

Letter to Editors

Shedding light on neurocysticercosis misinformation in the media

P. M. ALARCÓN-ELBAL*, A. CAZZANIGA, A. E. AHUIR-BARAJA, M. GARIJO TOLEDO

Department of Animal Production and Health, Public Veterinary Health and Food Science and Technology, Faculty of Veterinary Medicine, Universidad Cardenal Herrera-CEU, CEU Universities, Calle Tirant lo Blanc 7, 45115 Alfara del Patriarca (Valencia), Spain,
*E-mail: pedro.alarconelbal@uchceu.es

Article info

Received April 26, 2024

Accepted July 22, 2024

Recent research, published in the American Journal of Case Reports, examined the case of a 52-year-old American man without a recent travel history exhibiting atypical migraine symptoms which ultimately led to a diagnosis of neurocysticercosis (NC) (Byrnes *et al.*, 2024). This neglected tropical disease is endemic in most countries in Asia, Sub-Saharan Africa, and Latin America, clearly linked to poor sanitation and hygiene practices, and free-range pig rearing, among other factors (Sciutto *et al.*, 2000). Additionally, it is included in the PAHO/WHO action plan for its elimination (PAHO/WHO, 2016).

The casual agent of NC is *Taenia solium* (Cestoda, Cyclophyllidea, Taeniidae). This parasite's larvae migrates through the bloodstream of the human body, which is an accidental host, and eventually reaches the brain. However, it is also known to affect the eyes, liver, muscles, lungs, and kidneys, among other organs (CSPH *et al.*, 2020). NC is a severe illness frequently associated with epilepsy, headaches, cognitive deficits, and stands as a leading cause of death among food-borne diseases (Havelaar *et al.*, 2015). Given that the United States is not considered an endemic country, the story garnered worldwide attention from various digital media outlets. However, many of these reports have been characterized by a notable lack of scientific rigor, incorrectly attributing the condition to the consumption of undercooked pork.

Understanding the parasite's life cycle is crucial to contextualize the situation. Taeniosis occurs when individuals consume undercooked pork containing embedded larval cysts, known as cysticer-

cus, which develop into adult tapeworms in the human small intestine. This presentation typically does not cause severe illness but can lead to occasional symptoms such as nausea, vomiting, loss of appetite, and weight loss. However, harbouring a single *T. solium* tapeworm poses a significant health risk, as humans may develop cysticercosis by ingesting *T. solium* eggs, typically transmitted through poor hygiene practices resulting in fecal-oral transmission (Nash *et al.*, 2013). This can occur either by touching the hands of a carrier of the adult form with poor personal hygiene, or by consuming vegetables, fruits, or water contaminated by *T. solium* eggs. Additionally, pigs may ingest these eggs, which then develop into larvae, subsequently forming oncospheres, and eventually maturing into infective tapeworm cysts in their muscle (Fig. 1). The most common places to find these cysts are the psoas, masseters, triceps, tongue, diaphragm, and heart (Boa *et al.*, 2002).

Byrnes *et al.* (2024) speculated on the possibility of the patient contracting NC through autoinfection due to improper handwashing after acquiring taeniosis from his eating habits. However, it should be noted that this is merely a hypothesis by the authors, who did not conclusively diagnose taeniosis in the patient. Furthermore, contracting the adult form of *T. solium* through pork consumption is limited to regions with inadequate sanitation measures, predominantly found in rural communities within endemic areas. Here, pigs are often raised close to households for self-consumption, without any veterinary control. Misinterpretation of information has caused the media to erroneously associate NC with the consumption of

* – corresponding author

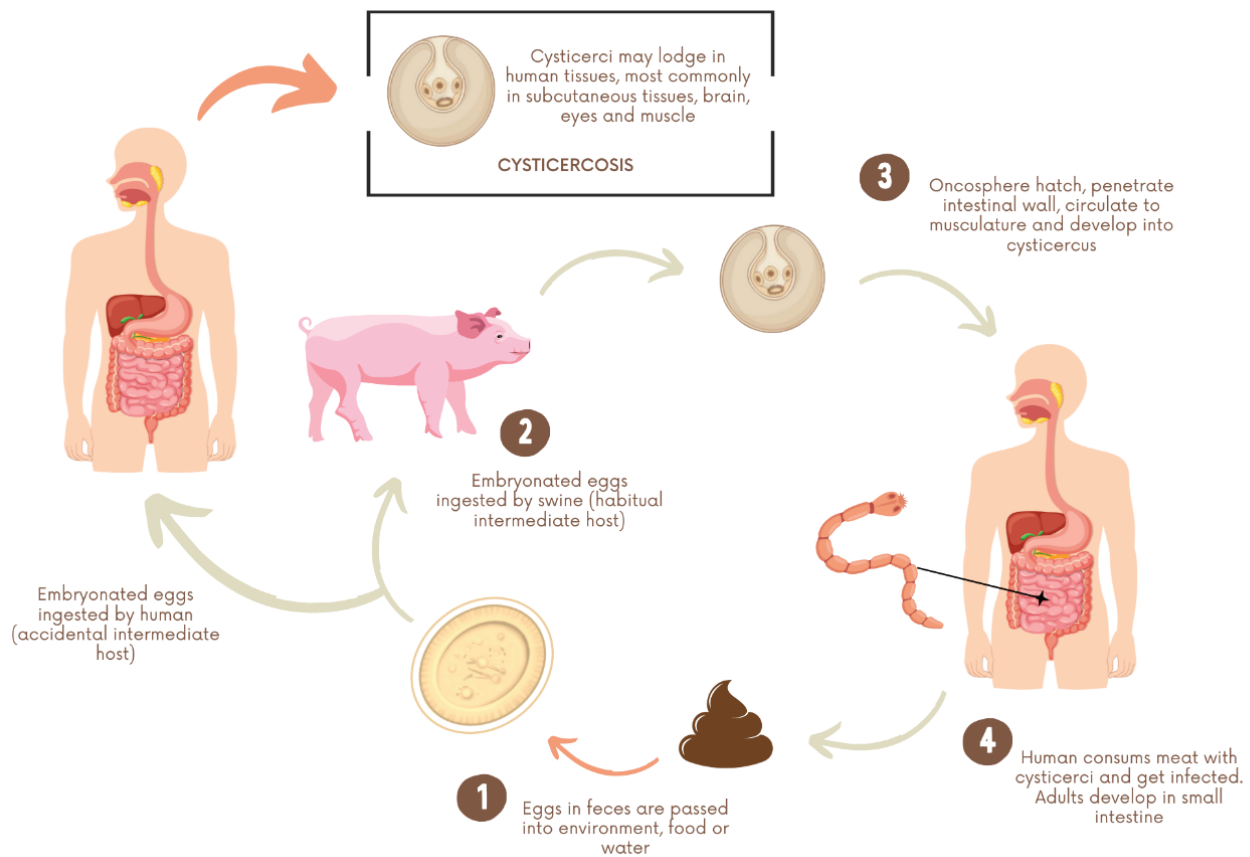


Fig. 1. *Taenia solium* life cycle.

undercooked pork, as evidenced by several headlines in digital press platforms from various countries. Recent media coverage has showcased scientific publications concerning this disease, exemplified by the fatal case of an 18-year-old Indian male diagnosed with disseminated cysticercosis, presenting numerous well-defined cystic lesions in the brain (Dev & Abbas, 2019). This case attracted substantial media attention, with most outlets once again attributing the cause of the infection to pork consumption in their headlines. Some examples of the news that inaccurately echoed these case reports are displayed in Table 1.

Such cases are likely rooted in the viral dissemination of digital misinformation, a phenomenon in which media outlets propagate or amplify stories without conducting fact-checking or verification, merely echoing the narrative of the original source. Media coverage of medical issues sometimes introduces fake news driven by ignorance or sensationalism, as previously addressed by García and Del Brutto (2020) concerning other cases associated with NC. Humans navigate the world through a collective process of gathering, filtering, and disseminating information. The integrity of this process is crucial, as misinformation can have far-reaching

consequences (West & Bergstrom, 2021), including in the realm of Global Health. The dissemination of inaccurate information regarding the detrimental health effects of consuming pork can also precipitate significant economic ramifications within the swine industry. Such misinformation may instigate consumer reluctance towards pork consumption, leading to decreased demand and subsequently impacting swine producers' revenue streams. Thus, the dissemination of accurate, clear, and well-contextualized information is vital to empower individuals against the spread of serious diseases like NC.

Finally, effective prevention can be achieved through targeted hygiene practices, including consistent handwashing, and ensuring raw vegetables and fruits are washed with potable water. Additionally, to prevent taeniosis in high-risk areas, it is recommended to cook whole cuts of meat to a minimum internal temperature of 145 °F (63 °C), and ground meats to 160 °F (71 °C), following CDC (2013) guidelines. Also, freezing pork at 39 °F (4 °C) for more than 1 month, or at -4 °F (-20 °C) for 1 – 3 days, is an effective measure to kill cysticerci (Sotelo *et al.*, 1986).

Table 1. Some examples of sensationalism news about different *T. solium* case reports in different countries.

Byrnes et al. 2024	Neurocysticercosis Presenting as Migraine in the United States
Date of publication	10/03/2024
Media	Le Parisien
Country	France
Headline	“Des vers retrouvés dans le cerveau d’un homme qui avait mangé du bacon mal cuit”
Link	https://www.leparisien.fr/faits-divers/des-vers-retrouves-dans-le-cerveau-dun-homme-en-floride-apres-quil-a-mange-du-bacon-mal-cuit-10-03-2024-YRV7SQHGYBGOLJ56KC23D7IMYI.php
Date of publication	10/03/2024
Media	The National Desk (TND)
Country	USA
Headline	“Doctors discover man suffering from chronic migraines had worm eggs in his brain”
Link	https://thenationaldesk.com/news/americas-news-now/doctors-discover-man-suffering-from-chronic-migraines-had-worm-eggs-in-his-brain-tapeworm-cyst-neurocysticercosis-bacon-pork-hospital-doctor-health-wellness-ct-mri-tests-swelling
Date of publication	12/03/2024
Media	NBC News
Country	USA
Headline	“Man finds out migraines caused by tapeworms; undercooked bacon may be culprit”
Link	https://www.nbcnews.com/news/us-news/man-finds-migraines-caused-brain-tapeworms-undercooked-bacon-may-culpr-rcna143011
Date of publication	13/03/2024
Media	The Guardian
Country	UK
Headline	“Tapeworms found in brain of US man who ate undercooked bacon”
Link	https://www.theguardian.com/us-news/2024/mar/13/brain-tapeworms-undercooked-bacon
Date of publication	14/03/2024
Media	El Mundo
Country	Spain
Headline	“Hallan Tenia en el cerebro de un estadounidense que comió tocino poco hecho”
Link	https://www.elmundo.es/ciencia-y-salud/2024/03/14/65f2a14a21efa05e448b4591.html
Date of publication	14/03/2024
Media	TVI Notícias
Country	Portugal
Headline	“Este homem sofria de enxaquecas horríveis. Tinha larvas de tênia no cérebro. A causa? Bacon mal passado”
Link	https://tvi.iol.pt/noticias/dores-de-cabeca/enxaquecas/este-homem-sofria-de-enxaquecas-horriveis-tinha-larvas-de-tenia-no-cerebro-a-causa-bacon-mal-passado/20240314/65f30f9dd34e87e0c08abb2f

Date of publication	15/03/2024
Media	News9Live
Country	India
Headline	"Bacon lovers, beware! Man complains of excruciating migraine pain after eating uncooked pork"
Link	https://www.news9live.com/health/health-news/bacon-lovers-beware-man-complains-of-excruciating-migraine-pain-after-eating-uncooked-pork-2465479
Date of publication	16/03/2024
Media	Corriere della Sera
Country	Italy
Headline	"Mal di testa causato da larve di verme solitario nel cervello: forse dopo aver mangiato pancetta poco cotta"
Link	https://www.corriere.it/salute/24_marzo_16/mal-di-testa-larve-verme-solitario-nel-cervello-ee32ee06-72d3-44ab-9767-db43645c7xlk.shtml
Dev & Abbas 2019	Disseminated Cysticercosis
Date of publication	28/03/2019
Media	Correio da Manhã
Country	Portugal
Headline	"Jovem morre com larvas acumuladas no cérebro por comer porco mal cozinhado"
Link	https://www.cmjornal.pt/mundo/detalhe/jovem-morre-com-larvas-acumuladas-no-cerebro-por-comer-porco-mal-cozinhada
Date of publication	28/03/2019
Media	New York Post
Country	USA
Headline	"Teen dies after brain infection from eating undercooked pork"
Link	https://nypost.com/2019/03/28/teen-dies-after-brain-infection-from-eating-undercooked-pork/
Date of publication	28/03/2019
Media	TN
Country	Argentina
Headline	"Comió carne de cerdo cruda y su cerebro se llenó de gusanos que le causaron la muerte"
Link	https://tn.com.ar/salud/familia/2019/03/28/comio-carne-de-cerdo-cruda-y-su-cerebro-se-lleno-de-gusanos-que-le-causaron-la-muerte/
Date of publication	28/03/2019
Media	Daily Mail
Country	UK
Headline	"How eating under cooked pork can kill you by invading your brain: Neural scans of 'white spots' reveal how teenager, 18, died when parasitic larvae built-up in his central nervous system and triggered deadly seizures"
Link	https://www.dailymail.co.uk/health/article-6859681/Man-18-dies-eating-undercooked-pork-caused-parasitic-larvae-invade-BRAIN.html

Date of publication	29/03/2019
Media	Il Giornale
Country	Italy
Headline	"India, mangia carne di maiale poco cotta: 18enne ucciso dalla tenia"
Link	https://www.ilgiornale.it/news/mondo/india-mangia-carne-maiale-poco-cotta-18enne-ucciso-tenia-1670578.html
Date of publication	29/03/2019
Media	Doctissimo
Country	France
Headline	"Un jeune indien meurt d'une infestation de larves de ténia dan son cervau"
Link	https://www.doctissimo.fr/sante/news/manger-porc-mal-cuit-mort
Date of publication	30/03/2019
Media	El Comercio
Country	Spain
Headline	"Muere por un afectación de larvas en el cerebro tras comer carne cruda"
Link	https://www.elcomercio.es/sociedad/muere-joven-afectacion-larvas-cerebro-carne-cruda-20190330063538-nt.html
Date of publication	01/04/2019
Media	Sky News
Country	UK
Headline	"Man, 18, dies from tapeworm larvae in his brain after eating pork"
Link	https://news.sky.com/story/man-18-dies-from-tapeworm-larvae-in-his-brain-after-eating-pork-11681211

Conflict of Interest

The authors have no conflicts of interest to declare.

Disclosure

The opinions expressed in this manuscript are the responsibility of the authors and do not necessarily reflect the criteria or policy of Helminthologia.

References

- BOA, M.E., KASSUKU, A.A., WILLINGHAM, A.L., 3RD, KEYYU, J.D., PHIRI, I.K., NANSEN, P. (2002): Distribution and density of cysticerci of *Taenia solium* by muscle groups and organs in naturally infected local finished pigs in Tanzania. *Vet Parasitol*, 106(2): 155 – 164. DOI: 10.1016/s0304-4017(02)00037-7
- BYRNES, E., SHAW, B., SHAW, R., MADRUGA, M., CARLAN, S.J. (2024): Neurocysticercosis Presenting as Migraine in the United States. *Am J Case Rep*, 25: e943133. DOI: 10.12659/AJCR.943133
- CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC) (2013): Parasites - Taeniasis. Retrieved March 24, 2024, from <https://www.cdc.gov/parasites/taeniasis/prevent.html>.
- DEV, N., ABBAS, S.Z. (2019): Disseminated Cysticercosis. *N Engl J Med*, 380(13): 1267. DOI: 10.1056/NEJM1810953
- GARCÍA, H.H., DEL BRUTTO, O.H. (2020): Fake news in neglected tropical diseases: The case of neurocysticercosis. *PLoS Negl Trop Dis*, 14(6):e0008208. DOI: 10.1371/journal.pntd.0008208
- HAVELAAR, A.H., KIRK, M.D., TORGERSON, P.R., GIBB, H.J., HALD, T., LAKE, R.J., PRAET, N., BELLINGER, D.C., DE SILVA, N.R., GARGOURI, N., SPEYBROECK, N., CAWTHORNE, A., MATHERS, C., STEIN, C., ANGULO, F.J., DEVLEESSCHAUWER, B. (2015): World Health Organization Foodborne Disease Burden Epidemiology Reference Group. World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. *PLoS Med*, 12(12): e1001923. DOI: 10.1371/journal.pmed.1001923
- NASH, T.E., MAHANTY, S., GARCIA, H.H. (2013): Neurocysticercosis-more than a neglected disease. *PLoS Negl Trop Dis*, 7(4): e1964. DOI: 10.1371/journal.pntd.0001964
- PAN AMERICAN HEALTH ORGANIZATION / WORLD HEALTH ORGANIZATION (PAHO/WHO) (2016): Plan of Action for the elimination of Neglected Infectious Diseases and Post-Elimination actions 2016 – 2022. In *55 th Directing Council; 68th Session of the regional committee of WHO for the Americas*. Washington, D.C., USA, September.

- ber 26 – 30, 2016. Retrieved March 24, 2024 from: <https://iris.paho.org/bitstream/handle/10665.2/31439/CD55-R9-e.pdf?sequence=1&isAllowed=y>.
- SCIUTTO, E., FRAGOSO, G., FLEURY, A., LACLETTE, J.P., SOTELO, J., ALUJA, A., VARGAS, L., LARRALDE, C. (2000): *Taenia solium* disease in humans and pigs: an ancient parasitosis disease rooted in developing countries and emerging as a major health problem of global dimensions. *Microbes Infect*, 2(15): 1875 – 1890. DOI: 10.1016/s1286-4579(00)01336-8
- SOTELO, J., ROSAS, N., PALENCIA, G. (1986): Freezing of infested pork muscle kills cysticerci. *JAMA*, 256(7): 893 – 894
- THE CENTER FOR FOOD SECURITY & PUBLIC HEALTH (CFSPH) (2020): Taeniasis, Cysticercosis and Coenurosis. Retrieved April 6, 2024 from <https://www.cfsph.iastate.edu/Factsheets/pdfs/taenia.pdf>
- WEST, J.D., BERGSTROM, C.T. (2021): Misinformation in and about science. *Proc Natl Acad Sci U S A*, 118(15): e1912444117. DOI: 10.1073/pnas.1912444117