Introduction

EU Regulation 2015/1375 risk based surveillance in stead of individual carcass Trichinella control for all pigs

Recently, an expert group of FAO/WHO developed a spreadsheet model (FAO-WHO, 2014) that
- estimates residual risk from tested pork (controlled housing)
- output model in its present form: infective portions of pork
Aim of the current study: to build a more detailed model, which includes modules for
- Trichinella distributions in meat
- Trichinella temperature inactivation by cooking
- dose-response for human infection
Resulting in estimates trichinellosis incidence and quantification of risk from different holding systems (attributions)

Parasite to Patient: a QMRA model for Trichinella spp

Many literature and experimental data

Trichinella prevalence 0.4% at 0.3 – 211 ML in hunted wild boar n = 686,595 (EFSA 2007 – 2012, Poland)
Trichinella prevalence 0.0001% in domestic pigs from non-controlled housing n = 114,395,817 (EFSA 2007 – 2012, Poland)

Data to validate a QMRA model

Trichinella incidence in humans observed: 264 confirmed cases out of 230 million tested (1.15 × 10^-6) (EFSA 2007 – 2012, Poland)
Trichinella at meat inspection

(positive) EFSA + field data PIWet

Batch 20 x 5 g diaphragm
# larvae per batch

100 g diaphragm

Random draw

Trichinella larvae detection

Probability to find at least one larva

280 PT records

<table>
<thead>
<tr>
<th>Batch</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
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<td>larvae per batch</td>
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<td>0.990</td>
<td>0.988</td>
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<td></td>
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<td>0.010</td>
<td>0.012</td>
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<td>0.020</td>
<td>0.016</td>
<td>0.027</td>
<td>0.073</td>
<td>0.843</td>
</tr>
</tbody>
</table>

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Negative multinomial distribution

Experimental infection data Bfr → model probability of Trichinella allocation to swine parts

Probability that a portion of pork (100 g) contains two or more larvae

Trichinella count in 100 g diaphragm

Cooking model

(data from Carlin et al., 1969; Randazzo et al., 2011)

100 g portions

• Consumption patterns
Dose-response Model

Dose-response modeling taking into account:
- Number of larvae
- Proportion male and female larvae
- Survival of larvae after ingestion

Human/swine are highly susceptible to low doses of Trichinella spiralis in an experimental model.

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QMRA – model

Keep track of zeros!

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QMRA – Simulation

Observed prevalence 0.4% at 0.3 – 211 Trichinella ML / WB

114,000 wild boar

−456 positive Wild Boar

2.5 – 5.6 pools

12.4 – 33.5 missed WB in those pools (in total)

Simulation wild boar

Observed prevalence 0.4% at 0.3 – 211 Trichinella ML / WB

114,000 wild boar

−12.4 – 33.5 WB

456 portions of shoulder, loin and belly/WB

12.4 – 33.5% residual positive portions

1.97 (0.82 – 4.00) cases/M/y
Simulated incidence:
- 1.97 cases per million per year from wild boar
- 1.56 cases /M/year from pigs under non-controlled housing
- 3.53 cases /M/year

Observed average incidence 2007 – 2012 in Poland:
- 1.15 cases /M/year

What about pigs from controlled housing?

Total incidence

Two way analysis:
1. Extrapolation of incidence from non-controlled housing to controlled housing
2. Estimation of probability of finding a positive pig in a next year, given absence of *Trichinella* during past number of years

Controlled housing

Ad 1.

Observed freedom of *Trichinella* of approximately 120 M pigs from controlled housing in the whole EU per year during the last 20 years

That is 0 positives per 2,400M (=2.4 billion) tested, hypothesized upper prevalence limit 1/2.4 billion pigs from non-controlled housing

Incidence extrapolation from non-controlled housing to controlled housing:

At max 1 EU citizen with trichinellosis every 40 years!

Controlled housing

Ad 2.

Dutch situation: 140 M pigs tested in 10 preceding years, what would be the probability of finding positives the next year?

EU 2015/1375: test 10% of pigs from controlled housing!
Discussion

QMRA results seem congruent with best available objective data

Variability included in all stages of QMRA and uncertainty in the dose-response module

Two cooking scenarios included, more scenarios modelled (uncertainty)

Heterogeneity in consumption pattern not included

Freezing not included, nor raw meat products

Majority of cases from wild boar (1.97/M/y from 0.6 M animals) compared to pigs from non-controlled housing (1.56/M/y from 114 M animals)

Conclusions

Our Trichinella QMRA is a data-dense model and its outcomes seem in close agreement with observed incidence data

Illegal or improper practices are impossible to model

Under approved controlled housing, Trichinella testing is not adding any value to protect human health

Compulsory meat inspection of all game intended for human consumption is a logical step to further improve food safety regarding Trichinella

Given absence of positive findings in large numbers of pigs from controlled housing in preceding years, testing only 10% of animals is not meaningful

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