Industrial dog food is a vehicle of multidrug-resistant enterococci carrying virulence genes often linked to human infections

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Introduction

➢ The increase in the number of pets in recent years has been followed by an exponential growth of the industrial pet food sector. Food contamination can be caused by different microbiological hazards, and pathogenic and/or antibiotic resistant bacteria (ABR) can be introduced in pet food in different phases of production chain (Fig. 1) (1).

➢ The growing demand for innovative products, which tend to be more natural, has been accompanied by new food safety risks with an increase in outbreaks and pet food recalls due to the presence of pathogenic bacteria (2).

➢ There is scarce information regarding the occurrence of ABR bacteria, and none about Gram-positive bacteria, in pet food. Enterococcus is a ubiquitous Gram-positive genus that is particularly resistant to harsh environments and different antibiotics and was used as study model in this study.

Aim

➢ To investigate if dog food commercially available in Portugal is a vehicle of antibiotic resistant Enterococcus spp.;

➢ To characterize Enterococcus faecalis and Enterococcus faecium isolates resistant to antibiotics that are considered as critical in the treatment of enterococcal human infections.

Methodology

➢ We analyzed 55 samples of dog food (wet, dry, raw, treats and semi-moist) from 25 international/national brands, which were processed as represented in Figure 2.

➢ Species were identified by PCR and MALDI-TOF/MS (3).

➢ Antibiotic susceptibility testing was performed by disk diffusion, E-test and broth microdilution methods, and results were interpreted according EUCAST or CLSI clinical breakpoints (3).

➢ The presence of genes conferring acquired resistance to vancomycin (vanA) and oxazolidinones (optA, poxB) was tested by PCR (3).

➢ The presence of ptsD, a virulence gene important for E. faecium colonization was tested by PCR (4).

➢ Clonality was established by Multilocus Sequence Typing in selected isolates (3).

Results

➢ Thirty-samples (54%) contained Enterococcus (7 species; Fig. 3);

➢ E. faecium and E. faecalis were more frequent in dry and wet samples, respectively.

Figure 3. Enterococcus spp. species detected and their distribution by the different types of dog food (given in %).

Figure 1. Representation of various stages of the pet food production chain where microbiological contamination occur.

The most frequent co-resistant phenotypes of MDR isolates: Erythromycin + Tetracycline + Streptomycin + Chloramphenicol (detected in 53% E. faecalis from raw and wet samples) – Ampicillin + Ciprofloxacin + Erythromycin + Gentamicin + Tetracycline + Streptomycin + Quinupristin-dalfopristin (detected in 19% E. faecium from raw samples)

➢ More than 40% of enterococci recovered were resistant to erythromycin, tetracycline, quinupristin-dalfopristin, streptomycin, gentamicin, chloramphenicol, ampicillin or ciprofloxacin, and to a lesser extent to linezolid (23%; optA, poxB) or vancomycin and teicoplanin (2% each; vanA).

➢ ptsD was detected in 16% of E. faecalis isolates which were all ampicillin-resistant and identified as hospital-associated clones.

➢ A diversity of clones was observed, in the same or in different species, and were previously associated with hospital (E. faecum ST17/ST80; E. faecalis ST40), farm animals, pets and environmental strains.

Conclusions

➢ This study shows that dog food from international brands is a vehicle of clinically-relevant enterococci carrying resistance to last resort antibiotics and relevant virulence genes, thus positioning pet food as an important source of antibiotic resistance spread within the One Health context.

➢ The high incidence of Enterococcus in a variety of dog food samples indicates the need to review selection of raw materials, manufacturing and hygiene practices in an emerging food sector growing worldwide, and to raise public awareness about the potential health risks when handling dog food if proper hand hygiene by pet owners is not conducted.

References


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