A Historical Verification of Hygiene Management and Food Allergy Management of School Lunches in Japan

Takako Takahashi*¹ and Hiromi Ishida*²

*¹Laboratory of Nutrition and Foodservice Management, Faculty of Home Economics, Kobe Women’s University
*²Laboratory of Administrative Dietetics, Kagawa Nutrition University

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ABSTRACT

Objective: This study aimed to examine a historical verification of hygiene management and food allergy management of school lunches in Japan.

Methods: We investigated the trend of past food poisoning from school lunches. We also examined each of the Standards of Hygiene Control of School Lunches. Furthermore, we investigated the historical backgrounds of standards related to hygiene management of school lunches, and showed changes in such standards up to the present. Regarding food allergies, we compiled data on current efforts by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

Results: Prompted by the first food poisoning fatalities caused by school lunches, the then Ministry of Education (currently MEXT) issued the Standards of Hygiene Control of School Lunches (“Old Standards”) as a notice in 1997. Subsequently, the “School Lunch Act” was largely revised and came into force on April 1, 2009, to work out an appropriate implementation of hygiene management. Under this revision, Article 9 of the School Lunch Act set the Standards of Hygiene Control of School Lunches according to a standard stipulated by MEXT (“New Standards”). Currently, each board of education in each territory is preparing and improving the manuals under the food allergy guidelines at school lunches.

Conclusions: For measures against both food poisoning and food allergies, it is important to decrease human errors as well as to educate people.


Key words: school lunch program, hygiene management, food allergy

I. Introduction

Securing food safety is the most important problem meal services face in continuously providing meals to a large number of people from a specific group. Various measures have been taken in school lunch programs to prevent the incidence of food poisoning, particularly for children who are growing but whose resistance is relatively weak. Against the background of the spread and continuous development of school lunch programs over more than 100 years in Japan, a high level of safety can be said to exist. However, accidents have occurred, including fatalities due to school lunches. That accidents could not be prevented is attributable to the fact that adequate measures corresponding to changes in school-lunch operations were not taken in response to such social factors as changes in food production/distribution, cooking processes, the number of meals, and separation of the place of cooking from that of eating. The system of hygiene maintenance and its methods have been reviewed each time an accident occurred, so as to prevent a recurrence.

The present study conducted a historical verification of hygiene management and food allergy management for safe and secure provision of school lunches, and aimed to clarify future problems to be solved under the circumstances of changing operation systems and facilities.

II. Method

We investigated the trend of past food poisoning from school lunches. From the report on incidents of food poisoning from school lunches by the Ministry of Education,
Culture, Sports, Science and Technology (MEXT) and food poisoning statistical data by the Ministry of Health, Labour and Welfare (MHLW), we compiled the number of incidents of food poisoning and the number of affected people. We also classified the outline of the Standards of Hygiene Control of School Lunches that came into practice on April 1, 2009 (hereinafter called “New Standards”) into the items of organization, human (labor), materials (food ingredients), and facilities, and we examined each of them. Furthermore, we investigated the historical backgrounds of the standards related to the hygiene management of school lunches, and showed changes in such standards up to the present.

On food allergy, we compiled the data on current efforts by MEXT.

### III. Results

1. **Standards of Hygiene Control of School Lunches and historical background of them**

In 1996, food poisoning caused by enterohemorrhagic Escherichia coli O-157 (hereinafter called O-157) occurred in several schools and areas in Japan. The number of O-157-affected patients exceeded 2,000. Ultimately, five people died. Samples of the school lunch portions that were provided to the children at the time of the food poisoning were preserved for three days in accordance with regulations. However, the latent period of O-157 is more than four days, which did not allow the preserved samples to be tested. Although pathogenic bacteria were identified from the stools of the patients, it was impossible to identify the causative food because of the short period the samples were preserved.

Prompted by the first food poisoning fatalities caused by school lunches, the then Ministry of Education (currently, MEXT) issued the Standards of Hygiene Control of School Lunches (hereinafter called “Old Standards”) as a notice in 1997. Subsequently, the “School Lunch Act” was largely revised and came into force on April 1, 2009, to work out an appropriate implementation of hygiene management. Under this revision, Article 9 of the School Lunch Act set standards of hygiene control of school lunches according to a standard stipulated by MEXT (“New Standards”). Each board of education of all prefectural, city, and town governments had prepared its own hygiene management manual for school lunches, based on the old standards at the time they were published.

2. **Changes to the legal basis of the Standards of Hygiene Control of School Lunches**

Table 1 shows the transition of standards related to hygiene management in school lunches. The old standards issued as the 1997 notice have been revised up to three times now, in 2003, 2005, and 2008. For each of these three revisions, the social background was taken into consideration.

Firstly, the standards were partially revised in 2003, based on comments by the former Agency of General Public’s “Report on the Results of Administrative Inspection on Safety and Hygiene of Food” and the situations surrounding school lunches. According to comments in the “Report of Administrative Inspection Results on Safety and Hygiene of Food (October 2000)”, the inspection results of 37 facilities/equipment for school lunches showed inadequate hygiene management, which became one reason for the said revision in 2003. The items contained in the large quantity of cooking facilities hygiene management manuals stipulated by the Ministry of Health (currently, MHLW) were not included in the Standards of Hygiene Control of School Lunches, and disassembling/cleaning of cooking machines was not adequate, which caused the food poisoning incidents at the school lunch facilities. As a result, the aim of this revision in 2003 was to be consistent with the hygiene management manual prepared by MEXT for a large number of cooking facilities.

Next, the system of diet and nutrition teachers started in Japan in April 2005, and in accordance with this system, the relevant provisions have been put in place. In the “Government’s policy toward the fourth proposal in the special zone for structural reform (February 20, 2004)”, it was pointed out that if the standards of hygiene control of school lunches were revised during 2004 school year, and each establisher of schools judged that the said revision in 2005 may not cause any problems in implementing safe school lunches, the possibility of adopting a chilling system for cooked food (in which quick-frozen heated food is preserved, and reheating is possible when necessary) should be established properly. As a result, the points of attention for hygiene management regarding the chilling method for school lunches that were adopted...
### Table 1  Transition of food safety management standards of school lunch programs with social backgrounds

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<tr>
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<tbody>
<tr>
<td>1996</td>
<td>Death due to food poisoning caused by O-157 after consumption of a school lunch.</td>
<td>A large quantity of cooking facilities hygiene management manuals was issued by the Ministry of Health, Labour and Welfare.</td>
</tr>
<tr>
<td>1997</td>
<td>Standards (former ones) of school lunch hygiene management were issued.</td>
<td>In the “report of administration inspection on the safety &amp; hygiene of food” (October in 2000), the former General Affairs Agency pointed out that consistency with the large quantity of cooking facilities hygiene management manuals of the Ministry of Health, Labour and Welfare should be ensured.</td>
</tr>
<tr>
<td>2000</td>
<td>Amendment of the former standards of the Ministry of Health, Labour and Welfare, to ensure consistency with the large quantity of cooking facilities hygiene management manuals.</td>
<td>Based on “The Government’s policy to the 4th Proposal for the Special Deregulation Zone for Structural Reform” (February 20, 2004), the standard of the school lunch hygiene management were amended during the fiscal year of 2004, and the feasibility of adoption of a cook-chill system in school lunch programs were clarified.</td>
</tr>
<tr>
<td>2003</td>
<td>Amendment of the former standards of the Ministry of Health, Labour and Welfare, to ensure consistency with the large quantity of cooking facilities hygiene management manuals.</td>
<td>Following the start of the Nutrition Educator System, related regulations were consolidated, and the former standards were amended to clarify points concerning food safety management in cases of the introduction of cook-chill systems in the school lunch program.</td>
</tr>
<tr>
<td>2004</td>
<td>Incidents of health hazards caused by made-in-China chilled GYOZA (Chinese dumplings), and cases in which residual pesticide and foul smells were detected from chilled processed foods.</td>
<td>The School Lunch Act (Act No: 160 of 1954) was largely amended to ensure the proper implementation of hygiene management, and these new standards were put into force.</td>
</tr>
<tr>
<td>2005</td>
<td>Amendment of former standards.</td>
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<tr>
<td>2007</td>
<td>The School Lunch Act (Act No: 160 of 1954) was largely amended to ensure the proper implementation of hygiene management, and these new standards were put into force.</td>
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<tr>
<td>2008</td>
<td>Incidents of health hazards caused by made-in-China chilled GYOZA (Chinese dumplings), and cases in which residual pesticide and foul smells were detected from chilled processed foods.</td>
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<tr>
<td>2009</td>
<td>Amendment of former standards.</td>
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were appended to the revision in 2005.

From 2007 to 2008, various health incidents such as that of a Made-in-China Gyozza (pot sticker) that occurred in Japan, the detection of agricultural chemicals from frozen processed food, and an incident in which an unusual smell was found in food were confirmed in succession. Based on these events, partial revisions were made in 2008 for further improvement of hygiene management for school
lunches. The major points of revision in 2008 concerned the purchase of food, acceptance of inspection/storage, inspection of food/preserved food, prevention of infectious disease/food poisoning incidents, and the response to their occurrences.

On April 1, 2009, the old standards were abolished. Then the new standards were largely revised and came into force, to work out an appropriate implementation of hygiene management. In particular, as the old standards were only a guideline that was indicated by the notice, a situation existed in which hygiene management was not completely implemented. Improvement was realized by enacting a law as a legal basis for the new standards, thus clarifying the legal positioning. In accordance with Sections 2 and 3 of Article 9 of the above-mentioned law, the law was revised for the preparer of the school lunches by making efforts to perform appropriate hygiene management in view of the new standards, as well as in making his or her responsibility clearer. Thus, the responsibility of a principal has become heavier. The new standards were formulated, based on the old standards. Among other things, parts of the hygiene management standard and health control of the employees responsible for the school lunches were changed to standards corresponding to the events caused by norovirus. They were revised to require that all records be kept for one year.

3. Trends of food poisoning incidents since the setting of standards for hygiene management

Figure 1 shows the trends of food poisoning incidents and the number of affected people (school children) between 1997 and 2014 during which the old standards were in force. First, in both 1997 and 1999, the number of cases of food poisoning peaked at 10, after which the incidents declined. According to the Implementation survey of school lunches, the number of schools where the school lunch program is implemented, either by a commissary system for school lunches or a conventional system, was 31,018 in Japan in 1997. These 10 cases of food poisoning caused by school lunches were very few by far, in comparison with food poisoning in other meal-providing facilities and restaurants. Next, the number of people affected by food poisoning of school lunches exceeded 1,000 every few years. Both the food poisoning incidents and the number of affected people were especially high in 1997. However, since the enforcement of new standards in 2009, the number of food poisoning incidents fell, but the number of affected people rose, depending on the year. Figure 2 shows the transition of the outbreak of food poisoning, and the number of symptomatic people.
because of school lunches provided by school kitchens from 1998 to 2016. Figure 3 shows the transition of the outbreak of food poisoning, and the number of symptomatic people, because of school lunches provided by collective kitchens from 1998 to 2016. In 1998, three cases of collective kitchen-caused food poisoning occurred, but incidents have tended to decrease since then. In 2011, food poisoning incidents were higher in number at collective kitchens than at school kitchens. Except for these incidents, food poisoning occurred more often at school kitchens than at collective kitchens, but the incidents tended to decline in number. In 2010, the incidence of food poisoning was 0 at collective kitchens and school kitchens. Combined with the number of affected people, food poisoning incidents caused at collective kitchens were high in 2011, with a large number of affected people as well. Taken together, the number of food poisoning incidents was high at school kitchens, but the number of affected people was bigger in collective kitchens.

Based on food poisoning incidents by causative agents, viral food poisoning has been occurring since 1999. Since then, except for 2010, viral food poisoning, especially caused by norovirus, has occurred frequently throughout the year, irrespective of the season. In cases in which the causative foods were identified at the school lunch facilities from 2000 to 2013, food poisoning due to norovirus and salmonella bacteria affected more than 100 people at one time. In 2011, as many as 1,522 people suffered food poisoning because of salmonella bacteria that were identified at a collective kitchen in Hokkaido.

4. Contents and composition of the Standards of Hygiene Control of School Lunches

Table 2 shows the classified new standards expressed in organization, human (labor), materials (food ingredients), and facilities, together with the general hygiene program.
### Table 2  Norms for hygiene supervision of school lunches

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
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<tbody>
<tr>
<td>Principal</td>
<td>The principal shall give consideration to the safe implementation of the school lunch program. The principal shall develop a system for thorough hygiene supervision of school lunches and make appropriate use of it.</td>
</tr>
<tr>
<td>School lunch nutritionist</td>
<td>As part of the hygiene supervision system, a diet and nutrition teacher or a school dietitian with similar qualifications shall be designated as hygiene supervisor.</td>
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<table>
<thead>
<tr>
<th>Human (labor)</th>
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<tbody>
<tr>
<td>Physical situation</td>
<td>Perform daily health checks and conduct a medical examination once a year.</td>
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<td></td>
<td>Conduct a stool test for Shigella, Salmonella, enterohemorrhagic Escherichia coli serotype O157, and other bacteria that need to be tested for at least twice a month.</td>
</tr>
<tr>
<td>Clothing</td>
<td>Wear special clean cooking clothes, aprons, masks, caps, and footwear while cooking and serving.</td>
</tr>
<tr>
<td>Hand washing</td>
<td>Clean and disinfect hands and fingers before starting work, after using the washroom, before moving from a contaminated work area to an uncontaminated work area, immediately before starting work and directly touching food, and before touching foods and utensils after touching raw meat, fish, shellfish, eggs, and uncooked vegetables.</td>
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<tr>
<th>Materials</th>
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<tbody>
<tr>
<td>Water</td>
<td>Before and after cooking every day, the water used shall be tested to verify that the free residual chlorine concentration is 0.1 mg/l or more and the results shall be recorded.</td>
</tr>
<tr>
<td>Food</td>
<td>Avoid foods that are excessively processed, carefully select hygienic foods that are fresh, and avoid harmful or suspicious foods. As a rule, foodstuffs for school lunches shall not be cooked the day before and all cooking shall be done at the school lunch preparation facility on the day. To prevent secondary contamination, prepare an operation schedule for cooking, indicating a procedure, time, and person in charge of cooking for each menu and a work flow diagram showing the process of preparing the food.</td>
</tr>
<tr>
<td>Cooking</td>
<td>From the viewpoint of prevention of secondary contamination, vegetables shall be cooked as a rule. Regarding foodstuffs to be cooked, it shall be confirmed through the use of a food thermometer that the central part of all heated foods have been heated to 75°C for one minute or longer (to 85°C for one minute or longer in case of foodstuffs with bivalves that may be contaminated with norovirus) or a temperature equal to or higher than this and the temperature and the time shall be recorded.</td>
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| Inspection                    | When inspecting delivered goods, the name, quantity, delivery time, supplier, manufacturer and its location, place of production, quality, freshness, presence/absence of foreign body contamination, expiration date, manufacturing date, and temperature of each item shall be inspected every day and the results shall be recorded. |

| Food for sanitation test      | As for preserved food, about 50 g each of raw materials, processed food, and prepared food shall be separately sealed in a clean container such as a vinyl bag every day and stored in a special freezer at –20°C or lower for at least two weeks. |

| Meal evaluation               | The prepared lunch shall be examined at least 30 minutes before lunch begins by a designated responsible people. |

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<tr>
<th>Facilities</th>
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<tbody>
<tr>
<td>Kitchen</td>
<td>Try to introduce a dry system to maintain dryness for the floor of a kitchen to suppress bacterial breeding. Check for the presence of rats and pests at least once a month. From the viewpoint of prevention of secondary contamination, partition the area in each room into a contaminated work area, a clean work area, and another area. Try to keep room temperature below 25°C and humidity below 80%, and check and record the temperature and humidity inside the cooking chamber.</td>
</tr>
<tr>
<td>Machines</td>
<td>Use movable machines and equipment and arrange them so that their arrangement matches the cooking process.</td>
</tr>
<tr>
<td>Containers</td>
<td>Special cooking utensils and containers shall be provided for each type of food, such as meat, fish, shellfish, eggs, vegetables, fruits, and the like, and each utensil and container shall be distinguished from the others, depending on the cooking process: pretreatment, cooking of raw food, cooking of cooked food, and so on.</td>
</tr>
<tr>
<td>Clothing</td>
<td>Aprons, footwear, and the like shall be clearly distinguished, depending on the type of work for which they are used.</td>
</tr>
<tr>
<td>Hand washing</td>
<td>Install a hand-washing facility in the front room and a bathroom stall of the restroom. Soap solution, rubbing alcohol, paper towels, and the like shall be always provided in hand-washing facilities for school lunch workers. Avoid using cloth towels.</td>
</tr>
</tbody>
</table>
It is stipulated that the school lunch nutritionist shall be a diet and nutrition teacher or a school dietitian, and the principal is instructed to establish a system in cooperation with experts and/or guardians to thoroughly ensure hygiene management with the people involved in school lunches for appropriate operation.

On hygiene management of the people concerned, to prevention of food poisoning caused by the employees in charge of cooking, a stool inspection is stipulated to be implemented more than twice a month throughout the year.

On materials (food ingredients), the ingredients are to be inspected before use and the meals inspected after cooking, and their samples are to be kept for two weeks. To prevent secondary contamination, vegetables are to be heat-cooked as a rule. During heat-cooking, the food temperature must be measured and recorded. Basically, it must be confirmed that the food temperature is over 75°C for more than one minute and that, in case of anticipated contamination by norovirus, the foods are to be heated to 85°C or above for over one minute to destroy norovirus. For prevention of secondary contamination, creation of a cooking worksheet indicating cooking procedure, time, and names of people in charge per recipe, as well as the work flow line diagram showing the process of preparing the food, is required.

Regarding the facilities/equipment, a dry system is recommended to prevent food poisoning caused by secondary contamination of food due to water splashed from the floor. By clearly dividing the work area into a contaminated zone and a non-contaminated zone, the standards ensure that only food is transferred so as not to intersect with the work flow line, thus preventing secondary contamination. The facilities are required to be checked for pests such as mice more than once a month, and if pests are confirmed, pest extermination is required to be conducted. From the standpoint of preventing food poisoning, the temperature inside the kitchen is to be under 25°C, moisture must be kept below 80%, and both the temperature and moisture during cooking are required to be recorded. Hand-washing facilities are also required to be properly set up. To avoid bringing pathogenic hand-carried bacteria or dirt into the kitchen, a washroom and hand-washing facilities exclusively for the employees responsible for school meals are to be provided in each of a front room, a bathroom stall of the restroom, and a work zone.

5. Response to food allergies

Based on the “Survey report on allergy diseases in 2007” and an interim “Survey on health control in school life” in 2013, we show the prevalence rate of food allergies in Figure 4. The prevalence rate of food allergies indicates the ratio of the number of school children who received diagnoses of food allergy from physicians at the time of the survey to the total number of school children surveyed in the whole of Japan. The six-year prevalence rate of food poisoning allergies almost doubled in primary schools. In 2008, under the supervision of MEXT, the Japanese Society of School Health (Public Interest Incorporated Foundation) published the “Guideline for responding to allergy ailments at schools” (hereinafter called the “Guideline”) for dealing with food allergies. For food-allergic children, provision of allergen-removed or substitute foods in school lunches has been implemented under the Guideline. However, a food-allergic child died after eating a school lunch in 2012 under the suspicion of anaphylactic shock. Thus, for the purpose of promoting efforts to prevent food allergy incidents in schools and kitchens, MEXT created the “Guideline for food allergy at school lunch services” in March 2015. This guideline showed the countermeasures to be taken against food allergies at schools such as thorough implementation of measures under the Guideline, leveling-up of workshops for teachers, utilization of an EpiPen® (adrenalin auto-injector) in case of emergency, and building a cooperation system with related organizations, as well as drawing up a policy for specific implementation, that related organiza-

![Figure 4](image-url)
tions such as the government, boards of education, and schools should actively implement on their own initiative. Currently, each board of education in each territory has been preparing and improving the manuals under the food allergy guidelines at school lunches(7).

IV. Considerations

Since the consolidation of the former standards of food safety management of school lunches in Japan in 1997, no cases of death have been reported. Despite the decreasing occurrence of food poisoning, there still have been some outbreaks.

Taken together, food poisoning was seen more often in school kitchens than at collective kitchens. On the other hand, in commissary systems, there are many diners who eat meals provided by a collective kitchen. Therefore, if food poisoning occurs even once, many people are affected.

For hygiene control under the new standards(3), stool examination is stipulated to be carried out more than twice a month throughout the year to prevent food poisoning caused by employees engaged in cooking. According to the hygiene management manual(15) for large cooking facilities in Japan, stool examination is required generally more than once a month for employees engaged in cooking. Compared with this frequency of examination, the standards of hygiene control of school lunches can be said to be much more severe. To confirm how Japanese standards of food safety management are strictly implemented, we compared this to standards in Korea, which has a common food culture, in which rice is a staple food. In Korea, regarding inspected meals and preserved meals, preserving 100 g of each cooked dish for 144 hours (six days)(20) below −18°C is obligated by law(21). If these conditions are compared with those of Japan, the preservation time is shorter in Korea, and is approximately only half. Moreover, in Korea preserving food ingredients is not obligatory. However, if the inspected meals and preserved meals are not preserved, a penalty is imposed(20). To probe the causes of food poisoning at the time of outbreak, it has been stipulated in Japan that meals for inspection and preservation adhere to precise regulations. These are that approximately 50 g of each of the materials before and after cooking, as well as the finished food, should be preserved at −20°C for two weeks to cover the latent period. To prevent secondary contamination, vegetables are to be heat-cooked as a rule. From these conditions, the school lunches are safe in terms of prevention of food poisoning. On the other hand, as heat-cooking is assumed for the vegetable dishes, it cannot be denied that the variety of menus may become limited. In the new standards(3), the measured center temperature recorded at the time of heat cooking and the recorded temperature and moisture in the cooking room can be confirmed retroactively, which allows us to look into the causes at the time food poisoning occurs. For thorough hygiene management, hygiene education is essential for the people concerned. For this purpose, thorough hand washing of the workers of school lunches, and daily on-the-job education on food safety management (and on why it is necessary to observe the new standards(3)) are required.

The ingredients of school meals are also limited to domestic products, considering the spirit of taking care of the Japanese food culture, and because it is easier to discover possible problems with the ingredients. Recently, from February to March 2017, large-scale food poisoning caused by norovirus occurred in primary schools in Tachikawa City and Kodaira City, in Tokyo. The causative ingredient was attributed to the shredded Nori (dried seaweed) of a domestic dried ingredient. Dried goods are not the object of examination for preserved food. In addition, foodstuffs that were neither disinfected nor heated at the school lunch service facilities were found to be a cause. From these findings, even if the new standards(3) are obeyed, it cannot be said that food poisoning is preventable. For school lunch programs, through reviews of large-scale food poisoning having taken place every few years, a new countermeasure has been established. Nevertheless, it is not perfect. It is necessary to explore a problem and to take countermeasures. For hygiene management, the first prerequisite is education of the people concerned.

The prevalence of food allergies and the incidence of anaphylaxis in school lunch services have both been increasing. Manuals for coping with food allergies and anaphylaxis are now being prepared at each board of education. The current problem lies in what, how, and how far food allergies should be dealt with in the meal service operation, in which human error such as wrong serving
should not occur. The tendency of the approach, which is shown in the guideline for coping with food allergies in school lunch programs⁹, may lead to thorough hygiene control actions being taken when food poisoning occurs, based on the new standards³, in addition to the response to food allergies, from the viewpoint of coping with matters to be addressed at school.

V. Conclusions

Since large-scale food poisoning due to O-157 accompanied by fatalities occurred in 1996, the old standards⁹ and the new standards³ were put into practice. These standards have been repeatedly revised because of the changing social background and the food-poisoning incidents. The current standards give instructions on the hygiene management system from the viewpoint of general hygiene programs, and hygiene management for human (labor), materials (food ingredients), and equipment/facilities. Each time hygiene management is revised, safe and secure provision of school lunches under more difficult conditions has been implemented. Even if a new action is taken, there is no end in accomplishing hygiene management of school lunch programs.

The standards for coping with food allergies in school lunch programs⁹ that were made after a food allergic child died from eating a school lunch in 2012 may be a pertinent approach leading to action being taken in case of a crisis including occurrence of food poisoning. For measures against both food poisoning and food allergies, it is important to decrease human errors as well as to educate people.

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Conflict of Interest

In the present study, there were no matters corresponding to any conflicts of interest.

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