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## **Risk Assessment of Import and Dissemination of Intestinal Pathogenic Bacteria via Fresh Herbs and Leafy Vegetables from South-East Asia**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. The opinion has been assessed and approved by the Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food and Cosmetics of the Norwegian Scientific Committee for Food Safety. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Several studies have demonstrated that fresh herbs and green or leafy vegetables can be contaminated by intestinal pathogenic bacteria such as *Salmonella* spp. Although systematic surveys are probably not conducted in any countries some places, in recent years the Rapid Alert System for Food and Feed (RASFF) has received approximately 30 alerts annually on the detection of potentially pathogenic bacteria contaminating such products.

Fresh herbs and green or leafy vegetables are mainly imported from southern Europe, but some are also imported from tropical and sub-tropical regions where the endemic level of intestinal

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pathogenic microbes is high. Traditionally such products have been imported particularly from South-East Asia, especially from Thailand. These imports occur predominantly through “immigrant-shops”, with the products largely used within the immigrant community, which also includes associated restaurants and catering-companies. However, such products are apparently also becoming more popular amongst the general public, and can therefore also be available on request in normal chain-stores. It is, however, difficult to estimate the total volume of these products imported into Norway because various different customs’ tariff codes are used. In 2006, 2 163 518 kg were registered as being imported into the EU (of which 25 % were basil, peppermint, or coriander). The total import into Norway must therefore be considered as low, but is probably increasing. The import of these products, and thus also their use, occurs predominantly in the larger towns and cities.

The food customs in the countries where these herbs originate dictate that they are normally cooked together with food. It is highly probable that the immigrant communities have largely continued this tradition, and therefore any contaminated products are unlikely to represent a risk of infection. In Norwegian food traditions, however, such ingredients are used without heating, being added directly to the cooked food for flavouring and/or decoration.

The products have a relatively short shelf-life (3-5 days) and are largely imported in small quantities by numerous small importers. Besides the general requirements that a producer/importer/distributor is responsible for a product offered for sale being “safe”, there are no other specific requirements on the testing of these products. The short shelf-life and the multitude of small importers (who probably do not always have satisfactory internal controls) also mean that fulfilment of such requirements would be unrealistic.

In 2005, the Norwegian Food Safety Authority (Mattilsynet) conducted an ad hoc survey of 162 products, mostly from Thailand, and found that 28 % were contaminated with *Salmonella*, and 35 % with *E. coli* at > 100 CFU/gram. This resulted in a general prohibition of import of such products from Thailand, upon which the Thai authorities themselves undertook an initiative such that 14, later increased to 23, so called “risk-products” exported to Norway and the EU, would be accompanied by a certificate documenting that they have been analysed for *Salmonella* and *E. coli* before export. Thereupon the import prohibition was rescinded. However, in 2006, *Salmonella* was again detected in various ad hoc samples. Therefore, in 2007 a project was initiated with the intention of investigating the occurrence of *Salmonella* and *Campylobacter* in such products, and additionally to evaluate any possible effect from the Thai certification initiative. In this project, *Salmonella* was detected in 15 % of 159 products, whereas *Campylobacter* was not detected at all. Risk simulation demonstrated that the chance of products being contaminated with *Salmonella* was 3 % (0-9 %) for products which were accompanied by a certificate, and 20 % (11-31 %) for products without certification.

On this basis, The Norwegian Scientific Committee for Food Safety (VKM), panel on Biological Hazards was commissioned to undertake a risk assessment on the use of fresh herbs and green or leafy vegetables imported from South-East Asia. In response, an ad hoc Working Group of experts was appointed with the mandate to draft a risk assessment.

In the surveys from 2005 and 2007, a total of 18 different serovariants of *Salmonella* were detected. All these have also been identified in patients to various extents, but only 9 of them in patients who have probably been infected in Norway. The domestic cases caused by these serovariants constitute 13 % of the total number of cases with these serovariants – a number that does not exceed the average proportion of domestic cases for all *Salmonella* variants. Therefore these data do not provide statistical support for the theory that fresh herbs/green or leafy vegetables represent a significant infection potential. However, statistical traces are not generally associated with sporadic cases and the sources for practically all the 300 – 400 domestic cases of salmonellosis diagnosed in Norway annually remain unknown.

As fresh herbs/green or leafy vegetables each time will only be used in small quantities, the direct use of such food probably only represents a marginal risk. The risk of infection will probably be particularly associated with the following conditions:

- (i) Food which is decorated with these products, or to which these products have been added for flavouring, that are not consumed immediately, but stored for a sufficient period at a suitable temperature for microbial replication to occur. In such instances, the food can become hugely contaminated over the course of a few hours;
- (ii) Other sensitive products (meat, eggs, dressings, etc.) may be cross-contaminated, and perhaps stored for a while in conditions suitable for microbial replication;
- (iii) For highly immunosuppressed individuals, the necessary infective dose will be very low. It is conceivable that serious illness in such patients could develop even when the products are used "correctly".

The panel's principle conclusions are:

1. Both national and international studies have demonstrated that a relatively high proportion of fresh herbs/green or leafy vegetables imported from South-East Asia might be contaminated with intestinal pathogenic microorganisms. Such products have also been recognised as the sources of outbreaks on several occasions. However, there is no statistical evidence that suggests that these products constitute an important source of infection in Norway. Nevertheless, as the sources of sporadic cases of infection are practically never identified, it is not possible to estimate the actual risk.
2. Thailand, as the most important production country in this context, has introduced a requirement that risk products that are exported to EU and Norway shall be accompanied by a certificate documenting that the products have been analysed for Salmonella and *E. coli* before export. This initiative has substantially reduced the contamination rate, but has not eliminated it entirely.
3. Due to different food customs in the producer countries and Norway respectively, contaminated products are likely to represent a considerably greater infection risk to the general public than to immigrant communities, who probably have mostly continued with their original food traditions.
4. It is also probable that the trend towards increased use of a steadily broader spectrum of fresh herbs/green or leafy vegetables will be applicable to the general public. However, the use of such products in hospitals or by severe immunocompromised patients should be avoided.
5. The significant reduction in risk that apparently has resulted for those products which are certified should be explored further, with direct communication with Thai authorities in instances of problems. Further investigation at varying time intervals should be supplemented by ad hoc or systematic sampling, in order that any failings or weaknesses in the system can be documented.

**Keywords:** VKM; assessment; Norwegian Scientific Committee for Food Safety; fresh herbs.

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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