


EFSA-Q-2012-00176; adopted on December 2014  
Request from the European Commission



Risk posed by pathogens in food  
of non-animal origin. Part 2:  
*Salmonella*, *Yersinia*, *Shigella* and  
Norovirus in bulb and stem  
vegetables and carrots

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## OUTLINE

- Background of mandate
- Terms of reference (ToRs 3 to 5)
- Approach to answer ToRs 3 to 5
- Conclusions and recommendations
- Acknowledgments

## BACKGROUND

Timeline	Milestone
May/June 2011	<b>STEC O104:H4 outbreak in Germany and France.</b>
June 2011	EFSA issues an <b>urgent advice on the public health risk of Shiga-toxin producing Escherichia coli (STEC) in fresh vegetables.</b>
October 2011	BIOHAZ Panel adopts a scientific opinion on the <b>risk posed by STEC and other pathogenic bacteria in seeds and sprouted seeds.</b> (Request from the European Commission on July 2011).
December 2012	BIOHAZ Panel adopts a scientific opinion on the <b>risk posed by pathogens in FoNAO (part 1) (outbreak data analysis and risk ranking of food/pathogen combinations).</b> (Request from the European Commission on January 2012).
Jan./Feb. 2013	The outcome of ToRs 1 & 2 (scientific opinion on FoNAO, part 1) was discussed between Commission and EFSA <b>to decide which food/pathogen combinations should be given priority for the other ToRs.</b>

## RISK POSED BY PATHOGENS IN FONAO (PART 2)


### ■ Concluded activities:

Draft opinion	Deadline
The risk from <i>Salmonella</i> and Norovirus in leafy greens eaten raw as salads.	<b>Adopted 6 March 2014</b>
The risk from <i>Salmonella</i> and Norovirus in berries.	<b>Adopted 22 May 2014</b>
The risk from <i>Salmonella</i> and Norovirus in tomatoes.	<b>Adopted 11 September 2014</b>
The risk from <i>Salmonella</i> in melons.	<b>Adopted 11 September 2014</b>
The risk from <i>Salmonella</i> , <i>Yersinia</i> , <i>Shigella</i> and Norovirus in bulb and stem vegetables, and carrots.	<b>Adopted 4 December 2014</b>

## Results of risk ranking (FoNAO – Part 1)

Ranking position	Pathogen	FoNAO category
<b>First</b>	<i>Salmonella</i> spp.	Leafy greens eaten raw as salads
	<i>Salmonella</i> spp.	Bulb and stem vegetables
<b>Second</b>	<i>Salmonella</i> spp.	Tomatoes
	<i>Salmonella</i> spp.	Melons
	Pathogenic <i>E. coli</i>	Fresh pods, legumes and grain
	Norovirus	Leafy greens eaten raw as salads
<b>Third</b>	<i>Salmonella</i> spp.	Sprouted seeds
	<i>Shigella</i> spp.	Fresh pods, legumes or grain
	<i>Bacillus</i> spp.	Spices and dry powdered herbs
<b>Fourth</b>	Norovirus	Bulb and stem vegetables
	Norovirus	Raspberries
	<i>Salmonella</i> spp.	Raspberries
	<i>Salmonella</i> spp.	Spices and dry powdered herbs
	<i>Salmonella</i> spp.	Leafy greens mixed with other fresh FoNAO
	<i>Shigella</i> spp.	Fresh herbs
	Pathogenic <i>E. coli</i>	Sprouted seeds
	<i>Yersinia</i> spp.	Carrots
<b>Fifth</b>	Norovirus	Tomatoes
	Norovirus	Carrots
	<i>Salmonella</i> spp.	Nuts and nut products
	<i>Shigella</i> spp.	Carrots

## TERMS OF REFERENCE

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- **ToR 3:** To identify the main risk factors for the specific food/pathogen combinations, including agricultural production systems, origin and further processing.
  - **ToR 4:** To recommend possible specific mitigating options and to assess their effectiveness and efficiency to reduce the risk for humans posed by food/pathogen combinations.
  - **ToR 5:** To recommend, if considered relevant, microbiological criteria for the identified specific food/pathogen combinations throughout the production chain.



## APPROACH TO ANSWER TOR3

**ToR3.** Provide a **descriptive analysis of the whole production process** for a **representative range of bulb and stem vegetables and carrots:**

- Risk factors for contamination by *Salmonella*, *Yersinia*, *Shigella* and Norovirus considered in the context of the **agricultural production, processing, distribution and retail/catering/domestic environments.**
- **Only minimally processed products** considered (which includes **cutting, washing, peeling, shredding, freezing, mashing and unpasteurized juicing**).
- Products undergoing **thermal treatments** (including **blanching**) as well as **shelf-stable juicing, pickling, canning, bottling, drying or powdering** are not considered in the scope of this mandate.

## APPROACH TO ANSWER TOR4

**ToR4.** To assess specific mitigation options, **separate sections** are included **relating to *Salmonella*, *Yersinia*, *Shigella* and Norovirus contamination of bulb and stem vegetables and carrots:**

- performed in a **qualitative manner** similar to that performed for the Scientific Opinion on the risk posed by STEC and other pathogenic bacteria in seeds and sprouted seeds
- included consideration of generic mitigation options identified in **previous FoNAO Part 2 opinions.**



## APPROACH TO ANSWER TOR5

**ToR5.** The **relevance of microbiological criteria applicable to production, processing and at retail/catering** were addressed considering:

- **Sampling and analytical methods** for the detection of *Salmonella*, *Yersinia*, *Shigella* and Norovirus (together with the use of *Escherichia coli* as an indicator organism) in bulb and stem vegetables and carrots;
- **Estimates of their respective occurrence and feasibility of microbiological criteria**, where available.

## GENERAL CONCLUSIONS


Emphasis given to vegetable types **associated with public health risks**, i.e. **carrots, onion and garlic**.

- Despite the variety of types of bulb and stem vegetables as well as carrots produced and consumed, there is **very little or no specific information for interactions with risk factors, mitigation options and occurrence of *Salmonella*, *Yersinia*, *Shigella* or Norovirus**.


Most information is available for ***Salmonella* and carrots**, although this is very limited.

Consequently, in addition to the limited data, conclusions are drawn through what is generally understood about the **properties of these pathogens** as well as **information from other fresh produce**.

## CONCLUSIONS TO TOR 4

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- **Primary objective** of operators producing bulb and stem vegetables and carrots: appropriate **implementation along the farm to fork continuum of food safety management systems** including Good Agricultural Practices (**GAP**), Good Hygiene Practices (**GHP**) and Good Manufacturing Practices (**GMP**).
  - **Each farm environment** should be evaluated independently for hazards as it represents a **unique combination of numerous characteristics** that **can influence occurrence and persistence of pathogens in or near bulb and stem vegetables as well as carrot growing areas**.
  - Both **water treatment** and **efficient drainage systems that take up excess overflows** are possible mitigation options to **prevent the additional dissemination of contaminated water**.

## CONCLUSIONS TO TOR 4



■ ***Salmonella*, *Yersinia enterocolitica* and *Y. pseudotuberculosis*:**  
to prevent direct contact with animal, bird or human faeces as well as indirect contact through slurries, sewage, sewage sludge, contaminated soil, water, equipment, food contact surfaces or food handlers.

■ ***Shigella* and Norovirus:**  
to avoid the use of sewage-contaminated water and inadequately treated sewage sludge.

**All persons involved in the handling of bulb and stem vegetables and carrots** should receive **hygiene training** appropriate to their tasks and receive **periodic assessment while performing their duties** to ensure tasks are being completed with due regard to good hygiene and hygienic practices.

## CONCLUSIONS TO TOR 5

- There is **no routine or regular monitoring of bulb and stem vegetables or carrots** for the presence of ***Salmonella*, *Yersinia*, *Shigella* and *Norovirus*** in the EU Member States.
- There are **limited studies available in the peer-reviewed literature** on the occurrence of these pathogens on/in bulb and stem vegetables or carrots.
- Considering the limited evidence for both the occurrence and public health risks from contamination of ***Salmonella*, *Shigella*, *Yersinia* and *Norovirus*** in the primary production and minimal processing of bulb and stem vegetables and carrots, **no conclusions can be made on the impact of the establishment of microbiological Hygiene Criteria, Process Hygiene Criteria or Food Safety Criteria on public health.**

## CONCLUSIONS TO TOR 5


- There is a **lack of data on the occurrence and levels of *E. coli* in bulb and stem vegetables as well as carrots.**

Thus, the **effectiveness of *E. coli* criteria to verify compliance to Good Agricultural Practices (GAP), Good Hygiene Practices (GHP), Good Manufacturing Practices (GMP) and food safety management systems (including HACCP) in the production and minimal processing of bulb and stem vegetables as well as carrots cannot be assessed.**





## RECOMMENDATIONS

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- A collage of food-related images including a cow, eggs, a landscape, purple grapes, and strawberries, with several white stars scattered at the bottom left.
- **More detailed categorisation of food of non-animal origin in EFSA's Zoonoses database on prevalence and enumeration of foodborne pathogens.**
  - If **additional biological hazards or further public health risks are identified** with the consumption of these categories of food of non-animal origin, **risk assessment studies** may be needed to inform the level of hazard control that should be achieved at different stages of the food chain.

These studies should be supported by **targeted surveys on the occurrence of foodborne pathogens in such vegetables at specific steps in the food chain** to indicate the level of hazard control and efficacy of application of food safety management systems, including GAP, GHP, GMP and HACCP that can be achieved.

## RECOMMENDATIONS

- Further data should be collected to **evaluate the suitability of microbiological (e.g. *E. coli*) indicators** for relevant microbiological hazards in bulb and stem vegetables and carrots during their production and minimal processing.

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- **EFSA BIOHAZ Panel Members.**
- **EFSA staff:** Maria Teresa da Silva Felicio and Ernesto Liebana Criado.

**Full opinion available at:**

<http://www.efsa.europa.eu/en/efsajournal/doc/3937.pdf>