Original Article

ECO-EPIDEMIOLOGICAL ASPECTS OF TRICHINOSIS IN A POPULATION OF CORRIENTES, ARGENTINA, AFFECTED BY OUTBREAK

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ABSTRACT
Trichinosis is a parasitic disease, produced by a Nematode of the genus Trichinella; It is a zoonosis that man can acquire after ingesting cold cuts, sausages or raw or insufficiently cooked meat products, coming from animals infected with viable encysted larvae. Our objective has been to describe the knowledge about Trichinosis in a post-outbreak population to know its epidemiological profile and propose control measures.

KEY WORDS: trichinosis epidemiology.

INTRODUCTION

Trichinosis is a parasitic disease, produced by a Nematode of the genus Trichinella;

It is a zoonosis that man can acquire after the ingestion of cold cuts, sausages or products raw or undercooked meat from animals infected with viable cystic larvae, mainly pig and wild boar and also large predators such as the puma.

After the ingestion of the contaminated food, through the digestion process the larvae in the small intestine, which evolve to an adult stage, differentiating into male and female.

After copulation, the gravid female releases the larvae into the circulatory system and then they migrate to the striated muscle, preferably those of high activity and great energy reserve to encyst forming the infectious stage when the cycle continues.

Thus, this parasite lodges and lives in muscles in rodents, pigs, wild animals and, accidentally, in humans.

The larvae, after entering the muscle fibers, in their process of encystment, induce changes such as the development of an insulating and protective capsule, forming a protective barrier of the immunological response of the host and of the therapeutic compounds. **(1) (2)**

There are 13 genotypes in the genus Trichinella, which are identified and differentiated by biochemical, morphological and molecular methods, 10 of them recognized at the species level (T. spiralis, T. nativa, T. britovi, T. pseudospiralis, T. murrelli, T. nelsoni, T. papuae, T. zimbabwensis, T. patagoniensis, T. chanchalensis), and 3 genotypes (Trichinella T6, Trichinella T8, and Trichinella T9) awaiting taxonomic definition.

The most prevalent human infection is caused by the spiralis strain, which has extensive worldwide distribution, constituting a public health problem in Southern Countries like Argentina, Chile and Uruguay, where trichinosis is endemic and evolves with sporadic epidemic Outbreaks.

The same occurs in European countries such as France, Italy, Belgium, Poland, Spain; however its prevalence is higher in developing nations, where socio-economic and poor sanitary conditions, together with environmental factors favor its transmission, as is the case in Latin America. **(1) (2) (3) (4)**

The **"domestic"** and " **wild** " **cycles** of the parasite have been clearly recognized , in terms of Their form of transmission and perpetuity.

Between the two is the "synanthropic" cycle of all identified species, only T spiralis remains and is transmitted in the "domestic cycle" of the disease although it can be present in wild animals. The rest of the genotypes are conserved and transmitted in the "Wild cycle" and can occasionally be identified in domestic animals.

The **domestic cycle** occurs due to improper feeding practices for animals, provision of meat residues from undercooked pigs and transmission through synanthropic animals living near pigs (like rats, weasels).

The **selvatic** or wild **cycle** occurs in nature between animals of habit carnivores and Scavengers.

In temperate zones, like Argentina, it is linked to wild boars, foxes, felines and others omnivorous and / or scavenger animals.

The synanthropic cycle intertwines the first two cycles since it is associated with animals that live near the human environment, mainly cats, dogs, rodents and animals that have expanded their ecological niche such as foxes.

The clinical picture has an incubation period that ranges from the moment of ingestion of the infected meat until the first symptoms appear and that lasts approximately 3 to 45 days.

It can manifest from an asymptomatic infection to a fulminant and fatal disease, depending on the number of larvae ingested and the immune status of the host.

Among the most common ones are diarrhea, fever, eyelid edema, conjunctivitis and muscle aches and ABS. Complications involve the central nervous system and the heart. The abdominal symptoms such as severe gastrointestinal pain, nausea, vomiting and diarrhea usually appear one or two weeks after eating the infected meat.

In severe cases, problems of concern may occur, such as motor coordination disorders, as well as cardiac and respiratory disorders. **(5)**

In the world, human cases have been reported in 55 (27.8%) countries, in domestic animals in 43 countries, and in 66 countries it was detected in wild animals.

They have also been registered since 1986.

Until 2009, 65,818 cases and 42 deaths from trichinosis were reported in 41 countries.
Asian countries have reported few outbreaks during this period, most of these occurring in China.
During the period from 1990 to 1999, the European Union registered the highest number of cases, 86% of the total (56,912), of which 50% happened in Romania.
This is followed by the Region of the Americas, with 7,179 reported cases, which represents 10.9% of the total.
Of this total, 5,221 cases (72%) have been registered in Argentina, in the period spanning from 1990 to 2005, the majority (89%) in the center of the country.
Trichinosis is a notifiable event, and during the period from 2014 to 2018, 5,211 cases were reported to the SNVS in Argentina with a greater distribution of outbreaks of Trichinosis in the province of Buenos Aires, originating mostly from domestic pigs.
The references indicate that 90% of the casuistry occurs in 5 provinces of the country, but it should be noted that Neuquén contributes a high proportion of wild cases.
In this period, SENASA reports that 26% of the positive diagnoses were obtained in samples of domestic animals from household chores and only 17% of diagnoses in wild species (wild boars, bighorn pigs and pumas).
The increase in human cases related to the consumption of pig meat in some provinces bordering Corrientes, in others with endemic behavior such as Santa Fe and Entre Ríos, with isolated outbreaks such as the province of Chaco and the appearance of outbreaks in cities on the coast of the Paraná river, in the Province of Santa Fe and Entre Ríos.
Trade of food from reporting areas such as the Province of Córdoba, in large quantities, oblige us to adopt measures to know the situational profile of Trichinosis in this region of the country.
The **descriptive studies** are oriented primarily to describe a health event, estimate the frequency referred to the attributes of person, place and time, describe the behavior and trend of the same and generate etiological hypotheses.
It may involve one-time interaction with groups of people (cross-sectional study) or you can follow some individuals throughout the time (longitudinal study).
Descriptive studies in which the researcher interacts with the participant may involve surveys or interviews to collect the necessary information.
This is how a descriptive study represents an accessible and simple way to establish a diagnosis of the situation from the information obtained from the intervention with the community.
In these studies we use probabilistic sampling (when the subjects are randomly selected and The researcher knows the probability of selection of each member of the population) **(9) (10)**
The **survey** is a systematic search for information in which the researcher asks the investigated subjects about the data you want to obtain, and then collects this individual data to obtain, aggregated data during the evaluation.

TABLE 1: DISTRIBUTION OF FAMILIES AND COHABITING SUBJECTS THAT WERE SURVEYED

Evaluated families	Families	%	Co-habiting	%
Presence of Triquinosis cases	11	16,2	53	29,6
Without Triquinosis	57	83,8	126	70,4
Total	68	100,0	179	100,0

Information is obtained in a systematic and orderly manner on the variables involved in an investigation, and this on a determined population or sample; it is massively applicable and obtains information on a wide range of issues at the same time.
Unlike other techniques, all interviewees are asked the same questions, in the same order, and in a similar social situation; so that localized differences are attributable to differences among the people interviewed. The survey technique is widely used as a screening procedure.
research, since it generates information quickly and efficiently.
In the health field there are numerous researches using this technique, including a wide variety of subjects.
The anonymized data does not require informed consent to share or publish, but following ethical principles, it is always recommended to inform the participants of the use and
destination of the data. (11) (12)

ECO-EPIDEMIOLOGICAL ASPECTS OF TRICHINOSIS IN A POPULATION OF CORRIENTES, ARGENTINA, AFFECTED BY AN OUTBREAK.

The Province of Corrientes is located in the Northwest of the Argentine Republic, between two rivers: Uruguay (to the east) and Paraná (to the west and north), which constitute the natural borders of its territory.
It covers, approximately, the region that its ancient inhabitants, the Guaraníes, called Taragüí.
Politically it is organized into 25 departments with a total of 1,120,801 inhabitants. **(13) (14)**
The Public Health System of the Province of Corrientes, registered a case of Trichinosis in the Year 2012 in the southern region and also between epidemiological week 26 and week 35 of 2014 reported to the Comprehensive Health System of Argentina (SISA) an outbreak of Trichinosis with a total of 16 cases confirmed in the town of Santa Lucia, Department of Lavalle.
Santa Lucía is an Argentine city, head of the Lavalle department, in the province of Corrientes, located on the western bank of the Santa Lucía River, between this river and the Paraná River, 194 kilometers south of the provincial capital city, with 15,697 inhabitants reported by the Provincial Department of Statistics and Census
The town of Santa Lucía de los Astos was founded by order of Don Hernando Arias de Saavedra, known as Hernandarias, in 1615.
Land of horticulturists, its production is based on producing teas, peppers and vegetables, mainly. In this region, cultural activities are very frequent, tourism and sports where hunting is practiced massively, mainly for the control of exotic animals.
It is also a commercial transit region due to its location between cities with the greatest impact on the production and regional economy both via rock and water. **(13) (14)**
The elaboration and commercialization of artisanal sausages in this region of the province of Corrientes is a profitable option for producers who creatively apply different recipes using a wide variety of raw materials, exotic even in some cases that differentiates them and guarantees successful sales during socio-cultural events such as producer fairs.
The main artisan products made with pork that are marketed in the area are produced by means of drying, smoking or curing compounds.
The sausages, which are made introducing the raw material in an organic or synthetic cul-de-sac, they are the most elaborate and promotion in commercial and socio-cultural activities.
This work aims to investigate the knowledge of the population affected and unaffected by this zoonosis to contribute information to the knowledge of the Eco-Epidemiological profile of Trichinosis and finally propose adequate control measures for its control, as well as proposing the generation of activities to disseminate knowledge at different levels of intervention.

OBJECTIVE

Describe the knowledge about Trichinosis in a post-outbreak population to know its epidemic profile. Identify logical control measures.

MATERIALS AND METHODS

They were included in this study 176 inhabitants of the town of Santa Lucia, people older than 14 years of both sexes, cohabiting or not with the cases, who voluntarily agreed to
the survey.
For this, they were previously informed of the objectives and scope of the work, as well as they have been

presented with reports from health authorities and scientific publications, preserving their identity of the subjects according to the regulations and regulations in force. Surveys were completed collecting data anonymously, only identifying the age and sex of the same; the necessary data was collected without using personal information.

The research team Doctors from the Institute of Regional Medicine carried out the field survey during the following months outbreak, specifically 90 days after the end of the outbreak, through home visits to identify in relation to the reported cases confirmed by the outbreak.

A descriptive study was carried out through a clinical-epidemiological survey using as a data collection instrument, a descriptive survey with closed responses to statistically interpret the results and to avoid that the interviewee identifies with some alternative answer.

In order to gather information in family nuclei where they were presented and where they were not presented cases of Trichinosis, these residents were spontaneously visited.

For each family that presented at least one case of Triquinosiss, from 3 to 5 randomly designated neighboring families were included during the tour of the area.

For the survey design, the population universe was defined, the sampling criteria support staff were trained, the software for data processing and data processing was established.

Period in report-writing.

The survey was made up of a 30-question questionnaire.

The information collected in the surveys was directed:

a) to the consumption of artisanal sausages based on pork in the last 30 days; is considered 30 days the average incubation period of trichinosis, which can reach up to 45 days; also the food reminder has greater precision as the time interval is smaller

b) the consumption of sausages made with game; the artisanal sausages have as base composition of pork and but it is frequent the addition of game pieces in percentage that modifies the organoleptic characteristics giving originality to the sausage.

c) knowledge about Trichinosis as a Foodborne Disease.

d) the way of acquiring (commercial or non-commercial) and way of consuming these foods. (family or social).

e) to the variety of raw material for the elaboration (mixtures with other game pieces).

f) the origin of the complementary raw material (exclusive task to increase production or aggregate of pieces of house of domiciliary stock).

g) the type of sausage made from household items (dried, cured, smoked, precooked, etc).

h) the food reminder of having presented clinical signs and symptoms compatible with Trichinosis after the ingestion of sausages.

Communication was maintained with the health authorities during the development of data collection, to propose to apply the clinical algorithm for approaching Trichinosis cases immediately if the need arises from the information collected that generates a suspicious case according to definition of cases from the National Epidemiological Surveillance Manual.

RESULTS

176 people related to the epidemic outbreak of trichinosis that occurred in the locality were surveyed of Santa Lucia, which represents a total of 68 families where 11 (16.2%) of them were presented to the less one case of Trichinosis and in the remaining 57 (83.8%) there were no cases.

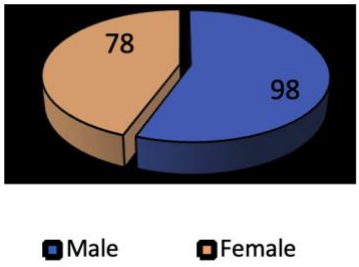
TABLE 1: DISTRIBUTION OF FAMILIES AND COHABITING SUBJECTS THAT WERE SURVEYED.

Evaluated families	Families	%	Co-habiting	%
Presence of Triquinosis cases	11	16,2	53	29,6
Without Triquinosis	57	83,8	126	70,4
Total	68	100,0	179	100,0

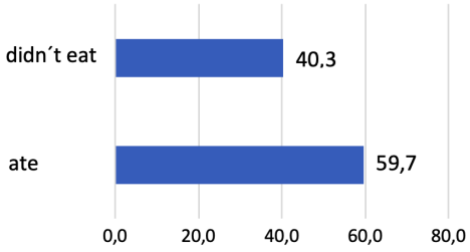
Of the total number of respondents, a male predominance was found with 55.7% (98 cohabiting) over the female with 44.3% (78 cohabiting). Figure 1.
In relation to the consumption of artisanal sausages based on pork in the last 30 days, 105 people who ingested (59.7%) and 71 who did not (40.3%) were registered. Graph 2.
Eco-epidemiological aspects of Trichinosis in a population of Corrientes, Argentina, affected by an outbreak.
In relation to the consumption of artisan sausages made with game in the last 30 days, there were 105 who ingested (59.7%) and 71 people who did not (40.3%). Graph 3

Regarding the knowledge of trichinosis as a Foodborne Disease, of the total respondents (N: 176) 129 people do recognize this ETA (73.3%) and 47 do not know about it (26.7%).
Among the 105 respondents post an epidemic outbreak, who ingested sausages made with pieceshunting in the last 30 days only 68.3% (71/105) recognize Trichinosis as a food-borne Disease. Table 2 and Graph 4.

Graph 1: Distribution of respondents according to sex.



Graph 2: Intake of pork sausage in the last 30 days of being surveyed.



Graph 3: Intake of sausages made with game pieces in the last 30 days.

TABLE 2: KNOWLEDGE OF THICHINOSIS AS A SOURCE OF ETA

Knowledge of those surveyed	Recognize ETA (N:105)	No Recognize ETA (N:105)	Recognize ETA (N:176)	No Recognize ETA (N:176)
Answers	71	34	129	47
Frequence	68,3	32,7	73,3	26,7

Graphic 4: Pray-products intake and knowledge of Trichinosis

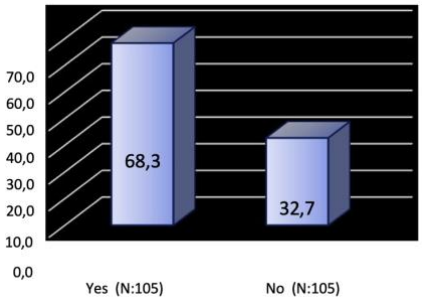


TABLE 3. WAY OF INTAKE OF THE PRODUCTS.

TYPE / CASES	Social meeting	Familiy party	Bought	Self-produced
Answers	91	13	41	63
Frequence	87,5	12,5	39,4	60,6

Regarding the knowledge about the composition of the preparation to make the chacinado and the presence or absence of mixtures with other game pieces, they answered NO knowing the composition of the sausage 51.4% (54/105) of those surveyed. 30.5% affirmed that the sausage they consumed was pork and the 18.1% (19/105) mentioned that the sausages they consumed were a mixture of farmed pig with game piece (pig moro). Table 4.

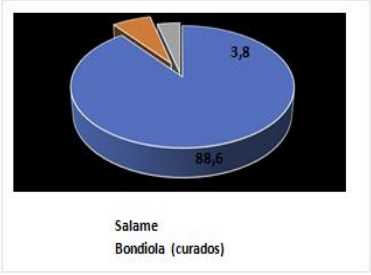
TABLE 4: KNOWLEDGE ABOUT COMPOSITION OF PRODUCTS.

Knowledge	Pig raised in captivity (N:105)	Wild pig (N:105)	Unknown (N:105)
Answers	32	19	54
Frequence	30,5	18,1	51,4

Regarding the origin of the complementary raw material, used to increase the volume of the prepared or mace in the elaboration of sausages, this information could be collected in those who ingested “chorizos”, those who manifested in 51.4% (51/105) not knowing if said aggravation was carried out; on 29.5 % (31/105) of those surveyed affirmed that wild pig meat (Moro pig) was added; 11.4% (12/105) deer without specifying the type of deer. The beef option had no answers in the question. 100% of the respondents who recognized mixtures in the sausages, mentioned using stock domiciliary. Regarding the type of sausage, salami was the most frequent with 88.6% (93/105) of the surveyed against “bondiola” with 6.7% (7/100) and “chicharron”, with 3.8% (4/105). Graph 5.

TABLE 5: RAW MATERIAL USED TO PREPARE SAUSAGES (N:105)

Raw material	Wild pig	Deer	Lamb	Bull	Unknown
Answers	31	12	3	5	54
Frequence	29,5	11,4	2,9	4,8	51,4



The food reminder of the questionnaire was consulted as part of it to those who consumed artisanal sausages in the last 30 days (N: 105) having presented signs and symptoms compatible with Trichinosis after the ingestion of sausages. No participant mentioned havingor have had such symptoms or signs.

DISCUSSION

The survey turned out to be the appropriate tool for data collection; compared to other tools.

While available, the survey allowed an effective development, since it was possible to reach the desired population at the same time with a minimum of error in filling in the questionnaire; the questions being from Closed response did not generate inconvenience for the participants to answer them.

At the end of the Trichinosis outbreak and after 90 days, 176 people were surveyed older than 14 years, mostly male (55.7%), belonging to 68 families where in 11 (16.2%) of them presented at least one case of Trichinosis.

In this context, a reminder with a minimum of error when answering the questionnaire that involves answers about historical events.

The high frequency of the consumption of artisanal sausages based on pork in the last 30 days, with 59.7% (105/176) of respondents who affirmed so, represents an opportunity to

foodborne illness if good manufacturing practices are not implemented.

The high consumption of artisanal sausages made with game, represented by 59.7% of respondents, it is undoubtedly an eating habit that can represent a health risk if it is not establish control processes over their safety.

In the knowledge of Trichinosis as a Foodborne Disease, 26.7% of the total of those surveyed still do not recognize it, a relevant aspect to discuss awareness-raising measures and awareness of more impact on the community in general; with the aggravation that within 105 respondents who ingested sausages made with game pieces only 68.3% recognize Trichinosis as ETA; if we also consider in this context two more aspects, on the one hand the responses to the questionnaire on the modality by which the chacinado was acquired and consumed (60.6% get it in a non-commercial way, that is, informally) and on the other hand considering that 87.5% consumption in events or social gatherings, several considerations arise to be discussed by the authorities to build a comprehensive approach to Trichinosis protocol.

51.4% of those surveyed who ingested cold cuts (N: 105), do not know its composition.

Regarding the origin of the meat with which it is prepared, that is, if they are pork or meat mixtures, between there, game pieces.

In this same group of respondents, 18.1% (19/105) mentioned that the sausages that they consumed were a mixture of farm-raised pig with game (Moro pig).

To increase production or generate some added value to the product, the processors supplement or complement the preparation prior to making the sausage with game or

other household chores, thus promoting your final product. In this sense, 100% of the who recognized mixtures in the sausages, mentioned using home stock, exclusively (lamb or other available).

Likewise, at the time of consuming it, 51.4% of the respondents stated that they did not know if such aggregation was carried out; but 29.5% of those surveyed affirmed the addition of wild pig meat (Moro pig) and 11.4% deer meat, without specifying the type of deer.

The beef option had no responses in the questionnaire.

Regarding the type of sausage, salami was the most frequent with 88.6% of those surveyed compared to Bondiola and Chicharron.

As salami is the one with the highest consumption, it places the "drying" process as the most used by the makers of artisanal sausages compared to the methodology of "cured", "smoked" or "precooked".

CONCLUSIONS

The presence of outbreaks of trichinosis is considered an indicator of poor hygiene measures.

Therefore, the corrective actions planned, agreed upon, and with follow-up indicators.

The context of knowledge and awareness reveals a situation to overcome therefore they must implement promotional measures with a greater impact on the community; education is vitally important health care of the population, mainly related to the consumption of artisanal sausages.

Good practices should be implemented at all stages during the production of the sausages, manufacturing and also from the health authorities to form advisory teams and auditors to guarantee quality standards in the production of safe food, considering the different raw materials and preserving their originality.

The elaboration and consumption of artisan sausages with game prey is a cultural habit of the population therefore should guide the prevention measures of Trichinosis in the preparation and consumption of them. The socio-cultural habits installed in these settlers and that can generate future outbreaks and the deficient hygienic-sanitary conditions related to raising pigs for artisanal consumption, demonstrate the need to continue in an intersectoral and multidisciplinary manner, researching to promote fund knowledge of Trichinosis and communicate advances and new discoveries that allow contribute to a better quality of life.

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