Ranking of consumer exposure to antibiotic resistance genes from retail meat

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Key messages

- This study reports the first quantification of antimicrobial resistance genes (ARG)s using qPCR data in these food products.
- ARGs such as the *tet(W)* gene are present in retail meat in European countries.
- There is a significant variability in the presence and abundance of *tet(W)* in retail meat among the nine countries.
- These results based on data from nine European countries are a first step towards the development of an exposure assessment.

Background

ARGs are widely present in different ecosystems[1]. The food chain has been identified as one of the major transmission pathways for ARGs and bacteria between the human and animal population, with cross-contamination of meat during slaughter considered one of the main mechanisms[1]. However, little is known about the cumulative exposure of consumers to ARGs and bacteria through food consumption[2]. Therefore, there is a need to quantify this exposure to resistance genes in order to better estimate a potential associated risk for public health.

Objectives

1) To develop a ranking method for resistance gene exposure based on human consumption of retail meat and to apply it in nine European countries as an example.
2) To assess the data needed for an ARG exposure assessment for consumption of retail meat.

Methodology

A stochastic model was developed in order to quantify the relative exposure to an ARG, *tet(W)*, through food consumption.
The following stochastic Monte Carlo model was proposed:

$$F_{sp} = C \times P \times Q$$

- F_{sp} = exposure per person per day
- C = standard serving size (g/day)
- P = prevalence of products with AMR determinant at retail
- Q = quantity of AMR determinant in contaminated products

➢ Data from nine European countries were available for the analysis (A,B,C,D,E,F,G,H,I).
➢ Prevalence and abundance of *tet(W)* gene were obtained from descriptive analysis of preliminary qPCR data. The food products sampled in the selected countries at retail were pork, chicken, turkey, veal and trout. These food products were assessed as sources of exposures.

Total number of samples by meat type and country.

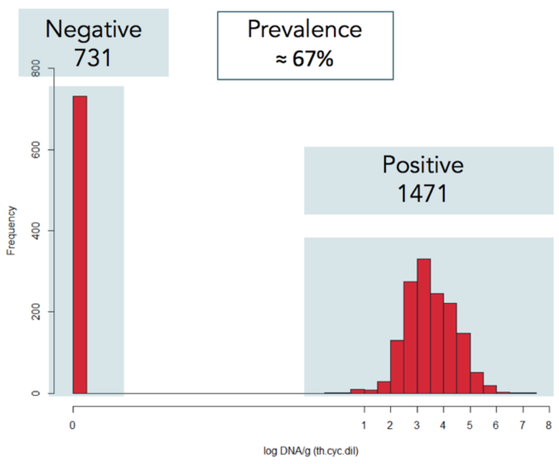
Retail meat product	Total	Country(n)
Pork chop	893	A(100), B(100), C(100), D(85), E(107), F(100), H(100), G(101), I(100)
Chicken drumstick with skin	899	A(100), B(100), C(100), D(88), E(107), F(100), H(100), G(104), I(100)
Turkey drumstick with skin	143	D(34), E(59), I(50)
Veal meat	144	D(44), E(50), I(50)
Trout meat	123	D(21), G(52), H(50)

➢ The ranking was established using a standard serving size of 150 g[3].

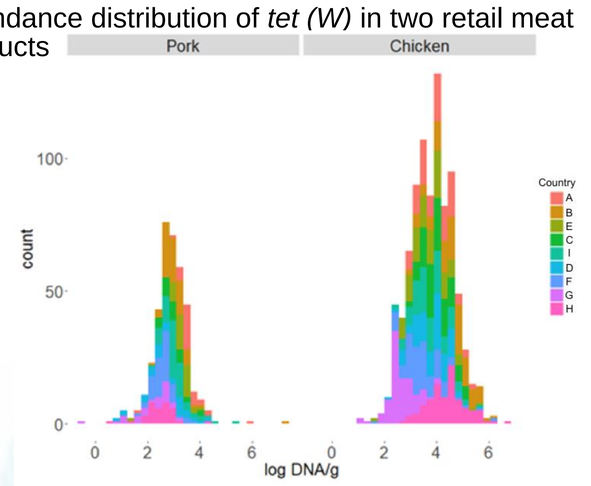
Preliminary results

Input variables

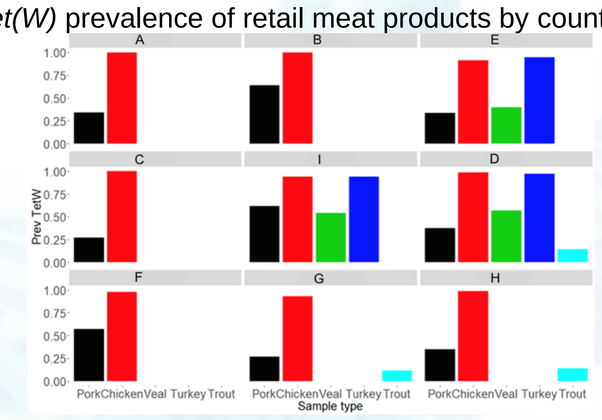
tet(W): Copies DNA/g meat (log scale)



Abundance distribution of *tet (W)* in two retail meat products

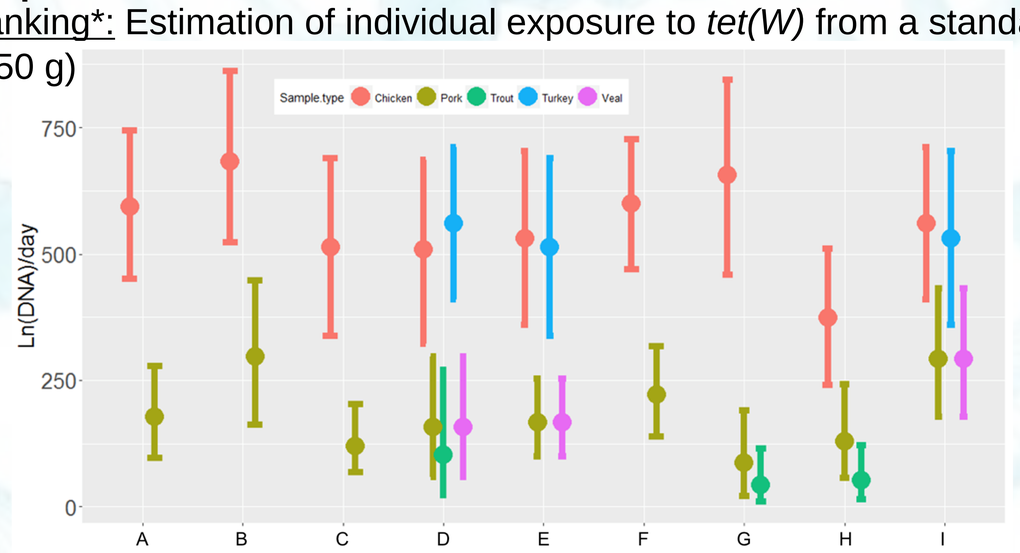


tet(W) prevalence of retail meat products by country*



Output data

Ranking*: Estimation of individual exposure to *tet(W)* from a standard serving (150 g)



*The lack of data for some countries is due to the absence of sampling for specific retail meat products.

Discussion

➢ This study tackles the need of quantifying the exposure to ARGs of the human population through food consumption. It ranks the relative human exposure to *tet(W)* gene through several retail meat products in nine European countries.
➢ The **health significance** of this exposure has not been quantified yet and remains unknown. For example, a key parameter to be estimated is the transfer of resistance genes from commensal to pathogenic bacteria in order to estimate the health consequences in the human population.
➢ The **qPCR** methodology used in this study need further development. Future work will involve the validation of qPCR data and the analysis of additional ARGs.
➢ qPCR data could potentially serve as a **safety indicator** for food hygiene and could help to prioritise risk management practices in the production chain.

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3. Kirman L, Walsh MC, Brennan L, Gibney ER, Drevon CA, Daniel H et al. Comparison of the portion size and frequency of consumption of 156 foods across seven European countries: insights from the Food4Me study. European Journal of Clinical Nutrition. 2016; 70: 642-644

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