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Characterization of illegal food items and identification of foodborne pathogens brought into the European Union via two major German airports

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ABSTRACT

Foods of animal origin brought illegally from third party countries into the European Community pose a risk for the introduction of diseases. This can lead to animal disease outbreaks with significant economic and social costs and subsequent severe trade restrictions. Further, disease outbreaks in humans due to illegally imported foods of animal origin have been described, yet, there are very few studies examining the potential human health impact. Passenger baggage is the most likely route by which illegal products enter a country. Therefore, the volume and geographic origin of foods of animal origin introduced illegally into Germany via the Frankfurt International Airport and Berlin-Schönefeld Airport by passenger luggage were characterized. Further, the occurrence of foodborne zoonotic bacteria such as *Salmonella* spp., *Listeria* spp., *Campylobacter* spp., *Yersinia* spp., Verocytotoxin-producing *Escherichia coli* (VTEC) and *Brucella* spp. and the microbial quality of the foods were analysed by total bacterial count. Between 2012 and 2013, a total of 663 food items were seized from 296 passengers arriving in Germany from 35 different departure countries. The majority of confiscates (51%) originated from Turkey and Russia. A selection of 474 samples was subjected to microbiological analyses. Twenty-three food products tested positive for at least one of the pathogens analysed. The majority of the contaminated foods were meat (33%) or meat products (42%), and milk products (21%). Considering that only a small fraction of arriving passengers is subjected to airport custom controls and only a small number of confiscated foods could be analysed during this study, further investigations are needed to understand the public health risks posed by illegally introduced food items.

1. Introduction

Despite an extensive regulatory framework substantial volumes of illegal animal products for human consumption continue to enter the European Union (EU) undetected; either as imports brought in by individuals for personal use or larger quantities indicating underlying commercial motivations.

One reason that illegal importation persists is because exotic foods are a traditional part of the diet of many immigrants who live in the EU. Further the need for the consumption of exotic foods originates either out of reminiscence or from a religious background (Grabowski et al., 2013). In 2011, nearly 20% of the total German population had a migration background. Most immigrants in Germany (from outside the EU) originated from Turkey (2.96 M) followed by Russia and Ukraine (1.5 M) and the Balkan countries (0.86 M) (Statistisches Bundesamt, 2012). Further, the popularity of exotic foods has also increased in the European population due to more extensive travelling activities and globalization. In 2010, more than 12 M Europeans travelled outside the EU (European Community (EC) [Internet], 2014).

Outbreaks of exotic animal diseases within the European Community have been caused by virus strains previously not isolated in the Community, including outbreaks of classical swine fever in 1996 and 2000 (Hartnett et al., 2007), and a major epidemic of foot-and-mouth disease (FMD) in 2001 (Peiso et al., 2011). These outbreaks can cause significant economic and social costs and lead to severe trade restrictions. Further, disease outbreaks in humans due to illegally imported foods of animal origin have been described (Noordhuizen et al., 2013).

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In many third countries animal production, disease surveillance and control, food technology and the hygienic conditions of food processing do not match European standards (Spies, 2008).

The EU aims to assure a high level of food safety and consumer protection. Therefore, legal food imports into the EU are well monitored for serious risks and alerts are registered through the Rapid Alert System for Food and Feed (RASFF). In contrast, in illegally imported foods neither the origin nor the conditions of food production can be monitored efficiently. The illegal introduction of animal products thus results in an increased risk of importing zoonoses and animal diseases into the EU (Anonymous, 2005).

The majority of the German immigrant population originates from regions where animal diseases such as FMD and African swine fever (ASF) are endemic (Food and Agriculture Organization of the United Nations (FAO) [Internet], 2013; Khomenko et al., 2013). But also exotic zoonoses such as human brucellosis, which is transmitted through the consumption of raw animal products such as unpasteurized milk or cheese (Pappas et al., 2006) occur frequently in these regions. Also, foodborne diseases like yersiniosis, campylobacteriosis and salmonellosis are a major public health problem in many developed and developing countries. Especially countries without strict food safety regulations possess a high prevalence of gastrointestinal diseases. Approximately one third of travellers to less developed areas of the world experience gastrointestinal complaints during their journey (DuPont and Ericsson, 1993; Steffen, 1986).

To mitigate these risks there are strict procedures for the introduction of animal products into the EU. Besides a clear legal framework concerning the commercial import of foodstuff (Regulation (EC) No. 882/2004 (European Community, 2004a); Regulation (EC) No. 854/2004 (European Community, 2004b)) the introduction from third party countries by individuals and for personal use is also regulated. Meat and meat products and milk and milk products for personal consumption cannot be imported into the EU unless such products fully comply with the Community's commercial import rules. Further, introduction of personal consignments of products of animal origin from third countries which form part of travellers' luggage is also prohibited (Regulation (EC) No. 206/2009 (European Community, 2009)). Also, the international trade of certain animal taxa (some are used as a food source, i.e. bush-meat) is prohibited or regulated for conservation reasons (Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Regulation (EC) No. 338/97 (European Community, 1996)).

To date, the amount and characteristics of exotic foods of animal origin introduced illegally into Germany by passenger luggage has not been studied extensively. Also, to our knowledge, there are no published studies which investigate the occurrence of zoonotic bacteria and the hygienic status of such illegally introduced and confiscated food products into the EU. The purpose of our work was to characterize the volume and geographic origins of exotic foods and to determine zoonotic pathogens (*Salmonella* spp., *Listeria* spp., *Campylobacter* spp., *Yersinia* spp., Verocytotoxin-producing *Escherichia coli* (VTEC) and *Brucella* spp.) entering Germany via the Frankfurt International Airport and Berlin-Schönefeld Airport.

2. Materials and methods

2.1. Sample and data collection at airports

The samples were collected during routine inspections of passengers at the Airport Berlin Schönefeld (IATA code SXF), and the Frankfurt Airport (IATA code FRA). A risk assessment of the current animal disease status of the countries of the departure airports is routinely performed by the competent authorities of the Federal States and veterinarians of the veterinary border inspection posts searching following databases: World Animal Health Information Database (OIE), Rapid Alert System for Food and Feed (EC), ProMedMail, Eurosurveillance (ECDC), Emergency Prevention System (FAO), European Animal Disease Notification System (EC). Based on the prevalence of animal diseases in a country or region, the frequency of controls is determined.

During routine inspections between the 24.2. and 23.5.2013 at the Airport Berlin Schönefeld, all food items confiscated by custom officers and veterinarians were collected. At the Frankfurt Airport ten days (30./31.08.2012, 10.–13.12.2012, 23.–26.04.2013) of special controls were performed. Here, custom and veterinary officers worked together in an enhanced surveillance scheme, where a greater percentage of passengers were selected and the focus of the inspection lay on passengers suspected of carrying prohibited foods. The selection of the passengers was based on internal evaluation criteria of the custom authorities.

Routinely, the flight origin of the passengers was recorded by the veterinary officers present during the inspections at both airports by looking at the baggage tag or by asking the passengers. All food products were frozen within 6 h after confiscation and transported according to the regulations for animal by-products of Category 2 (Regulation (EC) No. 1069/2009 (European Community, 2009)) at −20 °C.

2.2. Sample preparation

The samples were analysed with the permission of the competent authorities of the Federal States Hesse and Brandenburg. The passengers from whom food was confiscated were not informed of the analysis. The samples were kept at −20 °C until analysis. The exact weights of all food items were recorded. Foods which had a commercial packaging were defined as bought at a retail shop. 'Home-cooked' foods were cooked meals or fried meats without any further information on the origin of the food (commercial or homemade). Raw meats were characterized as 'raw'. All other food items were defined as homemade or bought at a local market, with a strong implication that they originated from the informal food chain. Seven food items, recognized as fish, spices or pastries were not included in the analysis.

All samples obtained in 2012 were subjected to microbiological and molecular analyses. Due to the large number of samples obtained, only every second food item collected during 2013 was analysed.

All samples were handled using established BSL2 practices, with containment equipment and facilities available for all activities involving contaminated materials or cultures. To avoid cross contaminations the food packages (commercial and non-commercial) were disinfected with 70% ethanol and opened on a disinfected surface with a sterilized knife.

2.3. Microbiological and molecular analyses

Twenty-five grammes of each food item was investigated for the presence of *Salmonella* spp., *Listeria* spp., *Campylobacter* spp., *Yersinia* spp. and Verocytotoxin-producing *E. coli* (VTEC). When 25 g of food product were unavailable the volume of the pre-enrichment media was adjusted to a 1:10 ratio, although this could have an effect on test sensitivity. All microbiological-positive results were confirmed by PCR, or in the case of VTEC by enzyme immunoassay.

2.3.1. Detection of Salmonella spp.

For the enrichment of *Salmonella* spp., 25 g of the homogenized food product was placed into 250 ml phosphate buffered peptone water (PBS buffer) (Carl Roth, Germany) and incubated for 24 h at 37 °C. Isolation and confirmation of *Salmonella* spp. was performed according to ISO 6579:2002 (International Organization for Standardization, 2002) and real-time PCR, respectively (Malorny et al., 2004). Furthermore, *Salmonella* colonies were serotyped according to the White–Kauffmann–Le Minor scheme (Grimont and Weill, 2007).

2.3.2. Detection of Yersinia spp.

For the enrichment of *Yersinia* spp., 25 g of the food samples was homogenized in Peptone Sorbitol Bile (PSB) enrichment broth and