FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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**Agenda Item 4.2. a)**

**GF/CRD Japan-1**
**ORIGINAL LANGUAGE**

## FAO/WHO GLOBAL FORUM OF FOOD SAFETY REGULATORS

***Marrakesh, Morocco, 28 – 30 January 2002***

**Conference Room Document submitted by Japan**

**Country Report**

# HYGIENE PRACTICE MANUAL FOR RADISH SPROUTS PRODUCTION IN JAPAN

**SUMMARY**

Hydroponically grown radish (*Raphanus sativus*) sprouts served in school lunch were epidemiologically implicated as causative vehicle of *Escherichia coli* O157:H7 at the largest outbreak occurred in Sakai City, Japan, in 1996. Laboratory experiments suggested the possibility that *E. coli* O157:H7 had grown during radish sprouts production. In order to improve sanitation level in radish sprout production, the Japanese Ministry of Agriculture, Forestry and Fisheries, in cooperation with the Ministry of Health and Welfare, developed hygiene practice manual for radish sprouts production in October 1996, then revised it in March 1998. The manual has adopted the concept of HACCP and identifies supplied water and seeds as critical control points (CCP).

## BACKGROUND

In July 1996, an outbreak occurred in Sakai City, Japan, affecting approximately 9,000 people manifesting diarrhetic, enterohemorrhagic and/or hemolytic uremic syndrome and causing 3 deaths. Hydroponically grown radish (*Raphanus sativus*) sprouts served in school lunch were epidemiologically implicated as a causative vehicle food of *Escherichia coli* O157:H7 (World Health Organization, 1996). Although intensive investigations into the manufacturer could not identify the contamination route that year, in small outbreaks occurred in Yokohama and Gamagori Cities in March 1997 outbreak (World Health Organization, 1997) it was revealed that the same lot of radish seeds was used but by a different manufacturer from Sakai. This suggested the contamination of the seeds before introducing to the farms.

Same lot of radish seeds that was stocked and left in wholesalers was subjected to the examination of *E. coli* O157:H7 and its relating genes. From the examination of 112 kg of existing seeds, *E. coli* O157:H7 was not isolated but Verotoxin gene was detected.

Research institutes in Japan initiated studies on the behavior of the bacteria on and in radish sprouts. The edible parts, the cotyledons and hypocotyls, became heavily contaminated with *E. coli* O157:H7 after the rapid growth of the bacteria at the time of germination of radish, when they were grown from seeds soaked in *E. coli* O157:H7 -inoculated water. These same parts became contaminated with *E. coli* O157:H7 when their roots were dipped into *E. coli* O157:H7 –inoculated water (Hara-Kudo et al. 1997). They also demonstrated the presence of viable enterohemorrhagic *E. coli* O157:H7 not only on the outer surfaces but also in the inner tissues and stomata of cotyledons of radish sprouts grown from seeds that had been experimentally contaminated with the bacterium (Itoh et al. 1998).

The epidemiological and experimental evidence emphasized the importance of establishing hygienic guideline for growing radish sprouts, including use of seeds free from *E. coli* O157:H7 and control of water.

## THE JAPANESE HYGIENE PRACTICE MANUAL FOR RADISH SPROUTS PRODUCTION

This manual was developed on October 14, 1996 by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) in cooperation with the Ministry of Health and Welfare, in order to improve sanitation level in radish sprout production and to recall public trust on the products. After the detection of Verotoxin gene, MAFF revised the manual on March 30, 1998.

The manual has adopted the concept of HACCP and identifies supplied water and seeds as critical control points (CCP).

The content of the manual includes,

1. Purpose
2. Scope
3. Definition of terms
4. Guidelines for production management
5. Guidelines for facilities and equipment
6. Protocol of sanitary management operation
7. Miscellaneous

with examination protocols of radish sprouts for *E. coli* and other enterohemorrhagic *E. coli* as an Annex.

***Extracts from the revised manual are listed below.***

1. Purpose of this manual

This manual was developed for preventing potential sanitary hazards during processing and shipping of radish sprouts. Guidelines and practices for processing and shipping sprouts are indicated, mainly in terms of biological control. Such manners are expected to improve and maintain sanitation in radish sprout production.

2. Scope of indication

This manual shall be applied to radish sprout production from industrial indoor facilities, using boxes and other type of containers.

3. Definition of terms

4. Guidelines for production management

3) Water supply

(i) When water other than piped water (such as well and ground water) is used, the quality shall be in compliance with water law article #4 (law #177, 1957) and the Ministry Order on Water Standards (the Ministry of Health and Welfare Order #69, 1992). Water quality tests shall be examined in accordance with these laws, and results shall be kept for 1 year.

(ii) When water other than piped water is used, sterilization and filtration devices shall be examined at least twice a day, including the time immediately after starting.

5) Control of seeds, sodium hypochlorite and other chemicals and radish sprouts

(i) Sodium hypochlorite and other chemicals for sterilization of water shall be of the approved type for food additives. They must be used separately from that used for seed sterilization. However, sodium hypochlorite and other chemicals, used for sterilization of water, may be used for seed sterilization.

(ii) On soaking, seeds shall be washed with and adequate amount of water. In addition, soaking shall be done with running (not pooled) water. There are few methods for sterilization of the seeds, such as using sodium hypochlorite or calcinated calcium compounds. However, choose a suitable one for the production line.

5. Guidelines for facilities and equipment

6. Protocol of sanitary management operation

Important management points of biological control of radish sprout production are management of ingredient seeds and water. Thus, the following shall be performed to prevent seeds and water from potential fecal bacterial infections, such as *E. coli.*

i) ingredient seeds

(1) Seeds shall be sterilized by the methods of 4-5)-(5). Prior to use, at least 1 sample from the same lot number shall be collected and tested. An external company shall test the seeds, and record the results.

(2) When *E. coli* is detected, further test shall be conducted to distinguish whether it is a Verotoxin producing strain (VTEC), or *Salmonella*. If VTEC or *Salmonella* is present, the ingredient seeds of the same lot number shall be suspended, and the seed wholesaler must be informed immediately about the possibility of VTEC or *Salmonella* contamination.

4) confirmation by product examinations

In order to confirm that preventive actions for *E. coli* contamination is definitely taken, product examinations on *E. coli* shall be conducted more than once in a month and recorded.

5) management operation protocol and record keeping.

## CONCLUSION

Through our sorrowful experience of a large outbreak that occurred at school, hygiene practice manual for radish sprouts production was prepared by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) in cooperation with the Ministry of Health and Welfare in October 1996 in order to prevent potential sanitary hazards during processing and shipping of radish sprouts. Since then, there is no outbreak or sporadic case relating to radish sprouts in Japan. The MAFF further developed Guide to Minimize Microbiological Food Safety Hazard for Hydroponic Leaf-vegetables in March 1999.

***References***

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