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Spread of antibiotic resistant bacteria from food of animal origin to humans and vice versa

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Abstract

Food-related bacteria are a very diverse population. They can be found in environment where food and feed is produced and handled. Nowadays, the foodborne zoonoses of greatest concern are campylobacteriosis, salmonellosis and Verotoxigenic *Escherichia coli*, and antibiotic resistance in these pathogens is an emerging health issue. Studies have been published about antibiotic resistant bacteria in different ecological niches. In our study, we found 40% of samples from food of animal origin contained bacteria resistant to one or more antibiotics. Without the interdisciplinary concept "one world one medicine one health", bacteria will continue to produce offspring that are multiresistant to antibiotics.

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Keywords: resistant bacteria; food of animal origin; food safety

1. Main text

Food-related bacteria constitute a heterogeneous group, with their original habitats extending to all ecological niches where food for human consumption is produced and handled. Such environments may be soil, plants, husbandry, animals, fresh water, marine ecosystems, fish, wild birds and other wild animals, or areas with human impact related to the people handling the food, e.g. food production industry or restaurants, or the effluent from

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human sewage[1]. In the past decades, campylobacteriosis, salmonellosis and Verotoxigenic *Escherichia coli* (VTEC) infection have largely replaced tuberculosis, brucellosis and parasitic diseases as the most common sources of foodborne zoonoses in humans in the EU[2]. However, an emerging health issue that poses a serious threat to public health worldwide is antibiotic resistance in these bacteria. Nowadays, effort has been directed into the study of antibiotic resistance of the nonpathogenic bacteria, most often *E. coli*. *E. coli* is a normal inhabitant of the warm blooded animal intestine, including human intestine, and can easily contaminate food products during animal evisceration at slaughter or during food manipulation[3]. In addition, *E. coli* can transfer their resistant genes to other pathogenic bacteria in the intestine. For this reason, industrialized animal food and food of animal origin is a potential source of antimicrobial resistant and virulent bacteria. Consequently the question remains: are resistant bacteria brought to food from the animal gut or from human carriers handling the food?

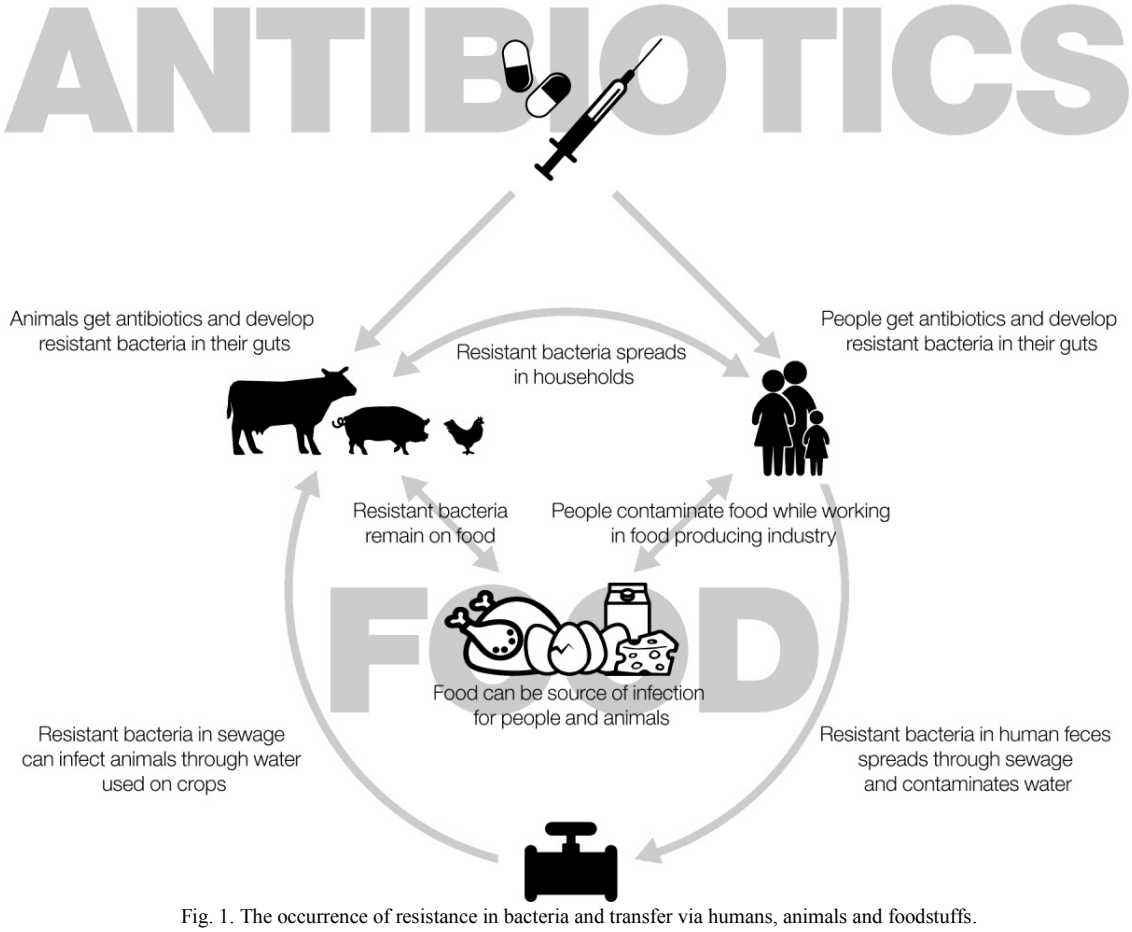

Fig. 1. The occurrence of resistance in bacteria and transfer via humans, animals and foodstuffs.

In past years, many studies have been published on antibiotic resistant bacteria. They were found in food of animal origin[4,5,6,7], livestock[5,6,8], companion animals[7,9] and in humans[7,9]. However, different studies yielded different results. Jouini et al.[4] discovered that 26% of *E. coli* isolates from food contained extended spectrum β-lactamases (ESBL) enzymes; while on the other hand, none of the faecal samples from animals had ESBL producing *E. coli*. In this study, the contamination during the transformation or commercialization processes of food cannot be excluded. In contrast, Geser et al.[6] found ESBL producing *Enterobacteriaceae* in 15.3% porcine, 13.7% bovine, 8.6% sheep and 63.4% chicken fecal samples and none in minced meat and milk samples. In contrast, Leverstein van Hall et al.[5] found the same ESBL genes in retail chicken meat and in poultry isolates. Overdevest et al.[10] found ESBL *E. coli* in