigs dealers will be higher than if the pigs have "pellets". A previous study showed a decrease down to 50% in the proportion of pigs that were allowed to run loose or have access to human feces, six months after an education intervention to control *T. solium* was delivered. As the authors state, perhaps these changes in pig breeding habits result from their importance as an economic resource.⁶ In summary, this study shows that restraint of pigs and basic hygiene and sanitary conditions may account for the absence of *Taenia solium* in rural communities and may suggest effective and practical intervention measures.

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