This is Provisional English translation of the original full text

Risk Assesment Report

Choking Accidents Caused by Foods

June 2010

Food Safety Commission

Contents

Page

<History of Discussion>

April 27, 2009	Concerning "Safety of Foods that Frequently Cause Choking Accidents Including Konjac jelly," the Prime Minister requested evaluation of the effects of foods on health (Notification No. 459, Social Policy Bureau, Cabinet Office, Government of Japan). The related documents were received.
May 14, 2009	The 285th Meeting of the Food Safety Commission (The Social Policy Bureau, Cabinet Office, Government of Japan explained the request.)
June 10, 2009	The 1st Meeting of the WG for food-related choking accidents
July 8, 2009	The 2nd Meeting of the WG for food-related choking accidents
July 15, 2009	The 3rd Meeting of the WG for food-related choking accidents
August 19, 2009	The 4th Meeting of the WG for food-related choking accidents
September 9, 2009	The 5th Meeting of the WG for food-related choking accidents
January 13, 2010	The 6th Meeting of the WG for food-related choking accidents
March 4, 2010	The 322nd Meeting of the Food Safety Commission (Consumer Affairs Agency, Government of Japan, explained the additional information.)
March 10, 2010	The 7th Meeting of the WG for Food-related choking accidents
March 25, 2010	The 325th Meeting of the Food Safety Commission (reporting)
March 25, 2010 to April 23, 2010	Collection of public opinions and information
June 8, 2010	The Leader of the WG for food-related choking accidents reported to the Chairperson of the Food Safety Commission
June 10, 2010	The 335th Meeting of the Food Safety Commission (reporting) (Reporting to the Prime Minister on the same day)

<List of Members of the Food Safety Commission>

(Until June 30, 2009)	(From July 1, 2009)
Takashi Mikami (Chairperson)	Naoko Koizumi (Chairperson)
Naoko Koizumi (Deputy chairperson)	Takashi Mikami (Deputy chairperson*)
Taku Nagao	Taku Nagao
Kazumasa Nomura	Kazumasa Nomura
Keiko Hatae	Keiko Hatae
Masao Hirose	Masao Hirose
Seiichi Honma	Masatsune Murata

* From July 9, 2009

<List of Members of the WG for Food-related Choking Accidents/Special Members>

(Until September 30, 2009)
Naoko Koizumi (Chairperson)
Taku Nagao (Deputy chairperson)
Sachie Ikegami
Takeo Uchida

<Observers>
Tetsuya Iwatsubo
Hiro Ogoshi
Takehiro Karaho
Naoyuki Kono
Kaoru Kohyama
Akihiro Shiotani
Hirofumi Shimizu
Hideyuki Takizawa
Hideki Hirabayashi
Junko Fujitani
Yoshiharu Mukai
Tatsuhiro Yamanaka

(Until December 17, 2009)
Naoko Koizumi (Chairperson)
Taku Nagao (Deputy chairperson)
Takeo Uchida

<Observers>
Sachie Ikegami
Tetsuya Iwatsubo
Hiro Ogoshi
Takehiro Karaho
Naoyuki Kono
Kaoru Kohyama
Akihiro Shiotani
Hirofumi Shimizu
Hideyuki Takizawa
Hideki Hirabayashi
Junko Fujitani
Yoshiharu Mukai
Tatsuhiro Yamanaka

(From December 18, 2009)
Naoko Koizumi (Chairperson)
Taku Nagao (Deputy chairperson)
Takeo Uchida
Yasushi Yamazoe

<Observers>
Sachie Ikegami
Tetsuya Iwatsubo
Hiro Ogoshi
Takehiro Karaho
Naoyuki Kono
Kaoru Kohyama
Akihiro Shiotani
Hirofumi Shimizu
Hideyuki Takizawa
Hideki Hirabayashi
Junko Fujitani
Yoshiharu Mukai
Tatsuhiro Yamanaka

Summary

1. Introduction

In the process of this evaluation, the Food Safety Commission of Japan has attempted to conduct a scientifical evaluatation from a fair and neutral perspective. Though collected data provided from the party that requested the evaluation was limited, the Commission also collected reference materials based on a small number of case studies that had not undergone peer review and were not supported by scientific evidence. In this way, the Commission has made efforts to collect as much information as possible.. For the purpose of this evaluation, the Commission has tried to identify the actual conditions of food-related choking accidents, and to clarify the foods that frequently caused choking accidents, their physical properties and the factors on the side of consumers.

2. Actual Circumstances of Choking Accidents

The basic outline of the circumstances of food-related choking accidents can be explained as follows. General population experience aspiration or difficulty in swallowing in their daily lives. Most people recover but a few experience obstruction of the respiratory tract that cannot be cleared. These people are transported to hospital by ambulance.

The number of deaths from food-related choking accidents has increased by a factor of approximately 1.2 over the past 10 years. Much of this increase can be attributed to deaths among the elderly. This phenomenon reflects the recent trend of society becoming older and having fewer children. Mortality from food-related choking accidents is stratified according to age. Mortality among those aged 65 and over exceeded the overall average, and mortality increased with further increase in age. The number of deaths from food-related choking accidents was compared with the total number of deaths, broken down by age. The percentage of infants aged 0 to 4 years who died from food-related choking accidents was higher than the overall mortality of this age group.

Sticky rice cake and steamed rice ranked high among causative foods. The elderly accounted for more than 80% of the victims of choking accidents involving grains, including sticky rice cake, steamed rice and bread. Among infants who required emergency treatment after having choked on some food, the leading causative food was candy, and infants accounted for more than 80% of the victims who choked on candy and were transported to hospitals by ambulance. Some cases of a foreign body becoming lodged in the trachea or bronchus did not result in choking injuries. Generally more than half of the victims of such cases were infants and the foreign bodies were beans/nuts and seeds, including peanuts.

3. Foods that Frequently Cause Choking Accidents

Whether a food is frequently involved in a choking accident depends not only on the number of cases of choking accidents but also on frequency of consumption. We selected the main foods (food groups) involved in choking accidents, determined the amount of consumption by food (food group) and mouthful of each food (each food group), and calculated the frequency of choking accidents per mouthful of food. This enabled us to make relative comparisons. According to the results, sticky rice cake was the leading cause of choking followed by mini-cup jelly, candy, bread, meat, fish meat, fruit, and steamed rice. When the data on choking on konjac mini-cup jelly cup were obtained separately, it ranked third, after candy.

The Food Safety Commission speculated that the frequency of choking on a mouthful of mini-cup jelly, including konjac jelly, was as high as that of choking on candy. If no accidents are reported after the introduction of countermeasures, including labeling that prohibits the consumption of mini-cup jelly by the elderly and infants, it would indicate that the frequency of choking on such jelly is lower than that of choking on candy.

4. Factors Involved in Choking Accidents

(1) Factors Other than Foods

We confirmed that factors other than foods were deeply involved in food-related choking accidents. Human beings have a wide area of cross-over between the respiratory tract and the alimentary passage. Food taken in via the mouth passes through this high-risk site. This seems to be the basic factor on the side of consumers.

The factors on the side of consumers can be reduced and choking accidents can be prevented if the following “eating techniques for the prevention of choking” are strongly

promoted: (1) knowing physical properties of foods and how to eat safely, (2) taking small mouthfuls of food and positioning it in the front part of mouth, (3) chewing food repeatedly and mixing it with saliva, (4) concentrating on eating.

Human beings have a natural ability to recognize the texture of bolus in the mouth and adjust it by chewing and mixing in saliva, and to judge whether or not the food is ready to be swallowed. Individuals who are either going through the stage of developing of this function or suffer an impairment of this function who likely to experience aspiration or difficulty in swallowing, leading to accidental choking.

No cases of accidental death from choking on konjac mini-cup jelly have been confirmed so far among healthy young and middle-aged people (between the ages of 15 and 64 years). Due to the small number of food-related choking accidents in this age group, the Food Safety Commission of Japan speculates that age is one of the factors involved in food-related choking accidents.

Among the elderly, the following factors are likely to be involved in choking accidents: age-related physiological changes (reduced chewing force, extended distance of laryngeal elevation, decreased sensitivity of swallowing reflex and delayed induction of swallowing reflex), loss of teeth, background disease (cerebrovascular disease), swallowing function disorder and self-feeding.

Among infants, the following factors are likely to be involved in choking accidents: development of dentition and occlusion, development of eating function, and behavior.

Of non-food-related factors, environmental factors such as the level of danger awareness of carers, first-aid procedures, and assisted feeding may be involved in choking accidents.

(2) Food-related Factors

General food-related factors such as the texture (surface smoothness, elasticity, hardness/difficulty in biting off), size and shape are likely to be involved in choking accidents.

Sticky rice cake, which is regarded as the leading cause of choking accidents by mouthful, frequently causes choking accidents particularly among the elderly because of the following factors. First, biting off a piece of sticky rice cake requires considerable chewing strength. Second, sticky rice cake is soft and elastic immediately after it is placed in the mouth but a decrease in temperature during chewing results in an increase in hardness (difficulty in biting pieces off). Elderly people with decreased texture recognition/adjustment function cannot sufficiently grind sticky rice cake and mix it with saliva. This means the food is swallowed and delivered to the pharynx before chewing is complete. Third, when elderly people have decreased texture recognition/adjustment function, the food bolus which increased stickiness due to a decrease in temperature becomes stuck in the area from the pharynx to the laryngeal vestibule. Such a food bolus will occasionally reach the trachea/bronchus and attach to the surface. This sticky food bolus is difficult to remove and can obstruct the respiratory tract. This physical property of food bolus is enhanced in the respiratory tract if the surface is not sufficiently wet. In individuals with a weak cough reflex, an obstructed respiratory tract cannot be cleared.

Konjac mini-cup jelly is likely to cause choking accidents because of the following factors. First, the packaging is designed so that the eater must tilt their head back and suck the jelly into their mouth. The jelly is therefore swallowed before the larynx is completely closed, obstructing the respiratory tract. Second, konjac mini-cup jelly is harder than ordinary jelly. (It is difficult to bite off a piece of konjac jelly.) The jelly is even harder when cold. If a piece of poorly chewed konjac jelly is swallowed and passed to the pharynx, it becomes stuck in the area between the middle pharynx and the larynx, obstructing the respiratory tract. Third, poorly chewed jelly can obstruct the respiratory tract since its size and shape match the opening of the respiratory tract. If the area is too dry, it is not possible to remove or break up an elastic foreign body adhering to it. Therefore, obstruction of the respiratory tract cannot be cleared.

The Food Safety Commission of Japan notes that mini-cup jelly not made from konjac is also ingested by tilting the head back and sucking in the same way as konjac mini-cup jelly. Therefore, jelly served in a similar size and shape with similar physical or physicochemical properties may cause choking accidents with approximately the same frequency.

Uniquely, candy is ingested by "sucking." Pieces of candy obstruct the respiratory tract in the following way: After being mixed with saliva, the surface of the candy becomes smoother and more slippery and cannot be retained in the mouth. Before it becomes small enough to be swallowed safely, it is accidentally sent to the pharynx and becomes stuck somewhere around the larynx. This creates an obstruction of the respiratory tract. Such accidental swallowing of candy is more likely to cause choking accidents among infants.

We also conducted a factor analysis on other foods that were likely to cause choking accidents, such as bread, meat/fish meat, fruit, and steamed rice. But this is not a definitive list of the foods that may cause choking accidents.

5. Overseas Countermeasures

We collected and summarized overseas data on choking accidents, mainly concentrating on those involving mini-cup jelly. Generally speaking, countries other than EU member countries have taken measures with the focus on risk management. These included determination of restrictions regarding hardness and portion sizes. However, it remains unknown as to whether these were determined on the basis of scientific evidence supporting a direct causal relationship with choking accidents.

6. Conclusion

Ethical considerations prevent the simulation and testing of food-related choking accidents using human subjects. Neither can an experimental simulation using animals be conducted due to technical barriers. We could not take an epidemiological survey approach because the details of food-related choking accidents have not been thoroughly clarified and the number of total incidents is limited. In addition, we found it difficult to statistically elucidate the causal relationship with various factors. For these reasons, we attempted to identify the actual circumstances and adopted a factor analysis approach on the basis of various relevant factors including those related to food and not related to food (consumers). Accordingly, we shall consider the international trends regarding the evaluation and accumulation of domestic and overseas scientific knowledge and conduct further assessments as necessary in the future.

I. Progress of Request of Evaluation

On April 27, 2009, the Prime Minister requested an evaluation of the potential health risks posed by certain foods, with a particular focus on the safety of foods that frequently cause choking accidents, including konjac jelly. The scope of the requested evaluation was explained in detail on May 14, 2009, at the 285th Meeting of the Food Safety Commission, Social Policy Bureau, Cabinet Office, Government of Japan (Consumer Affairs Agency). (Reference 1)

Based on its understanding that food-related choking accidents were caused by different factors with respect to a large variety of foods, the Commission decided to evaluate the foods that frequently caused choking accidents themselves and report its findings on the basis of currently available knowledge. Accordingly, in order to conduct surveys and discuss the issues concerning food-related choking accidents, the Commission organized the Working Group for Food-related choking accidents. (Reference 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19)

II. Subjects

1. Process of Evaluation

Almost all foodstuffs, especially solid foods, pose a greater or smaller risk in terms of their potential to obstruct the respiratory tract following aspiration, resulting in accidental choking. The risks for food-related choking accidents are the result of various factors, including the characteristics and contents of the food, the individuals consuming the food, and the external environment. In the case of hazardous factors related to foods and their contents, we can determine the acceptable intake and evaluate the health risk using the general assessment method. In view of the complicated factors present in this case, however, we found it difficult to apply such method.

The Food Safety Commission has therefore taken the following approaches to investigate food-related choking accidents and evaluate the health risks of foods:

(i) Identifying the actual circumstances of food-related choking accidents
(ii) Identifying the foods that frequently caused choking accidents
(iii) Analyzing the factors involved food-related choking accidents
(iv) Considering countermeasures (mainly countermeasures to deal with the problems presented by mini-cup jelly) adopted in other countries.

2. "Foods that Frequently Cause Choking Accidents"

(1) Definition

The phrase "foods that frequently cause choking accidents" is adopted both in the Prime Minister's request and the document titled "Risk Profiles of the Foods that Frequently Cause Choking Accidents, Including Konjac Jelly," submitted by the Japanese Cabinet Office's Social Policy Bureau. (Reference 1) According to the definition used in these documents, this means foods that are frequently involved in fatalities resulting from the "obstruction of the respiratory tract caused by the inhalation and/or ingestion of food" (Vital Statistics, Ministry of Health, Labour and Welfare) ["unforeseen accidents," W79 "obstruction of respiratory tract caused by the inhalation and/or ingestion of food," International Classification of Diseases (ICD) 10 (revised in 2007)].

According to the ICD 10 definition, aspiration of vomit, food-related injuries (other than those due to asphyxia or obstruction of the respiratory tract), and obstruction of the esophagus by foods (with no asphyxia or obstruction of respiratory tract) are excluded from "W79." (Reference 20)

(2) "Aspiration"

Aspiration indicates accidental entrance of foods and saliva, which are supposed to enter the esophagus, into the respiratory tract (the portion below the glottis). Aspiration is classified into the following two types: apparent aspiration, in which suffocation is present, and silent aspiration, with no suffocation. Microaspiration caused by saliva only is also classified as silent aspiration. Because this type of

aspiration is different from aspiration relating to foods that generally cause obstructions of the respiratory tract, microaspiration is not discussed in this report.

(3) Foreign Body in the Respiratory Tract

Once food enters the respiratory tract and remains in some portion of it, it becomes a foreign body in the respiratory tract (Fig. 1). (Reference 21, 22)

a. Various things, including fish bones, have been known to enter the larynx. Depending on their properties (sticky rice cake etc.) and location, foreign bodies can thoroughly obstruct the respiratory tract. In infants, beans, seeds and nuts (even things other than foods, such as rubber balloons) can come to overlie the glottis, get caught in the glottis, or become stuck in the infraglottic space as "dancing" foreign bodies, with the possibility that they may eventually cause serious difficulty in breathing or choking.

b. A foreign body caught in the trachea in the infraglottic space causes irritation, induces a severe cough and gets stuck in the lower part of glottis. Such foreign body may cause expiratory dyspnea leading to choking.

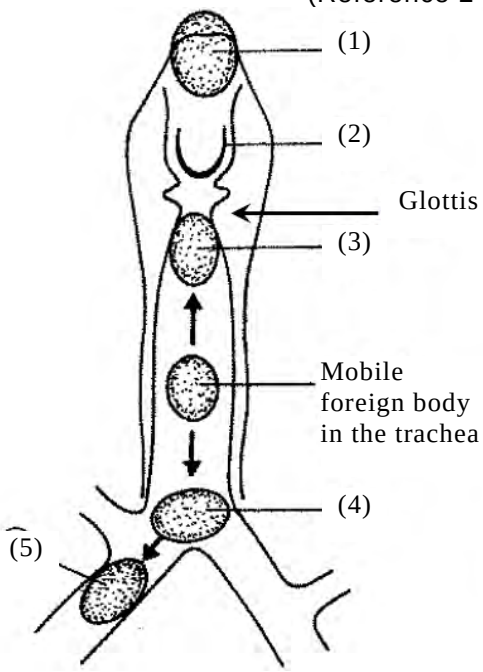
c. Once inside the trachea, depending on its size, the foreign body may cause obstructing suffocation or may become a mobile within the trachea and cause dyspnea. An infant who ate too many peanuts was reported to have died from obstruction of the area between the tracheal bifurcation to the bronchi. (Reference 5, 23)

Of foreign bodies in the respiratory tract, those described in "a" and "b" shown above ((1), (2), and (3) in Fig. 1) are likely to be the direct cause of choking accidents. Foreign bodies that reach the trachea/bronchus [excluding those described in "b" above ((3) in Fig. 1)] (foreign body in the trachea/bronchus) may get stuck in the bronchial space on the one side but cause no symptoms, provided they do not take the course described in "c" above.

Although the reports and data on food-related choking accidents are limited, numerous cases of foreign bodies in the trachea/bronchus that did not result in choking accidents, including those due to causes other than foods, have been reported, mainly in the field of otolaryngology. These reference materials provided us with plentiful data that assisted us in our attempt to identify the actual circumstances of choking accidents and conduct a factor analysis.

Although we did not examine the cases of foreign bodies in the trachea/bronchus that did not result in choking accidents and their causative foods and other factors as part of this evaluation, we will refer to the findings related to such cases in the process of identification of the factors involved in choking accidents as necessary.

Fig. 1: Positions of foreign body in the respiratory tract
(Reference 24 [partial modification])



(1) The laryngeal vestibule is obstructed.

(2) A membrane like substance overlies the glottis (expiratory dyspnea).

(3) The foreign body gets stuck in the lower part of the glottis after severe coughing (expiratory dyspnea).

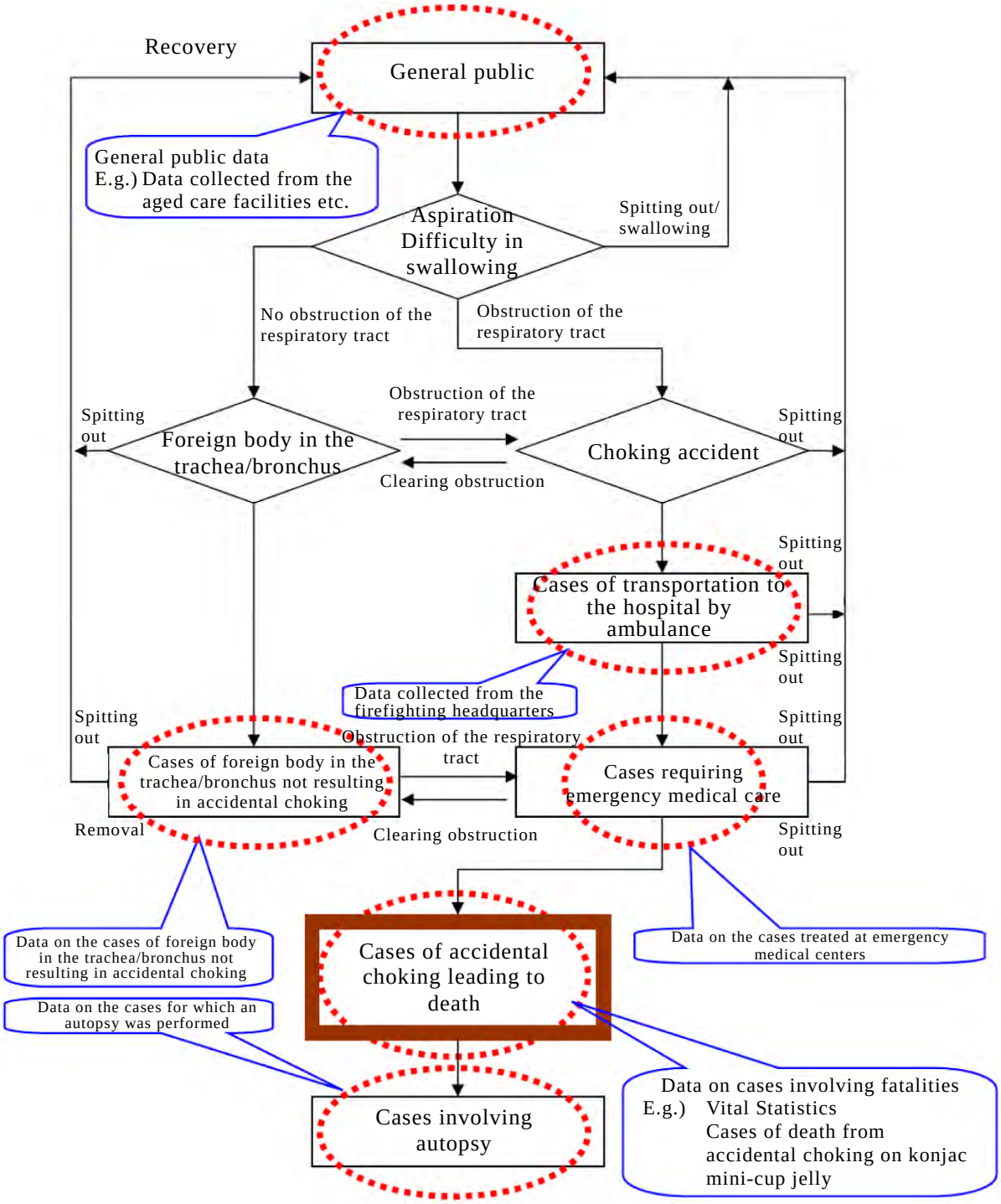
(4) The foreign body falls and obstructs the bronchial spaces at the tracheal bifurcation (expiratory dyspnea).

(5) The foreign body falls in the bronchial space, gets stuck, and becomes fixed (asymptomatic period).

III. Actual Circumstances of Food-related Choking Accidents

An inventory survey that would clarify the circumstances of all food-related choking accidents, along with the causative foods, has not been conducted in Japan. We therefore constructed a scenario of (fatal) food-related choking accidents, starting with aspiration of food or difficulty in swallowing (Fig. 2) and took a comprehensive approach to identify the actual circumstances of food-related choking accidents using the conventional data by population at each stage of the scenario.

Fig. 2: Relationship between the scenario of (fatal) choking accidents and relevant conventional data



1. General Public Data

(1) Data Collected from Aged Care Facilities

a. Ambulatory Facilities (2003-2004)

For the period from 2003 to 2004, a survey of choking histories and causes of choking was conducted on elderly people who required nursing care at home and regularly visited ambulatory facilities in Tokyo. Of 308 respondents, 36 had experienced food-related choking over the past 1 year (11.7%). Thirty-one of them identified the following causative foods: steamed rice (15 cases; 48.4%), meat (5 cases; 16.1%), sticky rice cake (4 cases; 12.9%), vegetables and fruit (2 cases; 6.5%), bread (2 cases; 6.5%). The causative foods remained unknown in the remaining 5 cases. Univariate analysis revealed the following significant risk factors: "ability of daily living (ADL)" ($p<0.05$), "cognitive function" ($p<0.05$), "history of cerebrovascular disease" ($p<0.05$), "use of drugs affecting the swallowing function (psychotropics, antidepressants, etc.) ($p<0.05$), "formula diet (porridge, chopped foods, etc)" ($p<0.01$), "assistance with eating" ($p<0.01$), "swallowing function" ($p<0.01$), and "force of tongue movement" ($p<0.05$). Furthermore, we conducted logistic regression analysis using the items judged to be significant in univariate analysis as independent variables and presence/absence of history of accidental choking as a dependent variable. According to the results, "history of cerebrovascular disease" [$p<0.01$, odds ratio (OR) 8.14 (95% confidence interval (CI) 1.52-9.47)] and "swallowing function" [$p<0.05$, OR 6.31 (95% CI 1.29-7.98)] were adopted as significant explanatory variables. (Reference 25)

b. Residential Facilities (2008)

In 2008, the residents and staff of nursing care facilities for the elderly located in Tokyo, Yamanashi, and Hokkaido, were asked about food-related choking experiences over the past 30 months. Of 437 residents, 51 (11.7%), including 2 who died, experienced food-related choking. The causative foods included vegetables (7 cases; 13.7%), fruit (4 cases; 7.8%), meat (4 cases; 7.8%), and fish meat (4 cases; 7.8%), steamed rice (3 cases; 5.9%), and bread (1 case; 2.0%). None identified "sticky rice cake" as a causative food, and 29 respondents (57%) reported that the causative food was "unknown." The authors speculate that the majority of respondents selected "unknown" because many residents were served meals of chopped or blended foods. Univariate analysis revealed the following significant risk factors: "ADL" ($p<0.05$), "cognitive function" ($p<0.01$), "independent feeding" ($p<0.001$), "collapse of occlusal support in the molar region" ($p<0.05$), and "swallowing function" ($p<0.01$). Furthermore, we conducted logistic regression analysis using the items judged to be significant in univariate analysis as independent variables and presence/absence of history of accidental choking as a dependent variable. According to the results, "cognitive function [$p<0.05$, OR 2.0 (95% CI 1.1-3.9)], "independent feeding" [$p<0.05$, OR 2.5 (95% CI 0.1-0.9)], "collapse of occlusal support in the molar region" [$p<0.05$, OR 2.2 (95% CI 1.0-4.6)] were adopted as significant explanatory variables. (Reference 26)

(2) Rate of Accidental Choking among Children

In 2009, 1,015 mothers with children aged 15 or younger were asked if their children had experienced food-related choking over the past year. Of those, 6.2% responded affirmatively (63/1,015). (Reference 27)

2. Data Collected from Firefighting Headquarters

(1) 80 Firefighting Headquarters (1998)

Ninety-six firefighting headquarters nationwide were asked about the number of calls requesting ambulance in 1998. Of these, 80 responded to the inquiry. According to their responses, ambulances were dispatched in 810 cases of food-related choking accidents (cases of choking on vomit excluded) (Table 1). Those aged 60 and over (612 cases; 75.6%) and those under 10 (129 cases; 15.9%) accounted for more than 90% of victims, clearly indicating that the elderly and infants constituted the majority of victims. The causative foods included sticky rice cake (150 cases; 18.5%), steamed rice (82 cases; 10.1%), vegetables/fruit (73 cases; 9.0%), and snacks (excluding candy) (60 cases; 7.4%).

Compared with the cases of death listed in W79 "obstruction of respiratory tract caused by inhalation and ingestion of food," Vital Statistics, the age distribution in these data (Table 2) indicates a higher percentage of infants.

In the monthly distribution of cases (Fig. 3), the number of cases of accidental choking caused by sticky rice cake was remarkably high from December to January. In Vital Statistics, the monthly death rate from "unexpected choking" is the highest in January [Fig. 9 (p.37)]. This can probably be attributed to accidental choking on sticky rice cake.

The emergency dispatchers provided oral instructions on how to remove foreign bodies to the bystanders on the scene in more than half of these accidents. About 70% of bystanders were "family members" with the majority of the remaining being "care facility staff" and "nurses" (less than 10% each) (Table 6). Bystanders who received instructions on removal from emergency dispatchers were more likely to attempt the procedure. Bystanders who received no instructions attempted to remove foreign bodies less frequently. Generally, most bystanders had no prior knowledge of how to remove foreign bodies before receiving the oral instructions provided by the emergency dispatchers (Table 3, Table 7).

The most common oral instructions given by emergency dispatchers concerned patting the victim on the back and more than 80% of bystanders who received oral instructions were told this technique, which was followed by the finger sweep method and the Heimlich maneuver (a technique using abdominal thrusts). About 7% of bystanders attempted to remove foreign bodies with vacuum cleaners (Table 4).

Table 5 shows the relationship between practical removal by bystanders and survival rate. The OR was 3.0 (95% CI 2.2-4.0) and whether bystanders attempted to remove foreign bodies was the determinant factor in reducing the number of fatalities involved in accidental choking on foods.

Bystanders applying the pat on the back method, the finger sweep method and Heimlich maneuver of removing foreign bodies were met with a success rate of about 60%. When an aspirator was used, the success rate was around 80% (Table 8). Emergency personnel frequently used a laryngoscope combined with Magill forceps and aspirators (Table 9). (Reference 28)

Table 1: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics and causative foods (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance (n=810) Causative food	Number of cases	Component ratio (%)
Sticky rice cake	150	18.5
Steamed rice	82	10.1
Vegetables/fruit	73	9.0
Snacks (excluding candy)	60	7.4
Meat	41	5.1
Bread	35	4.3
Candy	28	3.5
Fish meat	27	3.3
Others	314	38.8
Total	810	100

Table 2: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics and age distributions of W79 deaths, Vital Statistics
(Reference 28 [partial modification])

Age group (years)	Eighty fire fighting headquarters (1998) Cases of transportation by ambulance (n=810)		Cases of W79-related deaths in Vital Statistics (1998)	
		Component ratio (%)		Component ratio (%)
0-9	129	15.9	56	1.4
10-19	7	0.9	7	0.2
20-29	4	0.5	14	0.4
30-39	7	0.9	28	0.7
40-49	14	1.7	117	3.0
50-59	29	3.6	241	6.1
60-69	100	12.3	530	13.4
70-79	188	23.2	1,021	25.8
80-89	261	32.2	1,467	37.1
90-99	63	7.8	475	12.0
Unknown	8	1.0		
Total	810	100	3,956	100

Fig. 3: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics by month (Reference 28 [partial modification])

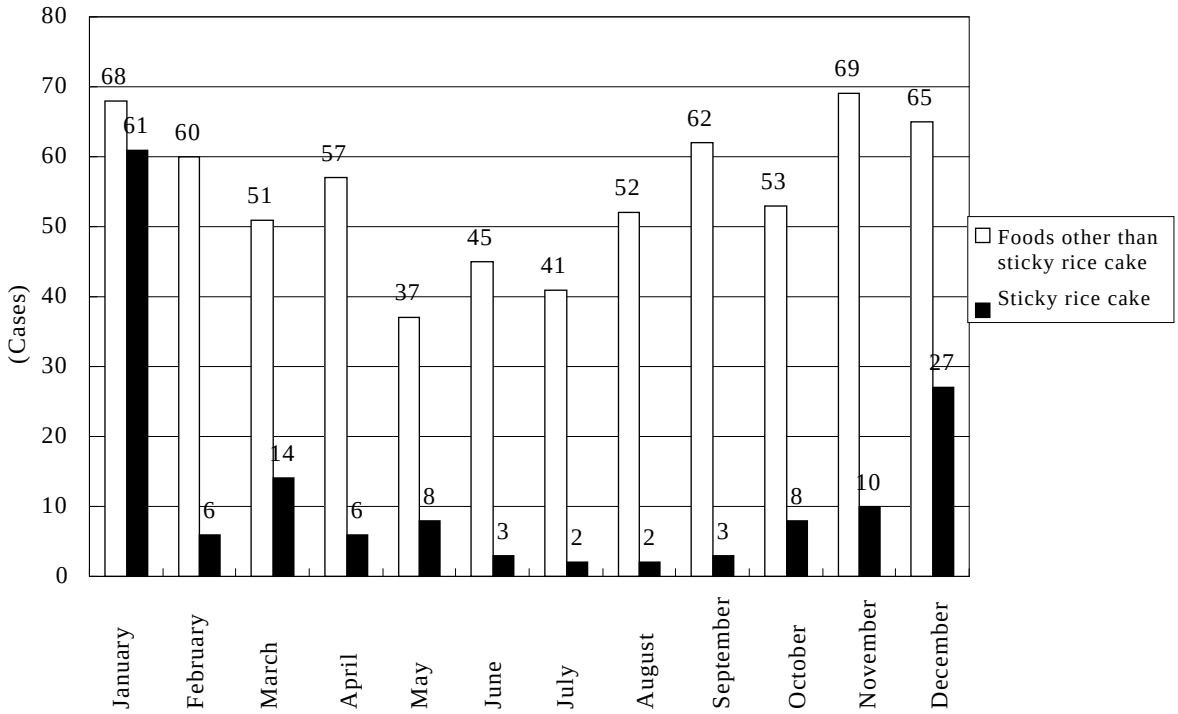


Table 3: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, practical oral instruction and bystanders' attempts to remove foreign bodies (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance (n=810) Oral instructions by the emergency dispatchers at firefighting headquarters	Removal by bystanders		Subtotal
	Performed	Not performed or unknown	
Oral instructions followed	287	53	340
Oral instructions not followed	143	165	308
Unknown	73	89	162
Total	503	307	810

Table 4: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics and contents of oral instruction (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance Cases of oral instructions followed (n=340) Contents of oral instruction (multiple answers allowed)	Number of cases	Received instruction(%)
Patting on the back	287	84.4
Finger sweep method	71	20.9
Heimlich maneuver	41	12.1
Vacuum cleaner	23	6.8
Lower side chest compression method	4	1.2
Chest compression method	0	0.0
Others	15	4.4
Unknown	3	0.9

Table 5: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, bystanders' attempts to remove foreign bodies and survival rate (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance (n=810)	Survival rate (%)	Mortality (%)
Removal of foreign body practiced by bystanders (n=503)	76.3	23.7
Removal of foreign body not practiced by bystanders (n=234) or unknown	50.9	49.1

Table 6: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, bystanders who attempted to remove foreign bodies (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance Number of cases of removal of foreign body practiced by bystanders (n=503) Persons who removed foreign bodies	Component ratio (%)
Family member	70.1
Care facility staff	9.8
Nurse	8.8
Doctor	5.9
Health nurse/helper	0.8
Nursery staff/teacher	0.8
Other	3.8
Total	100

Table 7: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, how bystanders learned how to remove foreign bodies (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance Number of cases of removal of foreign body practiced by bystanders (n=503) How the bystander learned the technique for removing foreign bodies	Component ratio (%)
Oral instructions	26.4
Medical professional	18.1
Lifesaving training by the firefighting department	4.8
TV program etc.	3.0
School program	1.2
Newspaper/magazine	0.4
Japanese Red Cross Society	0.4
Other	3.8
Unknown	41.9
Total	100

Table 8: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, techniques for removing foreign bodies used by bystanders and success rate (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance Number of cases of removal of foreign body practiced by bystanders (n=503) Removal technique used by the bystander	Cases of removal technique performed	Rate of successful removal (%)

Patting on the back	314	61.1
Finger wipe method	110	61.8
Aspirator	36	83.3
Heimlich maneuver	30	60.0
Vacuum cleaner	26	50.0
Chest compression method	3	66.7
Lower side chest compression method	1	100
Laryngoscope/Magill forceps	7	100
Other	17	58.8
Unknown	47	48.9

Table 9: 80 firefighting headquarters (1998), cases of transportation by emergency paramedics, techniques for removing foreign bodies used by the emergency paramedics and success rate (Reference 28 [partial modification])

Eighty fire fighting headquarters (1998) Cases of transportation by ambulance (n=810) Removal technique used by emergency paramedic	Cases of removal technique performed	Rate of successful removal (%)
Laryngoscope/Magill forceps	239	82.8
Aspirator	86	70.9
Patting on the back	50	46.0
Finger wipe method	14	78.6
Heimlich maneuver	11	18.2
Chest compression method	2	100
Lower side chest compression method	1	0.0
Vacuum cleaner	-	-
Other	-	-
Unknown	1	0.0

(2) 12 Firefighting Headquarters (2006)

In 2006, emergency paramedics were sent to respond to 724 emergency cases in regions covered by a total of 18 firefighting headquarters including those of the Tokyo Fire Department and headquarters located in 17 ordinance-designated cities. (Responses were obtained from 12 firefighting headquarters.) Of these cases, 65 (9.0%) resulted in fatalities and 227 (31.4%) were judged “serious.” The victims’ ages were identified in 595 cases. Those aged 65 and over (453 cases, 76.1%) and those ranging from 0 to 4 years in age (64 cases, 10.8%) accounted for slightly less than 90%. The causative foods could be identified in 432 cases. They included steamed rice (including rice ball, sushi, rice porridge) (94 cases, 21.8%), sticky rice cake (77 cases, 17.8%), bread (47 cases, 10.9 %), fish meat (37 cases, 8.6 %), fruit (33 cases, 7.6 %), meat (32 cases, 7.4 %), and candy (22 cases, 5.1%). Eight persons (1.9%) choked on mini-cup jelly (Table 10). (Reference 4, 5, 29)

The age distribution for these data (Table 11), which was similar to the data obtained from other firefighting headquarters, shows the percentage of infants involved in choking accidents higher than the rate of fatalities among infants from “inhalation and ingestion of food causing obstruction of respiratory tract (W79)” in Vital Statistics.

Table 10: 12 firefighting headquarters (2006), cases of transportation by emergency paramedics, causative foods (Reference 4, 5, 29 [partial modification])

Twelve firefighting headquarters (2006) Cases of transportation by ambulance with known causes (n=432)		Number of cases	Component ratio (%)
Grains	Sticky rice cake	77	17.8
	Steamed rice (rice ball included, but sushi and porridge excluded)	61	14.1
	Bread	47	10.9
	Sushi	22	5.1
	Rice porridge	11	2.5
	Other	Unknown	Unknown
Fish meat		37	8.6
Fruit		33	7.6
Meat		32	7.4
Snacks	Candy	22	5.1
	Rice dumpling	8	1.9
	Mini-cup jelly	8	1.9
	Jelly	4	0.9
	Other	Unknown	Unknown
Potato	Konjac noodle	4	0.9
	Konjac	2	0.5
	Other	Unknown	Unknown
Liquid food		8	1.9

Table 11: 12 firefighting headquarters (2006), cases of transportation by emergency paramedics and age distribution in the W79 fatality cases, Vital Statistics (Reference 4, 5, 29 [partial modification])

Age group (years)	Twelve firefighting headquarters (2006) Cases of transportation by emergency paramedics, where patient's age is known (n=595)	Component ratio (%)	Cases of W79-related deaths in Vital Statics (2006)	Component ratio (%)
0	6	1.0	18	0.4
1-4	58	9.7	16	0.4
5-9	9	1.5	2	0.0
10-14	2	0.3	1	0.0
15-29	2	0.3	8	0.2
30-44	11	1.8	80	1.8
45-64	54	9.1	553	12.5
65-79	173	29.1	1,371	31.1
≥ 80	280	47.1	2,358	53.5
Total	595	100	4,407	100

(3) Tokyo Fire Department (2006-2007)

For two years from January 2, 2006 to December 31, 2007, emergency paramedics were sent to the sites of 2,443 food-related choking accidents in the area covered by the Tokyo Fire Department. Those age 65 and over (1,655 cases, 67.7%) and those ranging from 0 to 4 years in age (412 cases, 16.9%) accounted for more than 80% of the victims of such accidents.

The causative foods included steamed rice (including sushi) (377 cases, 15.4 %), sticky rice cake (241 cases, 9.9%), meat (176 cases, 7.2%), candy (175 cases, 7.2%), bread (135 cases, 5.5%), and fruit (108 cases, 4.4%). Two persons (0.08%) choked on konjac mini-cup jelly (Table 12).

Table 12: Tokyo Fire Department (2006-2007), cases of transportation by emergency paramedics, causative foods
(Reference 4, 19, 30, 31 [partial modification])

Tokyo Fire Department (2006-2007) Cases of transportation by ambulance (n=2,443)	Sticky rice cake	Steamed rice (including sushi)	Bread	Meat	Fish meat	Candy	Fruit	Snacks (excluding candy)	Konjac mini-cup jelly	Other	Total
0-4	3	19	13	9	7	118	35	28	1	179	412
5-9	4	5	0	2	2	25	2	3		11	54
10-14	0	1	0	0	1	3	0	4		1	10
15-19	0	1	1	1	0	2	1	0		8	14
20-24	0	3	0	3	2	3	1	0		10	22
25-29	1	0	0	0	1	0	1	0		4	7
30-34	1	3	2	5	0	0	2	3		5	21
35-39	2	3	1	7	4	1	0	1		9	28
40-44	1	2	0	6	2	2	0	0		12	25
45-49	3	1	3	3	3	0	2	1		13	29
50-54	3	3	1	5	1	1	2	2		7	25
55-59	4	15	4	18	1	1	3	2		27	75
60-64	5	5	7	10	2	2	3	3		29	66
65-69	15	33	16	12	8	1	8	2		59	154
70-74	42	25	14	22	2	3	11	5		82	206
75-79	44	51	17	21	14	6	10	9		121	293
80-84	43	75	26	29	15	5	19	8		147	367
85-89	25	65	13	12	8	1	4	10	1	155	294
90-94	26	51	12	8	2	1	3	8		137	248
≥ 95	19	16	5	3	3	0	1	4		42	93
Total	241	377	135	176	78	175	108	93	2	1,058	2,443
Component ratio (%)	9.9	15.4	5.5	7.2	3.2	7.2	4.4	3.8	0.1	43.3	100.0

The percentage of elderly people was high in the cases of accidental choking caused by grains including sticky rice cake, steamed rice and bread. On the contrarly, the percentage of elderly people was as low as 9.7% (17 cases) in the cases of accidental choking caused by candy, where the percentage of children aged 0-4years was 67.4%(118 cases) and the number reaches to over 80% when expanding the age: 0-9 years (143 cases, 81.7%), and 0-14 years (146 cases, 83.4%) (Table 13). Accidental choking on bread frequently occurred in the elderly, and cases that were judged to be “serious or worse” accounted for 37% which exceeded the mean percentage of overall food-related choking accidents (26.9%). (Reference 4, 19, 30, 31)

Table 13: Tokyo Fire Department (2006-2007), cases of transportation by emergency paramedics, data by age group
(Reference 4, 19, 30, 31 [partial modification])

Tokyo Fire Department (2006-2007) Cases of transportation by ambulance (n=2,443) Causative food	Number of cases by age group (years) [component ratio (%)]							
	0-4	(%)	0-9	(%)	0-14	(%)	≥ 65	(%)
Sticky rice cake	3	(1.2)	7	(2.9)	7	(2.9)	214	(88.8)
Steamed rice (including sushi)	19	(5.0)	24	(6.4)	25	(6.6)	316	(83.8)
Bread	13	(9.6)	13	(9.6)	13	(9.6)	103	(76.3)
Meat	9	(5.1)	11	(6.3)	11	(6.3)	107	(60.8)
Fish meat	7	(9.0)	9	(11.5)	10	(12.8)	52	(66.7)
Candy	118	(67.4)	143	(81.7)	146	(83.4)	17	(9.7)
Fruit	35	(32.4)	37	(34.3)	37	(34.3)	56	(51.9)
Snacks (excluding candy)	28	(30.1)	31	(33.3)	35	(37.6)	46	(49.5)
Konjac mini-cup jelly	1	(50.0)	1	(50.0)	1	(50.0)	1	(50.0)
Other	179	(16.9)	190	(18.0)	191	(18.1)	743	(70.2)
Total	412	(16.9)	466	(19.1)	476	(19.5)	1,655	(67.7)

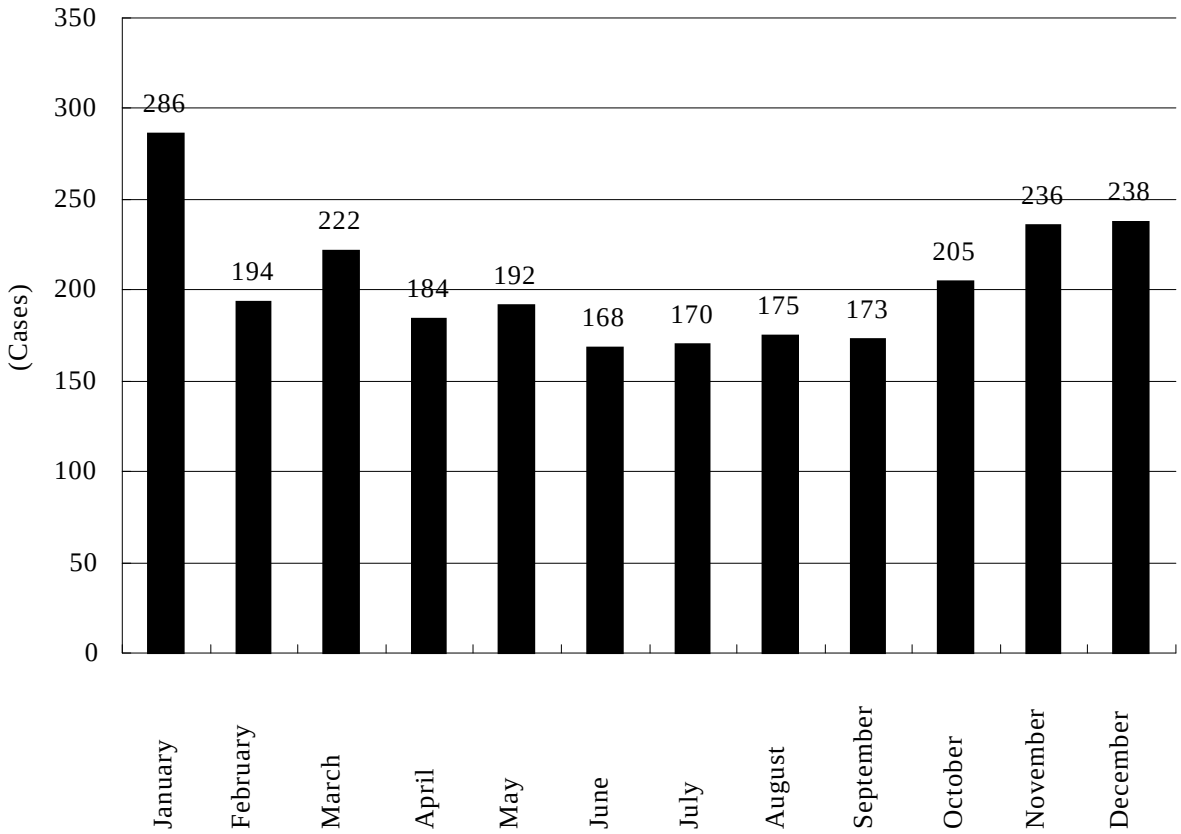
The age distribution (Table 14) shows that infants accounted for a greater proportion of victims than in deaths from “inhalation and ingestion of food causing obstruction of respiratory tract (W79)” in Vital Statistics.

The monthly data clearly show (Fig. 4) that the number of cases in January was prominent because of an increase in accidental choking on sticky rice cake. This finding corresponds to the trend of monthly rate of death from “unexpected choking” in Vital Statistics [Fig. 9, (p. 37)].

Table 14: Tokyo Fire Department (2006-2007), cases of transportation by emergency paramedics and age distribution of the cases of W79 fatalities, Vital Statistics (Reference 4, 30, [partial modification])

Age group (years)	Tokyo Fire Department (2006-2007) Cases of transportation by ambulance (n=2,443)	Component ratio (%)	Cases of W79-related deaths in Vital Statics (2006)	Component ratio (%)
0-4	412	16.9	34	0.8
5-9	54	2.2	2	0.0
10-14	10	0.4	1	0.0
15-19	14	0.6	0	0.0
20-24	22	0.9	2	0.0
25-29	7	0.3	6	0.1
30-34	21	0.9	14	0.3
35-39	28	1.1	21	0.5
40-44	25	1.0	45	1.0
45-49	29	1.2	48	1.1
50-54	25	1.0	83	1.9
55-59	75	3.1	202	4.6
60-64	66	2.7	220	5.0
65-69	154	6.3	282	6.4
70-74	206	8.4	438	9.9
75-79	293	12.0	651	14.8
80-84	367	15.0	843	19.1
85-89	294	12.0	747	17.0
90-94	248	10.2	552	12.5
≥ 95	93	3.8	216	4.9
Total	2,443	100	4,407	100

Fig. 4: Tokyo Fire Department (2006-2007), cases of transportation by emergency paramedics, monthly data (Reference 4, 6 [partial modification])



3. Case Data Collected from Emergency Medical Centers

(1) 75 Emergency Medical Centers (2007)

In 2007, patients requiring critical care were sent to 204 nationwide emergency medical centers that were registered as of November 2007. [Of these, 75 centers responded to the survey (response rate: 36.8%).] These patients included 378 cases that resulted in fatalities (58.7%). According to the data collected on those whose ages were recorded, the patients' ages ranged from 0 to 105 years and the mean age was 74.7 years (Table 16). Males accounted for 50.9%, while females for 49.1%. The causative foods were recorded in 371 cases. They included sticky rice cake (91 cases, 24.5 %), steamed rice (including rice ball, sushi, and rice porridge) (58 cases, 15.6 %), bread (43 cases, 11.6 %), meat (28 cases, 7.5%), fruit (27 cases, 7.3 %), and fish meat (25 cases, 6.7 %). Six persons (1.6%) choked on candy and 3 (0.8%) on mini-cup jelly. The number of cases by age group was tabulated according to causative foods. Those who choked on sticky rice cake numbered 6 ranging from 45 to 64 years, 44 ranging from 65 to 79 years, and 41 aged 80 and over, while those who choked on mini-cup jelly included 1 between the age of 5 to 9 years and 2 ranging from 65 to 79 years. The details of remaining cases were not reported (Table 15). (Reference 4, 5, 29) The age distribution in these data indicated that infants accounted for a greater proportion of victims than in deaths from "inhalation and ingestion of food causing obstruction of respiratory tract (W79)" in Vital Statistics (Section III, 5[1]) but it was otherwise not so different from the data on the cases collected from the firefighting headquarters (Section III, 2[2]). The percentage of fatalities was higher in the data collected from emergency medical centers than that in the data collected from firefighting headquarters but the data composition was similar to that of cases of death in Vital Statistics (Table 16).

Table 15: 75 emergency medical care centers (2007), cases of critical care, causative foods (Reference 29 [partial modification])

75 emergency medical centers (2007) Cases with known causative foods (n=371)		Number of cases	Component ratio (%)
Grains	Sticky rice cake	91	24.5
	Steamed rice (including rice ball, sushi, and rice porridge)	58	15.6
	Bread	43	11.6
	Other	Unknown	Unknown
Snacks	Rice dumpling	15	4.0
	Candy	6	1.6
	Mini-cup jelly	3	0.8
	Other	Unknown	Unknown
Meat		28	7.5
Fruit		27	7.3
Fish meat		25	6.7
Potato	Konjac	8	2.2
	Other	Unknown	Unknown
Liquid food		13	3.5

Note: In the original article, 190 cases of choking on "grains" included 28 cases of choking on "steamed rice (including rice ball)" and 11 cases of choking on "rice porridge." "Sushi" was not included in the category of "grains" and 19 cases of choking on sushi were reported separately. In this table, overlapping cases were not included and the cases of choking on "steamed rice (including rice ball)," choking on "rice porridge," and choking on "sushi" were counted separately.

Table 16: 75 emergency medical care centers (2007), cases of critical care and age distribution in the cases of W79 death in Vital Statistics
(Reference 29 [partial modification])

Age group (years)	75 emergency medical centers (2007) Cases of critical care with ages recorded (n=620)	Component ratio (%)	Cases of W79-related deaths in Vital Statics (2006)	Component ratio (%)
0	8	1.3	18	0.4
1-4	15	2.4	16	0.4
5-9	3	0.5	2	0.0
10-14	0	0.0	1	0.0
15-29	5	0.8	8	0.2
30-44	6	1.0	80	1.8
45-64	73	11.8	553	12.5
65-79	196	31.6	1,371	31.1
≥ 80	314	50.6	2,358	53.5
Total	620	100	4,407	100

(2) 185 Designated Centers with Certified Critical Care Doctors (2008)

For eight months from June 2008 to January 2009, a survey was conducted on patients (age: 0-15 years) requiring critical care at 433 centers including centers with certified critical care doctors designated by Japanese Association for Acute Medicine and emergency medical centers. A total of 185 centers returned responses (response rate: 42.7%). Ten centers reported 12 children ranging from 1 to 7 years of age (10 boys, 2 girls) who choked on food and received emergency care. Small children frequently choked on snacks as the causative foods were candy (4 cases), peanuts (2 cases), "soda candy" (2 cases), apple (1 case), "soybean snack" (details unknown) (1 case), "frozen jelly" (not made from konjac) (1 case), and salmon roe (1 case). All of them choked at home. The first-aid procedures used on the scene were slapping on the back (6 cases) and cardiac massage (1 case). Three victims were left untreated and 2 cases

were remained unknown whether first-aid was administered or not. The obstructed areas recorded included the right main bronchus ("soybean snack," salmon roe), the area between the tracheal bifurcation and the bronchi (peanuts), and hypopharynx (candy). Obstruction of the area from the oropharynx to the hypopharynx was reported in 3 cases. Except for a patient with common cold-like symptoms, none of the victims had any underlying disease. They did not any suffer development disorder, swallowing disturbance and congenital abnormality. Of 3 patients who suffered respiratory arrest, 1 was tapped on the back and spat out the foreign body two minutes after the accident. The remaining 2 patients suffered cardiopulmonary arrest. The patients' outcomes were recorded as follows: "good prognosis" (9 cases), "vegetative state" (1 case), and "death" (1 case) (multiple peanuts in the mouth fell down the throat and obstructed the area from the bronchial bifurcation to the bronchi) (Table 17). (Reference 4, 5, 23)

Table 17: 185 designated centers with certified critical care doctors and emergency medical care centers (2008), cases of emergency care, causative foods
(Reference 4, 5, 23 [partial modification])

Age	185 designated centers with certified critical care doctors and emergency medical centers (2008) Cases of transportation by ambulance (n=12)	Causative food						
		Candy	Peanuts	"Soda candy"	"Soybean snacks"	Apple	"Frozen jelly"	Salmon roe
1	3					1	1	1
2	2		1	1				
3	3	2			1			
4	3	1	1	1				
7	1	1						
Total	12	4	2	2	1	1	1	1

Notes: 1. "Frozen jelly" is different from konjac jelly.
2. The data on outcomes were available in 9 cases. Of these, a 4-year-old boy died of choking on "peanut."

(3) Data Collected from Individual Emergency Medical Centers

For the 16 years from 1978 to 1994, 52 patients (43 persons [82.7%] aged 65 and over) were transported by ambulance to university hospitals in Tokyo for treatment for obstruction of the respiratory tract. About 60% suffered serious symptoms such as cardiopulmonary arrest at the time of arrival at hospital. The causative foods were steamed rice (including rice ball, sushi, and rice porridge) (15 cases, 28.8%), sticky rice cake/rice dumpling (12 cases, 23.1%), bread (9 cases, 17.3%), and konjac (3 cases, 5.8%). (Reference 32, 33)

For the approximately six years and 10 months from January 1985 to October 1991, 16,744 patients were taken to the tertiary outpatient departments of emergency medical centers in Iwate Prefecture. They included 140 patients who choked on foreign bodies. Of these, 33 were adult patients who had a foreign body lodged in the respiratory tract. The foreign bodies were retained in the larynx (24 cases) more frequently than in the trachea/bronchus (9 cases). The leading food involved in obstruction of the larynx was sticky rice cake (15 cases, 62.5%) followed by konjac (3 cases, 12.5%) and rice dumpling (2 cases, 8.3%). The foods involved in obstruction of the trachea/bronchus were steamed rice (3 cases, 33.3%) and soba noodles (2 cases, 22.2%). (Reference 34)

For the four years and nine months from November 1990 to July 1995, 30 patients suffering acute respiratory failure due to obstruction of the respiratory tract by foreign bodies and requiring critical care (25 persons [83.3%] aged 60 and over) were taken to the emergency medical centers of public hospitals in Tokyo. Most of them were serious cases as 20 suffered cardiopulmonary arrest at the time of arrival at

the hospital. The causative foods included sticky rice cake (9 cases, 30.0%), bread (6 cases, 20.0%), meat (4 cases, 13.3%) and noodles (4 cases, 13.3%). (Reference 35)

For the five years and four months from January 1994 to April 1999, 33 patients who choked on foreign bodies (24 persons [72.7%] aged 60 and over) were transported by ambulance to emergency medical centers at university hospitals in Tokyo. The causative foods, in the descending order of frequency, were steamed rice, meat, noodles, and bread. For the five years and five months from January 1990 to May 1995, the patients with aspiration, who also transported by ambulance to the same medical care centers, included 48 patients with aspiration with known causes (mean age: 69.2 years). Of these, 8 suffered aspiration from sticky rice cake leading to suffocation (mean age: 76 years). The leading causative foods were steamed rice and meat. (Reference 36, 37)

For the three years from January 1995 to December 1997, 36,251 patients were taken to the emergency outpatient departments of public hospitals in Kyoto. Of these, 28 definitely swallowed foreign bodies. Sticky rice cake was the main cause of choking (n=4). (Reference 38)

For the 10 years from 1995 to 2005, 13 children (age between 0 to 11) who choked on foods were transported by ambulance to the emergency medical centers in Osaka City. The main causative foods were milk (6 cases) and steamed rice (3 cases). (Reference 39)

For the 3 years and 5 months from January 1999 to May 2002, 28 patients who suffered suffocation were transported to the emergency outpatient departments of private hospitals in Gifu Prefecture. They included 17 patients aged 61 and over who choked on food. The causative foods were sticky rice cake (6 cases) and steamed rice (including sushi) (4 cases). They included an elderly female who suffered suffocation while eating a piece of sticky rice cake alone. In this case, after development and removed by Magill forceps of a piece of sticky rice cake in the larynx, another piece of sticky rice cake measuring 10 × 13 mm was detected in the right main bronchus and endoscopically removed. Of these cases, 6 people survived and 11 died. (Reference 40)

In January 2001, a patient who choked on a piece of meat in soup noodle was taken by ambulance to the emergency medical center in Tokushima Prefecture. In this case, a bystander spent about eight minutes to remove the piece of meat before the arrival of emergency paramedics. (Reference 41)

In July 2006, an elderly male suffered aspiration leading to dyspnea while eating a piece of sticky rice cake in soup. (A member of his family had cut the sticky rice cake into 1- to 2-cm pieces to prevent accidental choking and boiled the pieces to soften them.) The family member drove him to a public hospital in Hyogo Prefecture to receive treatment. The patient had history of cerebral infarction and dentures. (Reference 42)

In November 2006, a patient who suffered dyspnea resulting from a foreign body in the trachea was transported by ambulance to a hospital in Hiroshima Prefecture. In this case, the causative food was skewered port cutlet (contents unknown). (Reference 43)

(4) Case Data Collected from Emergency Medical Centers in the U.S. (reference)

a. Overview

The U.S. Consumer Product Safety Commission (CPSC) conducts a survey on new patients with injuries treated at the emergency departments of hospitals as a part of the National Electronic Injury Surveillance System All Injury Program (NEISS-AIP). According to the results of analysis conducted by Centers for Disease Control and Prevention (CDC), in 2001, 17,537 children aged 14 and under (29.9/100,000 persons), who experienced accidental choking, including choking on foreign bodies other than foods[1], were taken to emergency departments of U.S. hospitals. Of these, 10,438 (59.5%) probably choked on

[1] Choking accidents due to a foreign body in the esophagus included.

foods. The leading causative food was "candy/gum" (3,325 cases, 19.0%) including "hard candy," "other candy (chocolate, gummies, etc.)," "gum," and "unspecified candies." These data do not include the patients who were taken to the medical institutions other than emergency departments and those who were not taken to medical institutions. Of the children who experienced accidental choking, 55% were reported to have been taken to emergency departments in the U.S. (Reference 44)

For the approximately nine years from 1989 to 1998, 1,429 children aged 14 and under were suspected of choking, admitted to 26 tertiary pediatric medical centers in the U.S. and Canada and underwent endoscopy of the upper respiratory tract and upper gastrointestinal tract. The causative foods were peanuts (375 cases, 26.2%), meat (96 cases, 6.7%), sunflower seeds (95 cases, 6.6%), popcorn (71 cases, 5.0%), and carrot (69 cases, 4.8%). A total of 103 children died of choking on the following foods: hotdogs (16 cases, 15.5%), "candy" (10 cases, 9.7%), grapes (8 cases, 7.8%), meat (7 cases, 6.8%), and peanuts (7 cases, 6.8%). (Reference 45)

As stated above, in North America, in addition to hotdogs which are a characteristic local food, "candy" is largely responsible for accidental choking among children. Which areas of the respiratory tract were obstructed in the cases involving candy was not reported.

b. Individual Item

In the U.S., a total of 6 infants (aged 8 months to 5 years) were reported to have died after choking on "candy" containing konjac. The food boluses were retained in the oropharynx in 3 cases. In a different case, an emergency life saving technician removed the candy with Magill forceps on the scene. In the 2 remaining cases, some treatment was conducted but the area of the respiratory tract that was first obstructed remained unknown. (Reference 46, 47)

(5) Case Data Collected from Emergency Medical Centers in the U.K. (reference)

The U.K. Department of Trade and Industry (DTI) analyzed the data collected from an overall case survey of 18 hospitals that accepted 5% of patients requiring critical care. The DTI estimated that, for each of the years between 1986 and 1996, an average of 1,072 children under 3 years suffered food-related choking accidents in the U.K. The foods involved in these accidents were snacks (345 cases, 32.2%), fish bones (214 cases, 20.0%), fruit (102 cases, 9.5%), and bread/biscuit (101 cases, 9.4%). The mean number of food-related choking accidents that affected 3-year-old children each year was estimated at 280. Snacks were involved in 80 of 280 accidents (28.6%). The trend of choking accidents was similar between the infants aged 3 years and those under 3 years but the percentage of the cases of choking on fish bone was higher in those aged 3 years (118 cases, 42.1%) than in those under 3 years. The DTI observed that, as children grow older, their diet becomes more varied and it becomes harder for parents to monitor them. (Reference 48)

4. Data on Cases of Foreign Bodies in the Trachea/Bronchus not Resulting in Accidental Choking

(1) Japan

There are cases of people accidentally swallowed foreign bodies but not experiencing complete obstruction of the respiratory tract or accidental choking. These people were taken to medical institutions (mainly otolaryngological departments) and received treatment for foreign bodies in the trachea/bronchus. As shown below, many such cases have been reported so far.

Table 18 is a list of surveys conducted on the patients in all age groups (not just children) who received treatment for foreign bodies (including those other than foods) in the trachea/bronchus during the specified period. (Reference 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76)

When the cases of a foreign body in the trachea/bronchus that were either

specific to some region or judged to be rare were excluded, more than half of the patients taken to medical institutions were young children. The rate of children accounted for more than 80% of such patients at many medical institutions. Those who ate beans/seeds including peanuts accounted for more than half of the patients who had foreign bodies including those other than foods lodged in their trachea/bronchus. This trend has not altered in any remarkable respect for the past decades. When such foreign bodies were limited to foods, the leading causative foods were beans/seeds followed by fish meat (generally fish bones) and fruit (with apples accounting for more than half of the causative fruits). According to the results of a special tabulation, the National Nutrition Survey (1998-2000), the weighted average of daily consumption of "(raw) apples" accounted for 23.9% of the weighted average of daily consumption of "fruit." This percentage was lower than the weighted averages of daily consumption of "(raw) persimmons" (28.1%) and "satsuma oranges" (27.4%). These numerical data indicated that apples were identified as causative fruit in many cases not because of the amount in which they were consumed but because of certain properties that made them become frequently lodged in the trachea/bronchus. Other causative foods reported were snacks, meat, vegetables, steamed rice, sticky rice cake, noodles and seaweed.

The patients who eventually died as a result of complications of suffocation and aspiration pneumonia accounted for 1.2-4.3%. [These numerical data indicate the component proportions collected by the reporting medical institutions (mainly otolaryngological departments). When persons who suffered serious symptoms and were taken to other medical institutions/departments (e.g., emergency medical centers) were included, the ratio of those who died from foreign bodies in the trachea/bronchus to the entire population who had foreign bodies in the trachea/bronchus seemed to be higher.]

The cases of a foreign body in the trachea/bronchus with known initial symptoms are listed in Table 21. The patients who suffered serious initial symptoms close to suffocation such as "dyspnea" and "cyanosis" remained at levels of 4-25% and 5-11% respectively. On the other hand, 6-71% of patients had "no symptoms" probably because of an "asymptomatic period" after foreign body became lodged in the bronchial space [Fig. 1 (p.11) (5)]. Peanuts that are retained as foreign bodies in the trachea/bronchus without being noticed absorb moisture and gradually expand. Such peanuts cause delayed obstruction of the respiratory tract. (Reference 77) The risk has been pointed out that once such peanuts become mobile ("dancing") foreign bodies in the trachea, they get stuck in the infraglottic space and induce suffocation (expiratory dyspnea [Fig. 1 (p.11) (3)]). (Reference 78)

Most of the data on foreign bodies in the trachea/bronchus not resulting in accidental choking indicated a higher percentage of male patients. When the data with the records of sex were selected from those listed in Table 18, the percentage of male patients was more than twice as high as that of female patients.

Table 19 presents the data on the cases of infants with a foreign body in the trachea/bronchus with records of causes including those other than foods. Although foreign bodies other than foods such as needles and pins were frequently detected, beans/seeds were identified as causative foreign bodies in about 70-80% of cases involving infants. Peanuts were responsible for most of such events. (Reference 79, 80, 81)

Few data included the detailed description of factors contributing to foreign body in the trachea/bronchus and the collected data were limited to those listed in Table 20. (Reference 59, 82)

Table 18: Data on patients in various age groups who experienced foreign bodies (those other than foods included) in the trachea/bronchus

Institutions surveyed (year of reporting)	Period of survey		Subjects of survey							Outcome	Main categories of foreign bodies							
		Duration (year)		Larynx	Males	Females	Infants	(range of age)	(%)	Death	Beans/ seeds/ nut	(%)	Fish meat	Fruit	Needles/ pins	Teeth	Toys	Nails/ screws
Osaka University (83)	1932-82	51	392	○	NA	NA	217	0-5	55.4	6	130	33	41		50			16
Toho University (74)	1952-71	20	27		NA	NA	20	0-6	74.1	0	18	67			4			
Gunma University (84)	1958-82	25	160		111	49	132	0-4	82.5	3	126	79	2	3	5	4	4	2
Sapporo Medical University (71)	1960-69	10	16		12	4	13	0-4	81.3	0	10	63	1		3		1	
Hirosaki University (80)	1962-78	16	63		43	20	38	0-4	60.3	NA	33	52			10	1	5	2
Tohoku University (77)	1966-76	10	100		67	33	80	0-4	80.0	1	68	68		2	8	5	11	1
Shinshu University (88)	1966-86	21	81		54	27	72	0-4	88.9	NA	65	80			7	2		4
Iwate Medical University (97)	1967-95	29	170		118	52	136	0-5	80.0	0	105	62	7	3	6	15	9	6
Hiroshima University (88)	1969-86	18	69		44	25	50	0-4	72.5	3	33	48	2	3	4	2	6	3
The Jikei University (81)	1970-79	10	32		24	8	18	0-3	56.3	NA	16	50		1	1	4	3	
Kitasato University (91)	1971-89	19	81	○	55	26	63	0-4	77.8	1	50	62	6	1	2	7	4	2
Osaka Red Cross Hospital (83)	1972-81	10	28		18	10	22	0-4	78.6	0	16	57			5		2	1
Nara Medical University (85)	1972-84	13	28		19	9	18	0-3	64.3	1	16	57	1	3		2		
Kinki University (91)	1975-89	15	10		4	6	8	0-4	80.0	0	6	60			1	2		1
University of Miyazaki etc. (87)	1978-86	8.6	25		18	7	20	0-4	80.0	0	18	72				1	1	
Mie University (97)	1978-94	16	69		44	25	57	0-4	82.6	0	43	62	2	5	4	2	3	
Sapporo Medical University (92)	1980-90	10	21		16	5	11	0-5	52.4	0	10	48	1		1	7	1	1
Kumamoto University (04)	1981-00	20	91	○	62	29	85	0-5	93.4	0	63	69	6	3	4	2		1
Niigata City General Hospital (91)	1982-90	9	23	○	15	8	18	0-5	78.3	1	19	83				1		
Saga Medical School (99)	1982-98	17.7	34		23	11	19	0-2	55.9	0	16	47	2		1	10	1	
Mie University (04)	1983-03	21	44	○	30	14	26	0-4	59.1	NA	22	50	4	1	3	8		
Wakkanai City Hospital (94)	1984-93	10	11	○	9	2	3	0-4	27.3	NA	3	27	2					
7 Universities in the Tokai Region (96)	1985-94	10	132		91	41	106	0-3	80.3	0	111	84				21		
Sapporo Medical University (98)	1991-96	5	10		6	4	5	0-4	50.0	0	5	50				3		1
Nihon University (99)	1992-96	5	14	○	8	6	9	0-4	64.3	0	7	50				1		1
Fukui Red Cross Hospital (04)	1992-04	12	13		12	1	3	0-4	23.1	NA	4	31				4		
Kyoto City Hospital (99)	1994-99	5	7		2	5	1	0-4	14.3	NA	3	43						
Saitama Medical University (05)	2002-04	2.5	7		6	1	0	0-4	0.0	0	0	0				5		1
Total			1,758		NA	NA	1,250			NA	1,016	58	77	25	119	109	51	43

Note:
1. "NA" stands for "not applicable."
2. "○" in the "Larynx" column indicates that the data included the cases of a foreign body in the larynx.
3. "Miyazaki University etc." includes University of Miyazaki Hospital and Miyazaki Prefectural Miyazaki Hospital.
4. "7 Universities in the Tokai Region" includes the data collected from Aichi Medical University, Nagoya University, Nagoya City University, Fujita Health University (one affiliated hospital included), Gifu University, Mie University and Hamamatsu University School of Medicine.
5. The data on the reported cases derived from "7 Universities in the Tokai Region," are limited to those relating to cases of entrance of foreign matters (peanuts and dentures) in the body accompanying the number of cases by age group.
6. "Beans" includes soybeans (including green soybeans, fermented soybeans, "snack soybeans" and "ceremonial soybeans"), red beans, pinto beans, broad beans, large red beans, peas, and green peas.
7. "Seeds/nuts" includes peanuts (including "bongo beans"), almonds, cashew nuts, chestnuts, walnuts, watermelon seeds, summer orange seeds, and pits of pickled plums.
8. Of 84 patients who choked on "fish meat," 60 definitely choked on "fish bones."
9. Of 27 patients who choked on "fruit," 16 definitely choked on "apples."
10. "Teeth" include dentures, dental crowns, and prostheses.

Table 19: Data on infants who experienced foreign bodies (including those other than foods) in the trachea/bronchus

Institutions surveyed (year of reporting)	Period of survey		Subjects of survey		Beans/ seeds/nut		Beans/seeds/nut						Beans/seeds/nut						
		Duration (year)		range of age		(%)	Sub-total	Soybeans	Red beans	Pinto beans	Broad beans	Green peas	Sub-total	Peanuts	Almonds	Chest-nuts	Walnuts	Water-melon seeds	Summer orange seeds
Osaka University (83)	1932-82	51	217	0-5	116	53	116	NA	NA	NA	NA	NA	0						
Gunma University (84)	1958-82	25	132	0-4	122	92	12	9	1	1	1		110	106	1	1		1	1
Sapporo Medical University (71)	1960-69	10	13	0-4	9	69	0						9	9					
Hirosaki University (80)	1962-78	16	38	0-4	28	74	NA	NA	NA	NA	NA	NA	NA	21					
Tohoku University (77)	1966-76	10	80	0-4	68	85	13	NA	NA	NA	NA	NA	55	48	4	2			1
Shinshu University (88)	1966-86	21	72	0-4	65	90	7	6			1		58	56		1	1		
Hiroshima University (88)	1969-86	18	50	0-4	30	60	NA	NA	NA	NA	NA	NA	NA	22		1			
The Jikei University (81)	1970-79	10	18	0-3	13	72	13	NA	NA	NA	NA	NA	0						
Osaka Red Cross Hospital (83)	1972-81	10	22	0-4	16	73	3	3					13	13					
Kinki University (91)	1975-89	14.8	8	0-4	6	75	1	1					5	5					
University of Miyazaki etc. (87)	1978-86	8.6	20	0-4	17	85	0						17	16	1				
Mie University (97)	1978-94	16	57	0-4	41	72	5	NA	NA	NA	NA	NA	36	34		2			
Sapporo Medical University (92)	1980-90	10	11	0-5	10	91	1					1	9	9					
Osaka Red Cross Hospital (98)	1982-96	15	14	0-3	9	64	2	1			1		7	7					
Wakkanai City Hospital (94)	1984-93	10	3	0-4	3	100	0						3	3					
University of Toyama (07)	1991-06	16	23	0-6	15	65	1	NA	NA	NA	NA	NA	14	12	2				
Nihon University (99)	1992-96	5	9	0-4	7	78	1	1					6	6					
Fukui Red Cross Hospital (04)	1992-04	11.7	3	0-4	2	67	1	NA	NA	NA	NA	NA	1	1					
Kyoto City Hospital (99)	1994-99	5	1	0-4	1	100	0						1	1					
Nagaoka Red Cross Hospital (08)	2003-07	5	8	0-6	7	88	1	1					6	6					
Total			799		585	73													

Note: 1. "NA" stands for "not applicable."
2. "Soybeans" includes fermented soybeans and green soybeans.
3. "Miyazaki University etc." includes University of Miyazaki Hospital and Miyazaki Prefectural Miyazaki Hospital.

Table 20: Factors contributing to foreign bodies (including those other than foods) in the trachea/bronchus

Contributing factor	Medical institutions surveyed (year of reporting)	Chiba University (1973)	Osaka Red Cross Hospital (1983)	Subtotal
	Period of survey	1961-1971 11 years	1972-1981 10 years	
	Non-food	Subjects	Subjects	
	Subjects (age group)	Infants alone	All age groups	
	Number of cases	52	28	
	Number of infants (range of age) (%)	48 (0-4 years) 92	22 (0-4 years) 79	
	Outcome (death)	4	0	
Playing		12	1	13
Having meal/holding between teeth			8	8
Coughing/smothering			7	7
Crying		6		6
Falling		5		5
Standing/walking		3	1	4
Having a cold (rhinitis)		3		3
Suddenly standing up		2		2
Jumping off something		2		2
Being hit on the back of head		2		2
Laughing		1	1	2
Receiving dental treatment			2	2
Putting a large amount of food in the mouth			2	2
Being surprised by brother			2	2
Jumping		1		1
Bumping		1		1
Calling others		1		1
Taking it with medicine		1		1
A parent put a finger in the mouth		1		1
Being scalded and surprised			1	1
Brother put it in the mouth			1	1
Shampooing without checking the mouth for foreign bodies			1	1
Unknown			1	1

Table 21: Data on the patients in various age groups who experienced foreign bodies (including those other than foods) in the trachea/bronchus where there is a record of initial symptoms

Institutions surveyed (year of reporting)	Number of cases	Initial symptoms (multiple answers allowed)																	
		Cough		Wheezing		Fever	Difficulty in breathing		Cyanosis		Vomiting	Chest pain	Pharyngeal pain	Bleeding	Retractive breathing	Disturbance/ loss of consciousness	Convulsion	Absence of symptoms		Other
			%		%			%		%									%	
Sapporo Medical University (71)	16	5	31	4	25	1	4	25				1	1					2	13	
Shinshu University (88)	81	60	74	47	58	13	13	16	9	11	11			1	1			5	6	3
Osaka Red Cross Hospital (88)	28	24	86	4	14	3	1	4										2	7	
Kumamoto University (04)	91	58	64	29	32	3	8	9	7	8	9					2				3
7 Universities in the Tokai Region (96)	91	48	53	23	25	19	10	11	10	11	2							22	24	
Saga Medical School (99)	34	17	50	7	21	6	5	15	2	6	1			1			1	8	24	
Mie University (04)	44	23	52	9	20	10	3	7	2	5		3	1		1	1				6
Nihon University (99)	14	13	93	4	29	6	1	7	1	7	3		4			1				
Fukui Red Cross Hospital (04)	13	6	46	3	23	3	3	23							1			1	8	2
Kinki University (05)	4	2	50				1	25				1						2	50	
Saitama Medical University (05)	7	1	14			1												5	71	1

Note
1. "Others" include sputum, abdominal pain, abnormal phonation, nasal discharge, discomfort in the chest during breathing, loss of appetite, atelectasis, and unknown.
2. The data collected from "7 Universities in the Tokai Region" were limited to those relating to some reported cases of choking on peanuts with known initial symptoms.
3. The data collected from "Nihon University" included 7 cases of "sudden attack of coughing," 6 cases of "persistent coughing," and 13 cases of "coughing." They included no overlapping cases.

In addition to the cases listed in the above table, the following cases were reported: 1,000 cases of foreign body in the trachea/bronchus collected from 37 nationwide clinics of otolaryngology in 1959 (Reference 83), 51 cases of foreign body in the trachea/bronchus collected from the departments of otolaryngology of private university hospitals in Tokyo over a period of about 10 years (1971-1981) (Reference 83), 47 patients who underwent removal of foreign body at the department of trachea and esophagus of a university hospital in Tochigi Prefecture over a period of about 13 years (1974-1987) (Reference 84), 45 patients aged 15 and under who were diagnosed with a foreign body in the trachea/bronchus at university hospitals in Tokyo and Chiba Prefecture over a 17-year period (1976-1992) (Reference 85), 8 children who were diagnosed with a foreign body in the trachea/bronchus at university hospitals in Tochigi and Gunma prefectures over a 20-year period (July 1978-July 1998) (Reference 86), 234 patients who experienced foreign bodies in the laryngopharynx and visited clinics in Osaka City over a 4.5-year period (December 1978-June 1983) (Reference 87), 23 children who experienced foreign bodies in the trachea/bronchus and were treated at public hospitals in Okinawa Prefecture over a 22-year period (1979-August 2000) (Reference 88), 739 cases of foreign body in the trachea/bronchus collected from 151 nationwide clinics of otolaryngology from 1981 to 1982 (Reference 83), 46 patients who experienced a foreign body in the larynx/trachea/bronchus and were treated at the department of otolaryngology of a university hospital in Kumamoto Prefecture over a 10-year period (1981-1990) (Reference 89), 1 patient who visited the department of surgery at a university

hospital in Kagawa Prefecture in October 1999 (Reference 90), 4 adults who experienced foreign bodies in the bronchus and received treatment at a department of internal medicine specializing in respiratory disease/allergy from October 2003 to June 2005 (Reference 91), 40 children who were suspected of having a foreign body in the trachea/bronchus and admitted to departments of pediatric surgery at hospitals in Osaka and whose causes could be confirmed over a 22-year period (April 1980-March 2002) (Reference 92), 5 patients who experienced a foreign body in the trachea/bronchus and received treatment at departments of pediatric surgery in Tokyo over a period of about 20 years (April 1972-June 1992) (Reference 93). Because these data were incomplete, they were not included in the above analysis.

Regarding a foreign body becoming stuck in the trachea/bronchus, according to some reports, the foreign body gets as far as the bronchus, particularly the right bronchus in adults and the left bronchus in children, for anatomical reasons. The comments differed from report to report, and the involvement of body position has been pointed out in some reports. It was difficult to find any specific trend in these data. (Reference 7, 9)

(2) Foreign Countries (reference)

We obtained the following overseas data: 234 children experienced a foreign body in the trachea/bronchus and visited a university hospital in Maryland over a period of about 53 years (1939-1991) (Reference 94), 250 patients experienced foreign bodies in the trachea/bronchus and were admitted to hospitals in Kuwait over a 14-year period (1962-1975) (Reference 95), 200 children experienced foreign bodies in the respiratory tract and received treatment at pediatric clinics in Haifa (Israel) over a 12-year period (1966-1977) (Reference 96), 224 children underwent removal of accidentally inhaled substances with a bronchoscope at the pediatric departments of university hospitals in Germany over a period of about 16 years (1968-1984)(Reference 97), 110 patients visited the otolaryngological departments of university hospitals in Sweden and were diagnosed with a foreign body in the bronchus over a 14-year period (1970-1983) (Reference 98), 230 children accidentally inhaled foreign bodies and received treatment at pediatric hospitals in Australia before 1971 (period unknown) (Reference 99), 132 patients experienced a foreign body in the bronchus and were admitted to hospitals in Mumbai (India) over a 10-year period (1972-1981) (Reference 100), 6 children had foreign bodies below the glottis and received treatment at pediatric clinics in Georgia (U.S.A.) over a 5-year period (1980-1984) (Reference 101), 94 children accidentally inhaled foreign bodies and were admitted to the pediatric wards of university hospitals in Germany over a 7-year period (1981-1988) (Reference 102), and 400 children accidentally inhaled foreign bodies and received treatment at the otolaryngological department of a university hospital in Shenyang (China) over a period of 7 years and 5 months (June 1982-November 1989) (Reference 103). In these reports, the leading causative foods were beans/seeds, including peanuts. Irrespective of differences in eating habits, socioeconomic conditions, and culture, the substances that obstruct the trachea/bronchus most frequently are beans/seeds and this trend seems to be apparent in almost all the countries.

5. Data on Fatalities

(1) Vital Statistics

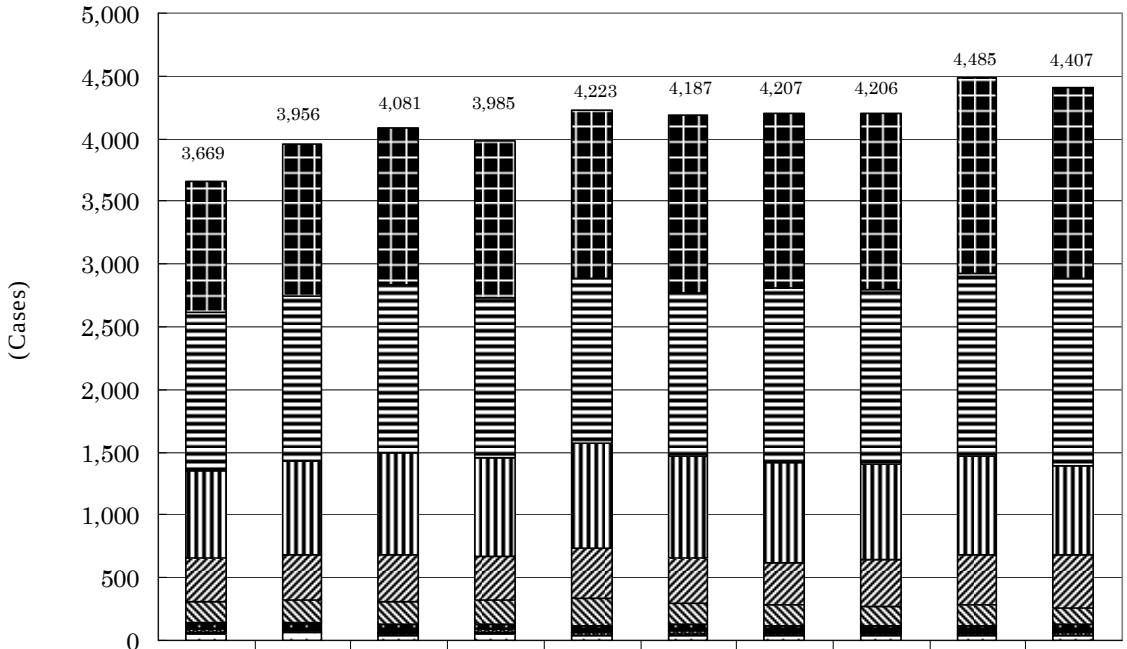
The number of cases of death from “obstruction of respiratory tract caused by inhalation and ingestion of food (W79)” (Vital Statistics) (Fig. 5) increased 1.20 times, from 3,669 to 4,407, over the 10 years from 1997 to 2006. Among the elderly aged 65 and over, the number of such cases has increased 1.24 times, from 3,014 to 3,729. This increase almost perfectly corresponds to the increase in the elderly population (from 19,600,000 in 1997 to 26,500,000 in 2006; rate of increase: 135%). Among the elderly aged 85 and over, the number of such cases increased from 1,053 to 1,515 over the 10-year period (rate of increase: 144%). This increase also seemed to correspond almost perfectly to the increase in the population of this age group (from 1,800,000 to

3,100,000; rate of increase: 168%). Of those who died from "obstruction of respiratory tract caused by inhalation and ingestion of food," those aged 85 and over accounted for 28.7% in 1997 and 34.9% in 2005, an increase of about 6 points. In the remaining age groups, the numbers of persons who died from "obstruction of respiratory tract caused by inhalation and ingestion of food" decreased or remained unchanged. Among children between 0 and 14 years of age, the number of such cases decreased from 57 to 37 for the 10 years from 1997 to 2006. Although infants aged 0-4 years account for the greatest number of deaths among children, the number of cases of deaths from obstruction of respiratory tract caused by inhalation and ingestion of food in these infants decreased from 50 to 34 for the 10 years from 1997 to 2006. (Reference 4, 104) As demonstrated by these data, the increase and decrease in the number of cases of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" for the 10 years from 1997 to 2006 seemed to reflect the social phenomenon of a declining birthrate and a increasing population of elderly people.

The rate of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" in children in the age group of 0-14 years (relative to 100,000 persons) was 0.30 in 2000 and 0.21 in 2006. In the U.S., 66 children aged 0-14 years died from "obstruction of respiratory tract caused by inhalation and ingestion of food" in 2000. (Reference 44) Because the number of children in this age group was 60,253,000 (Reference 105), the mortality was estimated at 0.11 (relative to 100,000 persons).

Some persons "accidentally inhaled foods," experienced obstruction of the respiratory tract, and died of encephalopathy or multiple organ failure after resuscitation. For statistical purposes, these cases were occasionally treated as fatalities resulting from disease. This should be kept in mind when interpreting the number of cases of death in Vital Statistics. (Reference 8, 106)

Fig. 5: Change in the number of cases of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" (1997-2006)

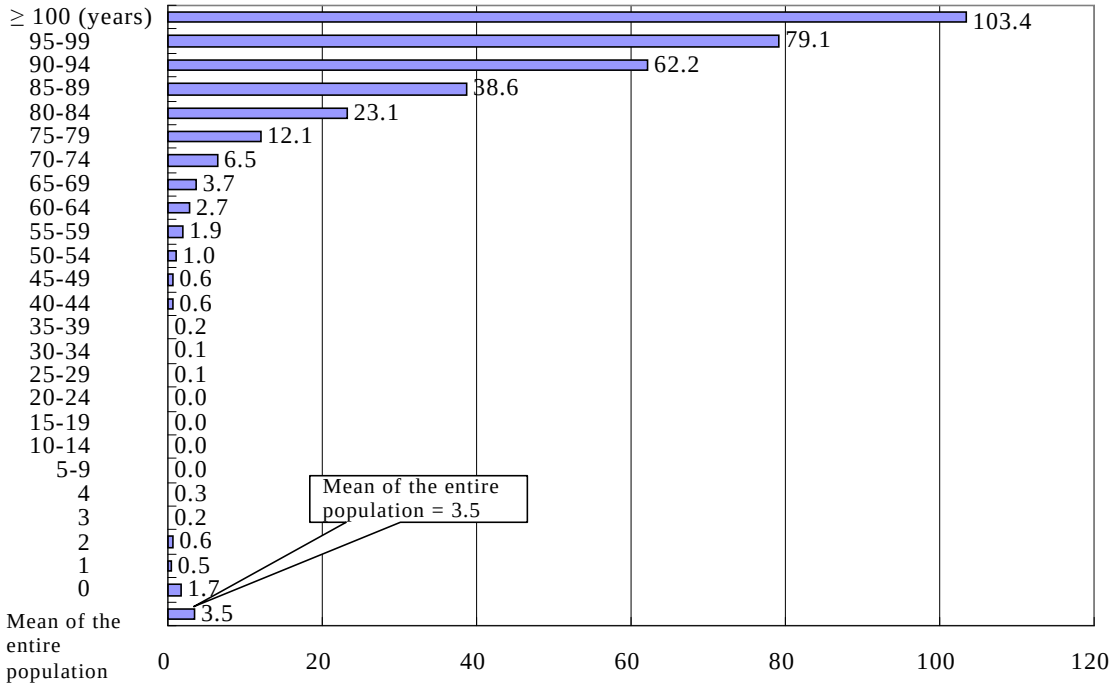


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
≥ 85 (years)	1,053	1,213	1,248	1,252	1,337	1,415	1,399	1,413	1,564	1,515
75-84	1,260	1,308	1,336	1,279	1,312	1,296	1,391	1,382	1,447	1,494
65-74	701	753	812	789	840	824	797	773	785	720
55-64	347	366	369	345	394	354	336	362	400	422
45-54	163	171	190	189	227	171	168	164	166	131
35-44	48	62	55	46	49	48	52	50	52	66
25-34	24	11	15	23	19	22	18	16	23	20
15-24	13	13	12	6	8	13	10	8	7	2
0-14	57	59	43	55	36	43	36	38	40	37

a. The Elderly

The average rate of death was 3.5 (relative to 100,000 persons). Compared with this average, the rate of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" in each age group in 2006 was as follows: 3.7 (65-69 years), 6.5 (70-74 years), 12.1 (75-79 years), 23.1 (80-84 years), 38.6 (85-89 years), 62.2 (90-94 years), 79.1 (95-99 years), and 103.4 (≥ 100 years). These figures show that, with the increase in age, the rate of death rapidly increased, especially among those aged 70 and over (Fig. 6). (Reference 4, 104)

Fig. 6: Rate of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" (relative to 100,000 persons) (2006)

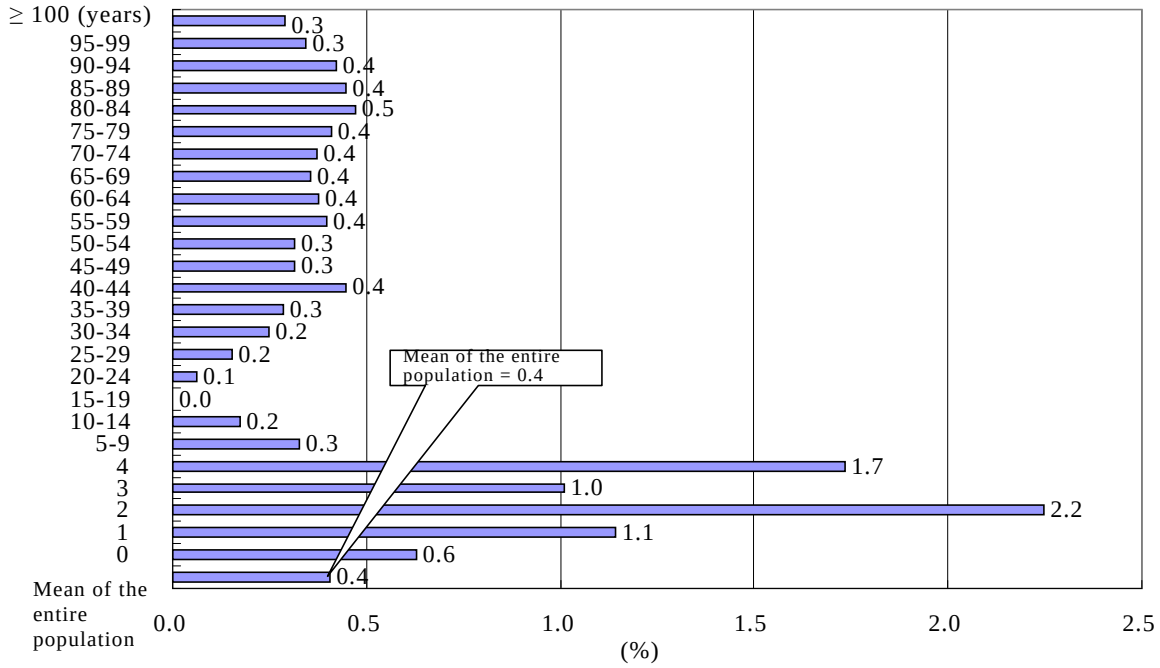


In 2006, among the causes of death in the elderly, "unexpected accident" ranked fifth after "malignant neoplasm," "cardiac disease," "cerebral ischemic injury," and "pneumonia." According to these data, 26,314 elderly persons aged 65 and over encountered "unexpected accidents at home (fall, death by drowning, choking, fire, intoxication, etc.)" and died. The number of fatal cases of "other unexpected choking" (death by drowning/near-drowning excluded) (7,724 cases), which exceeded that of "fall/falling down" (5,070 cases), "unexpected death by drowning/near-drowning" (4,552 cases), and traffic accidents (4,161 cases), was ranked first. About half of the fatal cases of "other unexpected choking" were classified as those of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" (3,729 cases). (Reference 104)

b. Children

The number of deaths from "obstruction of respiratory tract caused by inhalation and ingestion of food" as a percentage of all deaths in each age group is calculated. Among the infants ranging from 0 to 4 years in age, the respective percentages were 0.6%, 1.1%, 2.2%, 1.0%, and 1.7%. These figures exceeded the overall mean (0.4%) but the numbers among children older than 5 years were below the overall mean (Fig. 7). (Reference 4, 104)

Fig. 7: Deaths from "obstruction of respiratory tract caused by inhalation and ingestion of food" expressed as a percentage of total deaths in the respective age groups (2006)



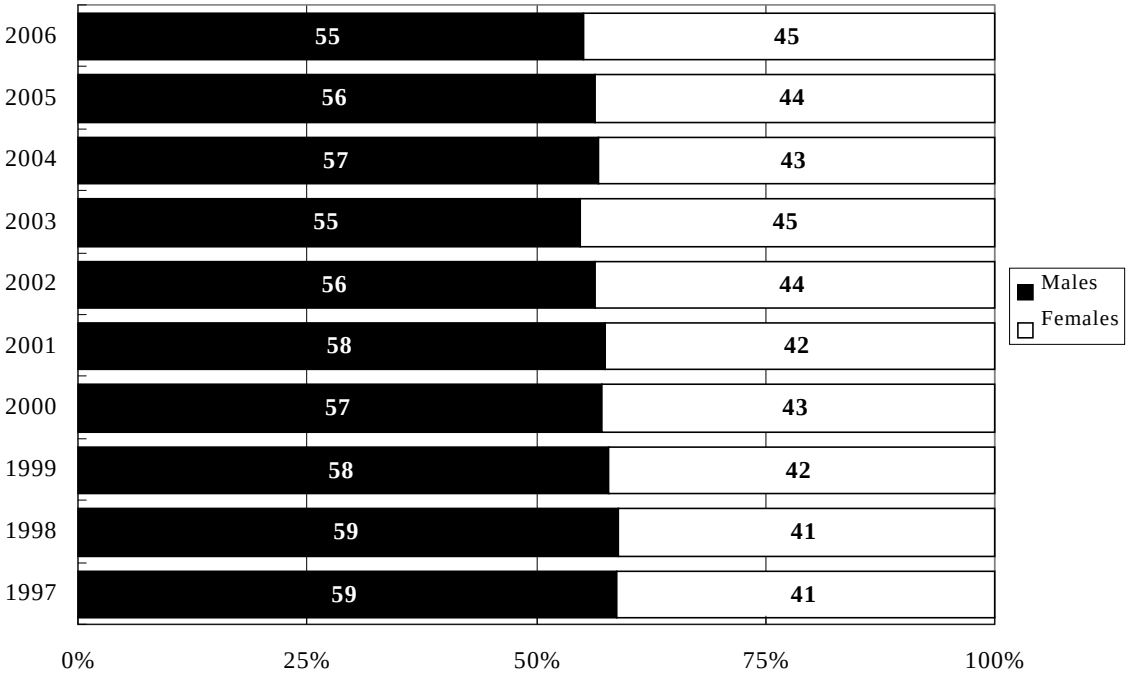
In 2006, the fifth biggest cause of death among the infants under 1 year old and the leading cause of death among infants aged 1-4 years and children aged 5-9 years were "unexpected accident." The ratio of cases of death from "obstruction of respiratory tract caused by inhalation and ingestion of food" to the cases of death from "unexpected accident" was 18/149 (12.1%) for the infants under 1 year old, 16/207 (7.7%) for the infants aged 1-4 years, 2/169 (1.2%) for children aged 5-9 years, and 1/106 (0.9%) for children aged 10-14 years. (Reference 104) These figures demonstrate that the number of such fatal cases decreases after the period of infancy.

c. Sex

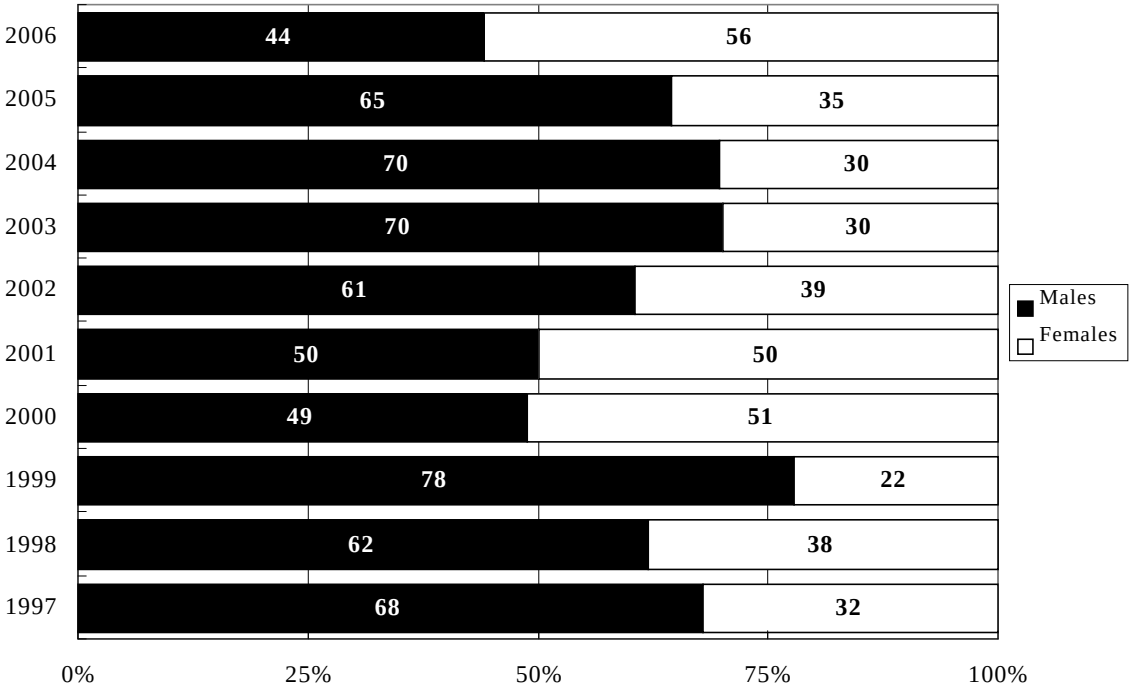
The number of deaths from "obstruction of respiratory tract caused by inhalation and ingestion of food" from 1997-2006 broken down by sex is shown in Fig. 8. Among the entire population, infants, and the elderly, males died more frequently than females. (Reference 4, 104)

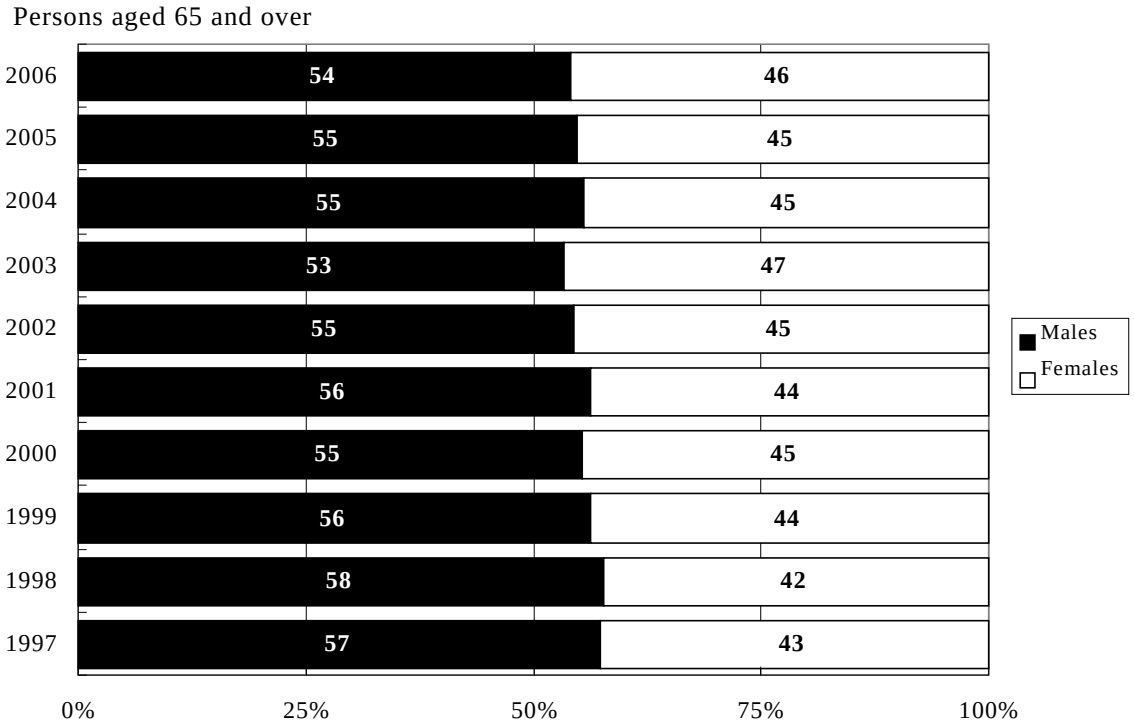
Fig. 8: Breakdown by sex of deaths resulting from "obstruction of respiratory tract caused by inhalation and ingestion of food" (1997-2006)

Entire population



Infants between 0 and 4 years of age

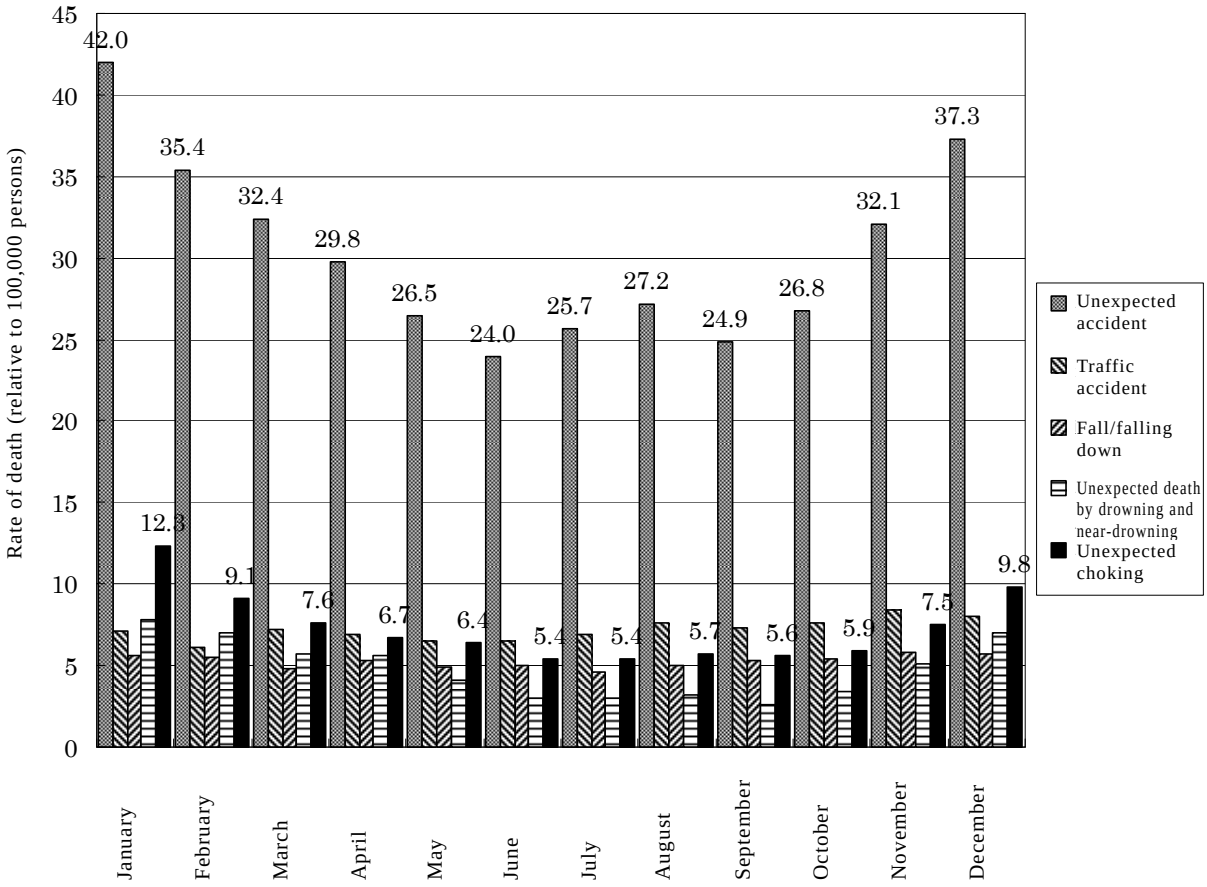




d. Timing of Accidents

The rates of death from “unexpected choking” and “unexpected death by drowning and near-drowning” in 2006 were examined by month. They were found to be highest in January and lowest in summer. In fact, the rates in January were more than twice as high as those in summer. These higher rates contributed to the increase in the rate of death from overall “unexpected accident” in winter, particularly in January. (Reference 4, 104) In view of the monthly trend in the number of cases included in the data derived from the firefighting headquarters (Section III, 2), we speculated that the monthly rate of death from “obstruction of respiratory tract caused by inhalation and ingestion of food” probably showed a similar trend. The seasonal variation reflects Japanese food-related cultural practices (sticky rice cake is eaten during the New Year period, which has the highest incidence of deaths).

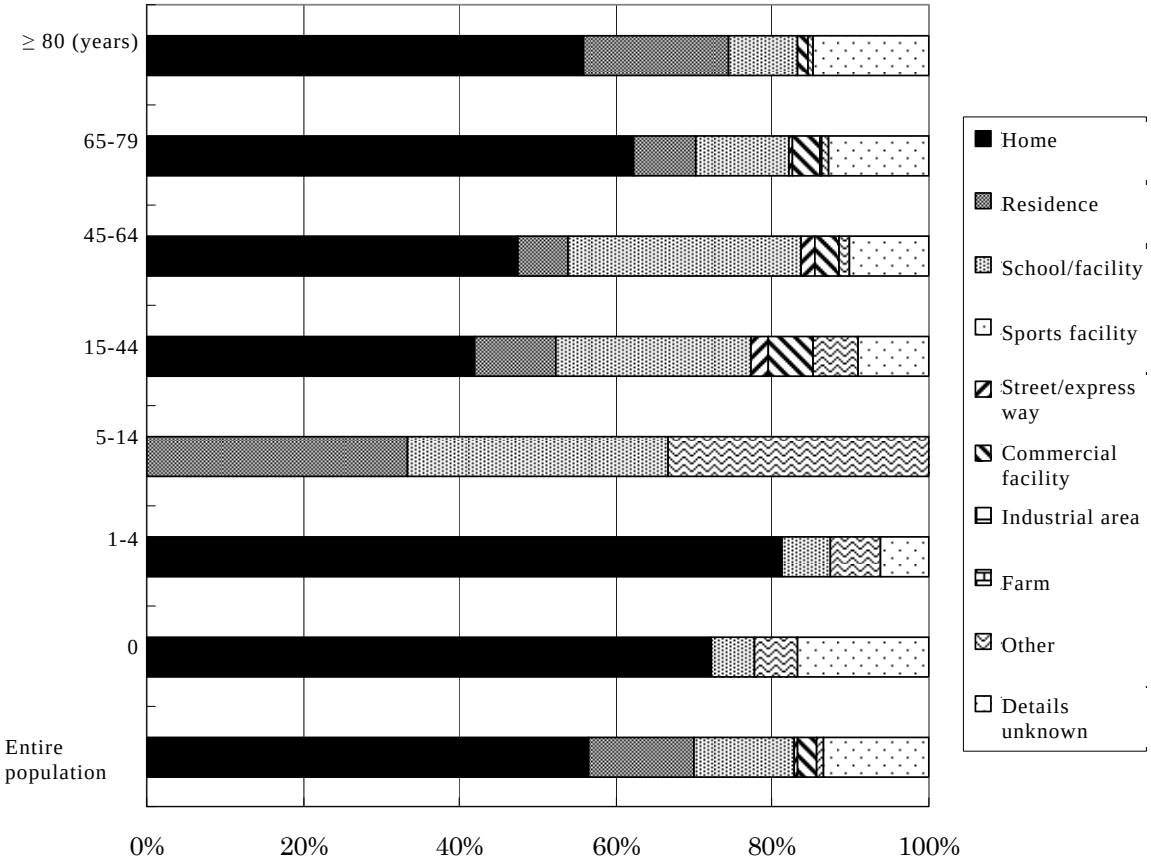
Fig. 9: Monthly rate of deaths from "unexpected accidents" (relative to 100,000 persons) (2006)



e. Site of Accidents

The cases of death from "unexpected accidents (excluding traffic accidents)" in 2006 are represented graphically according to the site of the accident and age of the victim. Infants aged 0-4 years generally encountered such accidents at home (70-80%), more so than other age groups. (Reference 4, 104)

Fig. 10: Sites of "unexpected accidents (traffic accidents excluded)" resulting in death (data by age group) (2006)



(2) Cases of Death from Choking on Konjac Mini-cup Jelly

According to Social Policy Bureau under the Japanese Cabinet Office, 22 cases of death from accidental choking on konjac mini-cup jelly have been confirmed in Japan over the approximately 13 years from July 1995 to July 2008 (ratio of males to females 16:6). (Reference 1) The National Consumer Affairs Center of Japan reported the details of 17 of these cases (ratio of males to females 13:4) (Appendix 2). The number of male victims was consistently large in these data. According to the data on these 17 cases, the victims ranged in age from 1.5 to 87 years, and all but 1 (a 41-year-old female admitted to a psychiatric hospital) were either infants or elderly people. No healthy young or middle-aged persons (aged 15-64) were reported to have died from accidental choking on mini-cup jelly.

The 10 pediatric cases included 4 children aged 6 to 7. In 1 of the 4 cases, the absence of chew marks on the causative food indicated that the child had probably swallowed it without chewing. (Reference 1) In this case, the eruption of anterior teeth (incisors) (replacement of old anterior teeth with new ones) is regarded as one of the factors contributing to the choking accident [Table 34 (p.58)]. Emergency paramedics were dispatched to treat at least 12 of the victims and 6 victims received first-aid treatment from bystanders. "Eating jelly while fighting over it with brother," "sucking jelly into the mouth"—in addition to these cases, however some of the victims used a spoon to cut the jelly into small pieces before eating it.

There are 32 reported cases of accidental choking on konjac mini-cup jelly not resulting in death (Appendix 3). Many of these victims were saved by bystanders who performed first-aid treatments such as "slapping on the back," "sweeping with a finger," and "bending the victim's head down" and making them spit out the inhaled pieces of jelly.

(3) Exogenous Deaths Reported by OECD Member States (reference)

In 26[2] of the member states of Organisation for Economic Co-operation and Development (OECD), more than 20,000 children ranging from 1 to 14 years of age died from exogenous causes [exogenous death: death resulting from an unexpected accident and death resulting from an intentional act (suicide, homicide)] each year. Although the rate of exogenous death was reduced to half during the period from 1970s to 1990s, the number of exogenous deaths as a percentage of total deaths increased from 25% to 37% during this period. In Japan, the rate of exogenous death among infants was reduced to slightly less than 40% during the period from 1970s to 1990s. Japan, however, was ranked 12th from the bottom among the 26 OECD member states (Fig. 11).

The data on exogenous deaths reported by 26 OECD member states during the period from 1991 to 1995 were compared with those in 2006 in Japan. The causes of exogenous death in Japan were characterized by low percentages of “traffic accident” and “other unexpected accidents” and a high percentage of “other exogenous causes” including suicide. The percentage of “other unexpected accidents” including “obstruction of respiratory tract caused by inhalation and ingestion of food” in Japan (about 11%) was slightly less than 2/3 of the mean percentage in OECD member states (about 17%). (Reference 107)

[2] Iceland, Turkey, and Luxembourg were OECD member states during this period but they are not included in the 26 states mentioned here.

Fig. 11: Rate of exogenous death among children reported by 26 OECD member states (Reference 107 [partial modification])

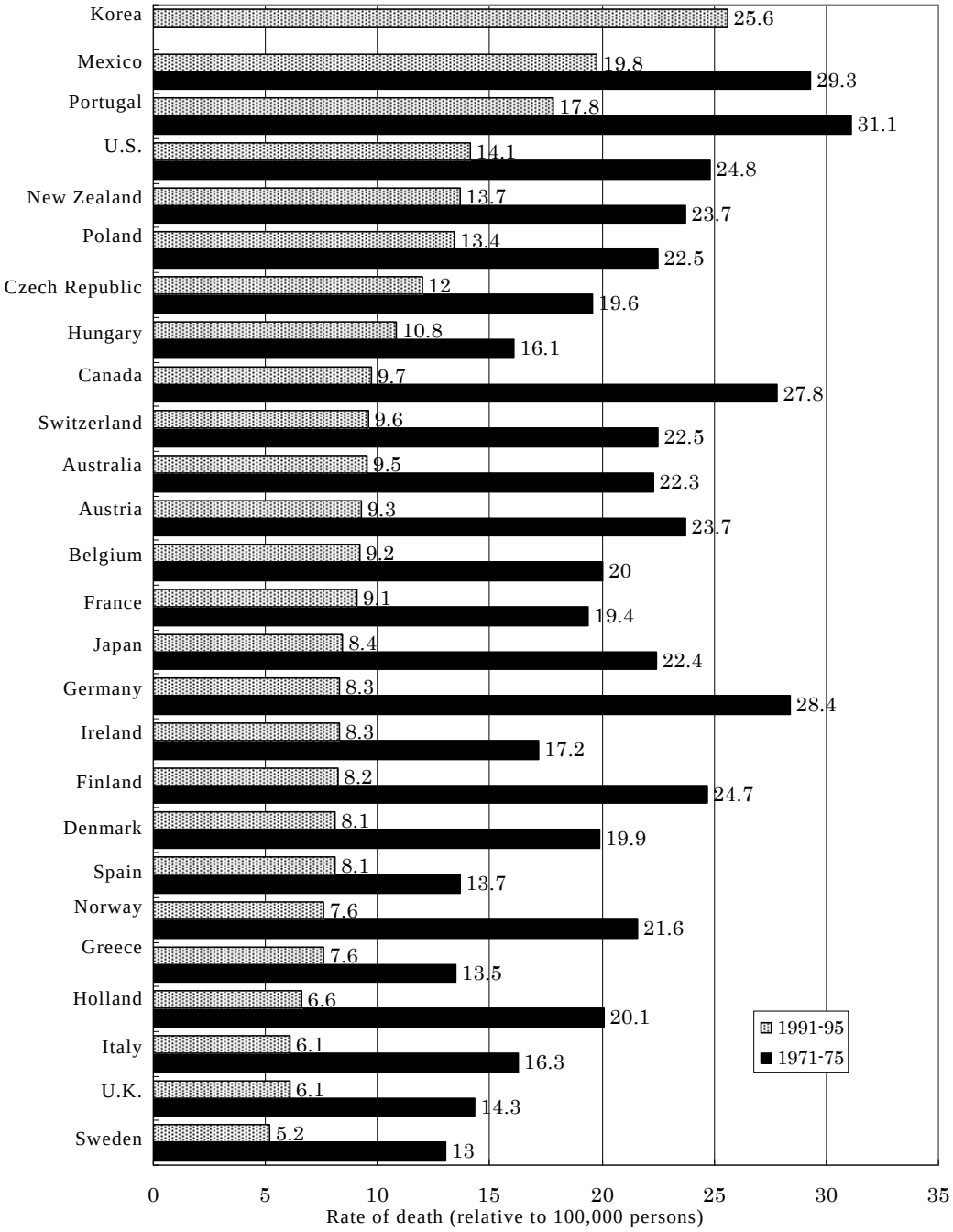
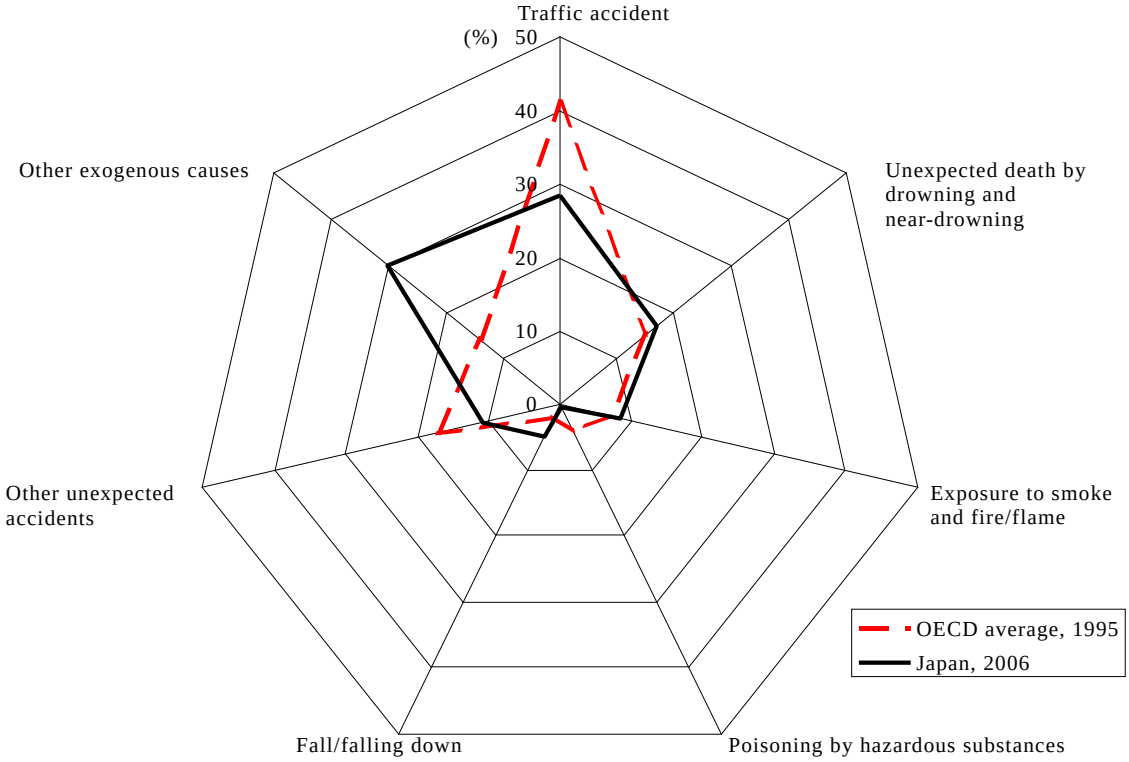


Fig. 12: Details of exogenous death among children: comparison between Japanese data and OECD data (mean of the data obtained from 26 member states)
(Reference 107 [partial modification])



(4) Data on Cases of Death from Accidental Choking in the U.S. (reference)

The death certificates of children aged 9 and under issued in 47 states in the U.S. over the 3 years from 1979 to 1981 (about 32,000,000 children; coverage of 97%) were collected for further review. They included 200 cases of death from food-related accidental choking. The causative foods were reported in 103 of these cases. The leading causative food was hotdogs (17 cases, 16.5%) followed by "candy" (10 cases, 9.7%), peanuts (9 cases, 8.7%), and grapes (8 cases, 7.8%). (Reference 108) These figures were close to those reported by tertiary medical institutions in the U.S and Canada during the period from 1989 to 1998 (Section III, 3[4]) with regard to accidental choking resulting in death among children (aged ≤ 14 years).

The children aged 9 and under who died from obstruction of the respiratory tract by foods or non-foods or who died from accidental choking due to external pressure in Maryland during the period from 1970 to 1978 were registered by the State Medical Affairs Office. The cause of such fatal accidents was food in 12 of 42 registered cases. Hotdogs were identified as the causative food in half the cases (n=6). The pieces of hotdogs that caused the fatal choking accidents were not sufficiently chewed and were large in size. The pieces removed from 3 victims ranged from 13×25 mm to 25×38 mm in size. These hotdog pieces were removed at hospitals or during autopsies. They were reported to have been lodged in the "pharynx (oropharynx)" or "larynx." They were also reported to have become "lodged in the hypopharynx, obstructing the entrance of the esophagus and larynx." (Reference 109)

6. Data on Autopsy Cases

A total of 95 cases of food-related accidental choking fatalities were autopsied by the Tokyo Metropolitan Medical Examiner's Office in 1992. In these cases, the causative foods were sticky rice cake (including sweet sticky rice cake) (11 cases, 11.6%),

steamed rice (including fried bean-curd stuffed with vinegared rice) (6 cases, 6.3%), bread (6 cases, 6.3%), meat (5 cases, 5.3%), konjac (4 cases, 4.2%), raw fish (4 cases, 4.2%), potato (2 cases, 2.1%). (Reference 110)

In 1999, 2 victims of food-related choking accidents were autopsied at the forensic department of a university in Hokkaido. (A judicial autopsy was conducted in 1 case.) One victim was a 65-year-old male (complete loss of teeth, bedridden) who had choked to death while cooking and eating pieces of ram at home. According to the autopsy result, an uncooked piece of ram (9×5 cm, 18 g) that had been barely chewed was found to be almost completely obstructing the trachea. Another victim was an 82-year-old male (history of cerebral infarction, bedridden), who was being fed by a staff member at a facility for the elderly. The man refused to eat more than a spoonful of the food (soba noodles) so the assistant gave him a liquid food formula as nutritional support. The man then suffered dyspnea and died, although attempts were made to suction the liquid food formula out of the trachea. According to the autopsy result, the area below the tracheal bifurcation was obstructed with soba noodles, seaweed, and gray liquid. The man's cough reflex was weakened in this case. (Reference 111)

IV. Foods that Frequently Cause Choking Accidents

Whether a food frequently causes choking accidents is defined not only by the number of cases of choking accidents as mentioned in Section III but also on the frequency of consumption. We selected the main foods (food groups) responsible for choking accidents and used the formula (Fig. 13) to calculate the frequency of choking accidents per mouthful of food to give an index of the tendency of those foods to induce a choking accident. This enabled us to make a relative comparison. We referred to the National Nutrition Survey (mentioned below) in the process of determining mean daily intake by food (food group). Infants (under 1 year), however, were not included in this survey. We therefore calculated the frequency of choking accident per mouthful of food with no consideration of infants.

Fig. 13: Formula for calculating the frequency of choking accidents per mouthful of food

$$\left(\begin{array}{l}\text{Frequency of choking accidents}\\ \text{per mouthful by food (food}\\ \text{group)}\end{array}\right) = \frac{\text{Deaths from accidental choking on food (food group) (persons/year)} / 365\ \text{(days/year)}}{\left(\begin{array}{l}\text{Mean daily intake by food (food}\\ \text{group) (g/day)}\end{array}\right) / \left(\begin{array}{l}\text{Mouthful amount by food}\\ \text{(food group) (g)}\end{array}\right) \times \left(\begin{array}{l}\text{Population}\\ \text{(persons)}\end{array}\right)}$$

Number of Deaths from Accidental Choking by Food (food group)

We used the emergency medical care cases reported by "75 Emergency Medical Centers (2007)" as the source of data on the number of deaths from accidental choking by food (food group). These cases were selected for the following reasons: They were collected from a nationwide survey; the percentage of fatalities was high; and the age distribution of emergency medical care cases was similar to that of deaths from "obstruction of respiratory tract caused by inhalation and ingestion of food (W79)" in Vital Statistics [Table 16 (p.23)]. We used the component percentage of food-related cases in which emergency medical treatment was needed[3] [Table 15 (p.22)] to prorate the deaths from "obstruction of respiratory tract caused by inhalation and ingestion of food" in Vital Statistics (2006). We were thus able to calculate the number of deaths from accidental choking related to the food (food group) (Case 1-1 and Case 1-2) (Table 22).

The 3 cases of choking on "mini-cup jelly" included at the "75 Emergency Medical Care Centers (2007)" were not necessarily caused by "konjac mini-cup jelly." For 22 cases of death from accidental choking on konjac mini-cup jelly reported by the Japanese Cabinet Office's Social Policy Bureau, in view of the variation between years, we also conducted a calculation using the mean annual number of deaths of 1.7 as the number of deaths from accidental choking on "konjac mini-cup jelly" (Case 2-1 and Case 2-2) (Table 23).

[3] The emergency medical care cases reported by "75 Emergency Medical Care Centers (2007)" included 620 cases in which the age of the victim was recorded (including cases where the causative food was unknown). Of these, 8 were infants (1.3%). Infants are probably included in the 371 cases in which causative foods were identified, although they seem to account for a small percentage. The leading causative foods involved in the cases of children under 10 years of age were snacks and candy followed by milk beverages including cow's milk. Therefore, infants were more likely to choke on milk beverages. The target foods (food groups), however, do not include milk beverages. Accordingly, the component percentages of cases in which emergency medical treatment was required care in relation to target food (food group) incidents listed by"75 Emergency Medical Care Centers (2007)" does not change to any remarkable degree even if the infants concerned are excluded. We can therefore reasonably use the reported component percentage to calculate the frequency of choking accidents per mouthful of food among the non-infant population.

Table 22: Number of deaths from accidental choking by food (food group) (estimation) (Case 1-1 and Case 1-2)

Food (food group)	Deaths from accidental choking (estimation)	(Reference) Component ratio (%)
Sticky rice cake	1,075.3	24.5
Steamed rice	684.7	15.6
Bread	509.1	11.6
Meat	329.2	7.5
Fish meat	294.1	6.7
Candy	70.2	1.6
Fruit	320.4	7.3
Mini-cup jelly	35.1	0.8

Table 23: Number of deaths from accidental choking by food (food group) (estimation) (Case 2-1 and Case 2-2)

Food (food group)	Deaths from accidental choking (estimation)	(Reference) Component ratio (%)
Sticky rice cake	1,075.3	24.5
Steamed rice	684.7	15.6
Bread	509.1	11.6
Meat	329.2	7.5
Fish meat	294.1	6.7
Candy	70.2	1.6
Fruit	320.4	7.3
Konjac mini-cup jelly	1.7	

Beans/nuts/seeds including peanuts accounted for more than half of the cases of foreign body in the trachea/bronchus not resulting in choking accidents. They were also the leading causative foods involved in fatal cases involving infants reported in the data derived from "185 Designated Centers with Certified Critical Care Doctors/Emergency Medical Centers (2008)" [Table 17 (p.24)]. We were unable to identify the method for estimating the ratio of fatal cases of choking on beans/nuts/seeds including peanuts to cases of death from "obstruction of respiratory tract caused by inhalation and ingestion of food (W79)" in Vital Statistics. Therefore, we did not calculate the frequency of choking accidents per mouthful of beans/nuts/seeds including peanuts.

Mean Daily Intake by Food (food group)

We referred to the results of the National Nutrition Survey conducted by the Ministry of Health, Labour and Welfare. In the National (Health) Nutrition Survey in 2001 and later, the intake was described according to "subcategory" of foods, with no more detailed classification reported (e.g. the subcategory of "processed rice" can be further divided into various rice-based foods including "sticky rice cake"). We speculated that there was no remarkable change in the trend of intake by food (food group) over the past 10 years and that using the results of the survey conducted immediately before 2000 did not make any difference. In order to limit the influence of variation between years, we used the mean of results obtained for several years. We asked the Ministry of Health, Labour and Welfare to prepare a special tabulation of the results of National Nutrition Surveys for 3 years including 1998, 1999, and 2000. For the daily intake by food based on the special tabulation of the survey results, we calculated the weighted average on the basis of the number of subjects of survey in each year and used that figure.

For the intake of "mini-cup jelly," the following two cases were considered for determination: (i) the intake is estimated to be half of the intake of "jelly" according to the National Nutrition Survey (Case 1-1) (Table 24); and (ii) the intake is estimated from the sales of "bite-sized jelly snacks" based on the data reported by the Consumer Affairs Agency (Case 1-2) (Reference 31) (Table 25). For the intake of "konjac mini-cup jelly," the following two cases were considered for determination: (i) the intake is estimated from the sales based on the data reported by the Social Policy Bureau under the Japanese Cabinet Office (Reference 1) (Case 2-1) (Table 26); and (ii) the intake is calculated as an amount equivalent to 80% of sales of "bite-size jelly snacks" reported by

Consumer Affairs Agency (Reference 31) (Case 2-2) (Table 27).
For details of the method of calculation, see Appendix 4.

Table 24: Mean daily intake by food (food group) (Case 1-1)

Food (food group)	Mean daily intake (g)
Sticky rice cake	3.10
Steamed rice	355.54
Bread	39.90
Meat	77.93
Fish meat	94.15
Candy	0.45
Fruit	105.69
Mini-cup jelly	0.38

Table 25: Mean daily intake by food (food group) (Case 1-2)

Food (food group)	Mean daily intake (g)
Sticky rice cake	3.10
Steamed rice	355.54
Bread	39.90
Meat	77.93
Fish meat	94.15
Candy	0.45
Fruit	105.69
Mini-cup jelly	0.47

Table 26: Mean daily intake by food (food group) (Case 2-1)

Food (food group)	Mean daily intake (g)
Sticky rice cake	3.10
Steamed rice	355.54
Bread	39.90
Meat	77.93
Fish meat	94.15
Candy	0.45
Fruit	105.69
Konjac mini-cup jelly	0.33

Table 27: Mean daily intake by food (food group) (Case 2-2)

Food (food group)	Mean daily intake (g)
Sticky rice cake	3.10
Steamed rice	355.54
Bread	39.90
Meat	77.93
Fish meat	94.15
Candy	0.45
Fruit	105.69
Konjac mini-cup jelly	0.38

Mouthfuls by Food (food group)

A mouthful is not the same as the amount of food swallowed each time. Generally, accidental choking occurs as a result of swallowing a piece of food put into the mouth. Therefore, it makes more sense to calculate “frequency of choking accidents” not on the basis of frequency of swallowing but on the basis of frequency of putting food into the mouth. Some choking accidents occur as a result of putting an excessive amount of food (an amount exceeding an appropriately sized

mouthful) into the mouth. In this assessment, however, we attempted to conduct a relative comparison with respect to the main foods (food groups) responsible for choking accidents. Accordingly, we speculated that use of a mean value as "a mouthful" made no difference.

The researchers selected 10 persons (5 males, 5 females) with normal biting function from three age groups: 5-year-old children, 8-year-old children, and adults (mean age: 27.1 years) and measured the amount of food (steamed rice, bread [bun][4], fish sausage, apple) they put into their mouth each time (Table 28) (Reference 112, 113). According to this report, irrespective of the type of food, adult males take significantly larger mouthfuls of food than females[5]. For other parameters used in the calculation formula in Fig. 13, however, no data by sex were available and the frequency of choking accidents was calculated with no consider of sex differences.

Table 28: Actual measurement of one mouthful by food (g)
(Reference 112, 113 [partial modification])

Matsuyama (2006) Yagi et al. (2006) Each age group consists of 10 subjects	Steamed rice	Bread (bun)	Fish sausage	Apple
5	7.2±2.1	2.9±1.5	5.8±2.6	5.7±3.0
8	9.5±4.2	3.8±2.0	8.5±3.3	7.3±2.7
Adults (mean age: 27.1 years)	16.6±5.7	6.4±2.2	11.7±3.9	12.3±4.1

We decided to determine what amount constituted a mouthful of different types of foods (sticky rice cake, steamed rice, bread, meat, fish meat, fruit) according to the data listed in Table 28. For candy and mini-cup jelly (including konjac mini-cup jelly), we considered how the foods were consumed and made a determination of mouthful per unit of package. Table 29 gives a mouthful of food that was applied to Case 1-1, Case 1-2, Case 2-1, and Case 2-2. The details of the method of calculation are described in Appendix 4.

Table 29: A mouthful of food (food group)

Food (food group)	Mouthful amount (g)
Sticky rice cake	9-10
Steamed rice	11-22
Bread	4-9
Meat	8-16
Fish meat	8-16
Candy	3-8
Fruit	8-16
Mini-cup jelly/konjac mini-cup jelly	14-29

We used the calculation formula (Fig. 13) to obtain the frequency of choking accident per mouthful of food (food group) in Case 1-1, Case 1-2, Case 2-1, and Case 2-2 (Table 30, 31, 32, 33).

In order to obtain the estimations in Case 1-1 and Case 1-2, we considered the paucity of the absolute number of cases of accidental choking on "mini-cup jelly" (n=3) relative to the number of cases of emergency medical care (n=371), and applied this component percentage to the number of fatal choking accidents (n=4,389) (victims under 1 year old excluded). Moreover, we adjusted the intake of "mini-cup jelly" to a half of the intake of "jelly" reported in the National Nutrition Survey. This made it possible for us to make estimations with a reasonable margin of error. In order to obtain the estimations in Case 2-1 and Case 2-2, we used the actual number of cases of fatal choking on konjac mini-cup jelly reported by the Social Policy Bureau under the Japanese Cabinet Office as the

[4] According to the author of the original article, a mouthful of bread is smaller than that of other food probably because human beings determine mouthful size on the basis of visual information. (A piece of bread is relatively lighter than other foods of the same size.)

[5] There was no recognizable difference in mouthful size between boys and girls in the two age groups (5-year-old children and 8-year-old children).

basic data. We also considered the fact that these reported cases were limited to the victims who died a relatively short time after the choking incident. Accordingly, we may have made an underestimation compared with the number of fatal choking accidents reported in Vital Statistics.

Considering the results of calculation of four separate cases, the Food Safety Commission made a comprehensive finding as follows: The frequency of choking accidents per mouthful of konjac mini-cup jelly seemed to be similar to that of candy. If no accidents are reported after the introduction of countermeasures, including labeling that prohibits the consumption of mini-cup jelly by the elderly and infants in 2008, it would indicate that the frequency of choking on konjac mini-cup jelly is lower than that of choking on candy.

The incidence of choking accidents per mouthful of food was calculated in consideration of accidental choking caused by various factors including those related and unrelated to foods. Therefore, the figure does not represent the incidence intrinsic to each food (food group). The figures used for calculation included some estimated values because of the paucity of data. Before interpretation of these data, sufficient attention shall be directed to these points.

Table 30: Incidence of accidents of choking on a mouthful of food (food group) (Case 1-1)

Food (food group)	Frequency of choking accident per mouthful of food ($\times 10^{-8}$)
Sticky rice cake	6.8-7.6
Mini-cup jelly	2.8-5.9
Candy	1.0-2.7
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 31: Incidence of accidents of choking on a mouthful of food (food group) (Case 1-2)

Food (food group)	Frequency of choking accident per mouthful of food ($\times 10^{-8}$)
Sticky rice cake	6.8-7.6
Mini-cup jelly	2.8-4.7
Candy	1.0-2.7
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 32: Incidence of accidents of choking on a mouthful of food (food group) (Case 2-1)

Food (food group)	Frequency of choking accident per mouthful of food ($\times 10^{-8}$)
Sticky rice cake	6.8-7.6
Candy	1.0-2.7
Konjac mini-cup jelly	0.16-0.33
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 33: Incidence of accidents of choking on a mouthful of food (food group) (Case 2-2)

Food (food group)	Frequency of choking accident per mouthful of food ($\times 10^{-8}$)
Sticky rice cake	6.8-7.6
Candy	1.0-2.7
Konjac mini-cup jelly	0.14-0.28
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

V. Factors Involved in Food-related Choking Accidents

1. Factors Other than Foods (factors on the side of consumers)

As pointed out in Section III, the factors other than food, such as the age of consumers, are deeply involved in food-related choking accidents.

In view of the case reports mentioned and summarized in Section III, we roughly divided the common sites of obstruction by food into the following two areas.

(i) The area from the oropharynx to laryngeal vestibule [Fig. 1 (p. 11) (1), (2)]: in relation to this area, choking accidents involving mini-cup jelly and sticky rice cake among the elderly (small pieces of sticky rice cake have occasionally reached the bronchus) and accidents involving candy among infants have been reported. The choking accidents involving hotdogs reported in the U.S fall into this category.

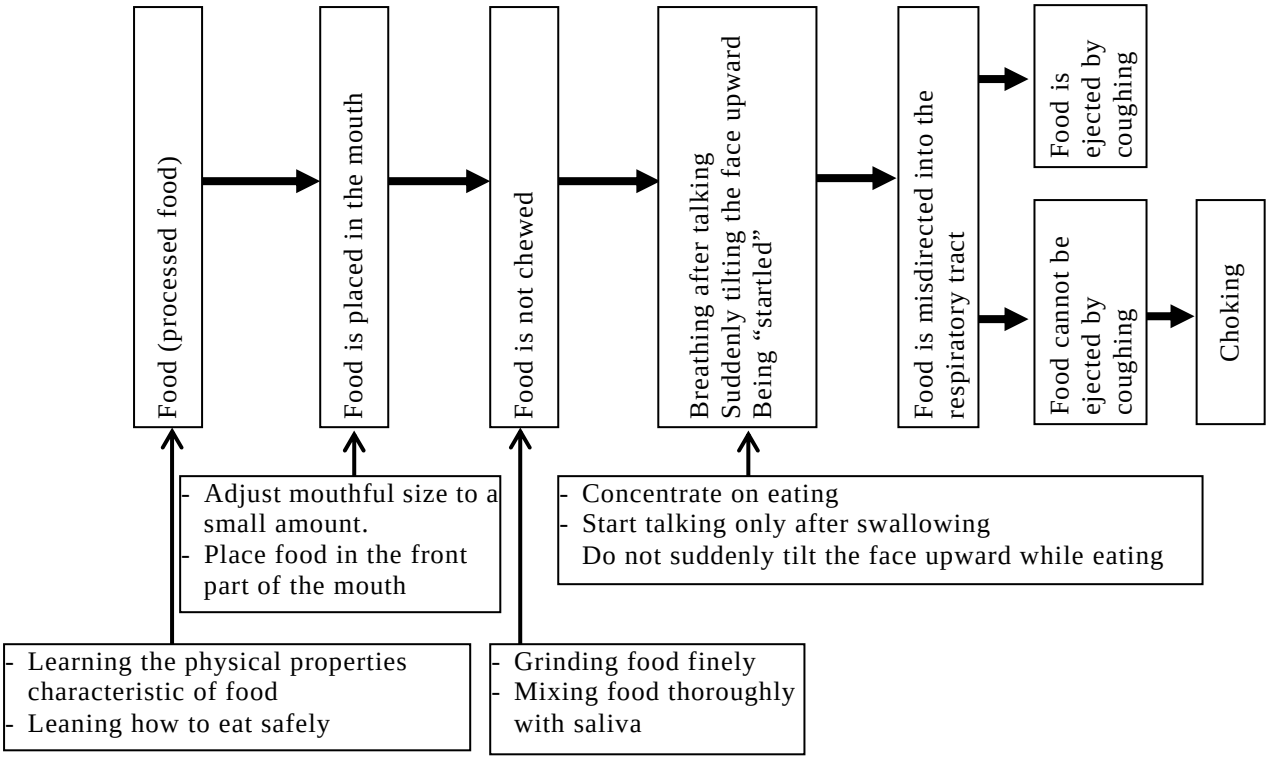
(ii) Beyond, the glottis, the area from the infraglottic space to the tracheal bifurcation [Fig. 1 (p. 11) (4)]: in relation to this area, choking accidents involving fruit and beans/nuts/seeds among infants have been reported. In one incident, a piece of meat measuring 9×5 cm was reported to have passed through the glottic space—which was said to be about 1 cm^2 in adults (Reference 7, 9)—and become stuck in the trachea.

The human larynx is positioned lower than in other mammals, and we also have a larger pharyngeal cavity and laryngeal cavity. This enables human beings to produce a large variety of sounds, although it also means a greater overlap between the respiratory tract and the passage of food, which increases the risk of aspiration (Reference 7, 9). In order to survive and maintain health, humans need to take food in via the mouth, making it impossible to avoid the passing of food through the risk areas described above ((i), (ii)). We consider this condition to be the basic factor contributing to food-related choking accident on the side of consumers. Moreover, we identify the manner in which the food is consumed, age, and the environment as the main non-food-related factors on the side of consumers.

(1) How to Eat, Recognition of Texture and Adjustment

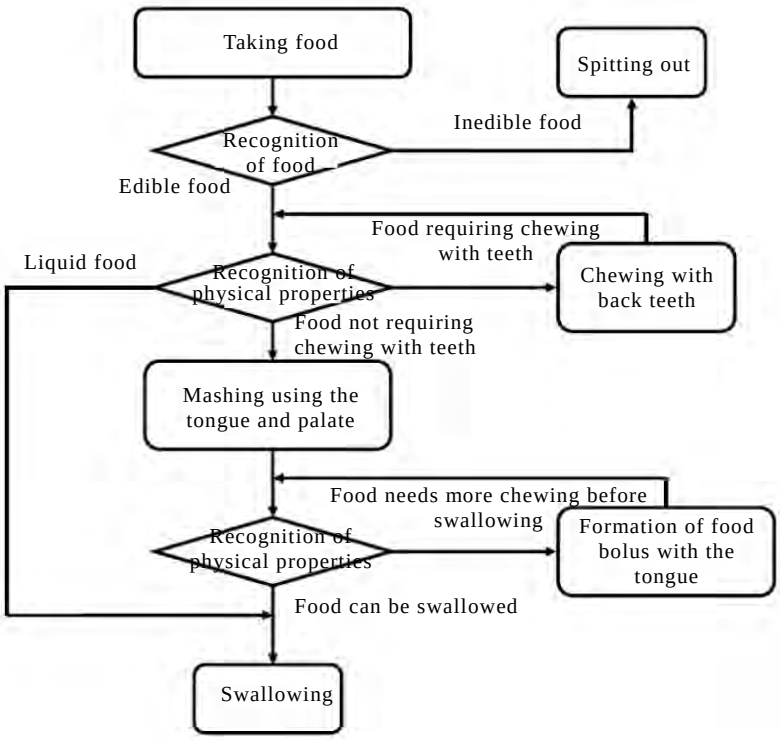
The factors on the side of consumers could be reduced and choking accidents could be prevented if the following "eating techniques for prevention of choking" (Fig. 14) were strongly promoted: (i) knowing physical properties of foods and how to eat foods safely, (ii) taking a small mouthful of food and placing food in the front part of mouth, (iii) chewing food repeatedly and mixing it with saliva, (iv) concentrating on eating. (Reference 114)

Fig. 14: Mechanics of food-related choking accidents and "techniques for preventing choking" (Reference 114 [partial modification])



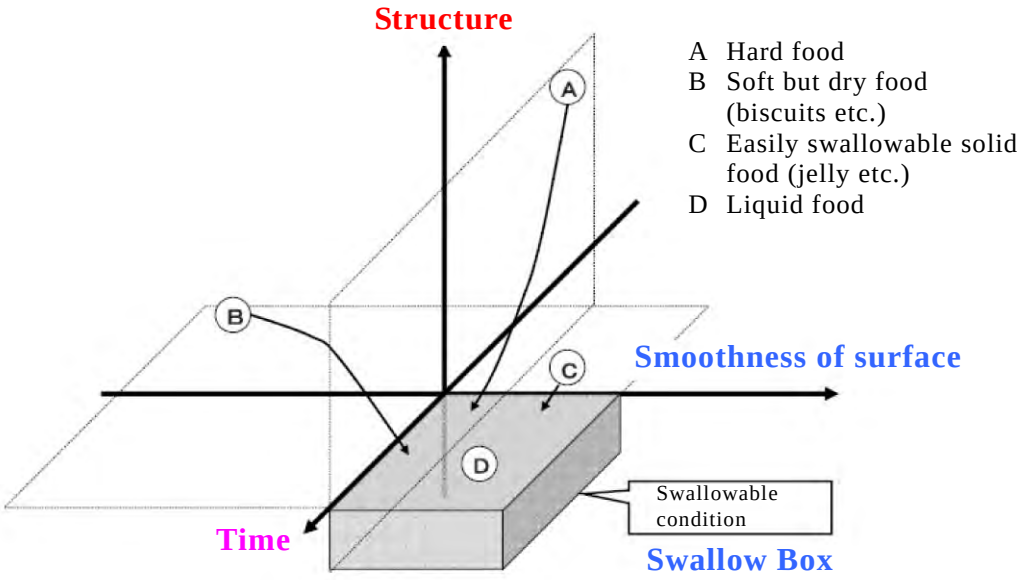
The texture of food is defined as the physical properties of food that can be tactilely recognized by humans. In this sense, texture includes the feeling on the tongue, the ease with which it can be pierced by the teeth, hardness, and the ease with which it can be swallowed. Based on their recognition of the texture of food, humans while eating judge whether the food in their mouth needs chewing, whether a bolus has been formed appropriately, and whether they can swallow the food already chewed (Fig. 15). (Reference 7, 11, 115, 116)

Fig 15: Recognition of texture and chewing/swallowing
(Reference 7, 11, 115, 116 [partial modification])



Human beings place food in their mouth, chew it using their teeth and sufficiently mix it with saliva to surface smooth. When the food in the mouth is judged to be appropriately chewed and chewing is complete, the food is swallowed. On the basis of this process, a model (Fig. 16) has been reported. (Reference 7, 11, 116, 117)

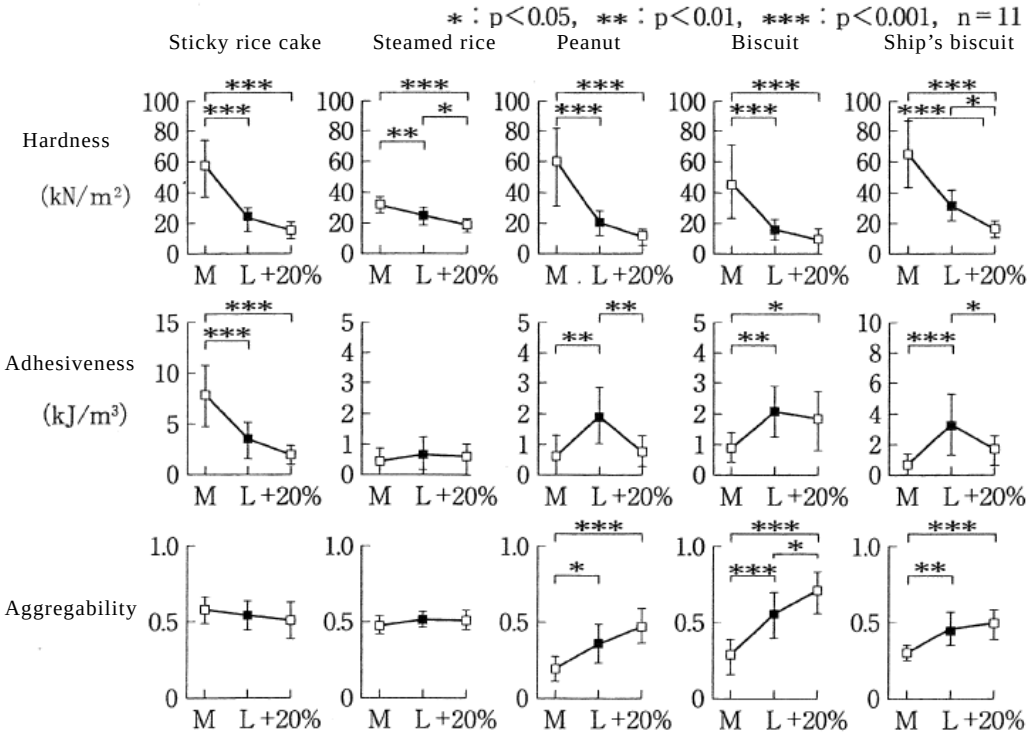
Fig. 16: Adjustment of food texture by chewing, and swallowing
(Reference 7, 11, 115, 116, 117)



Eleven healthy volunteers were given sticky rice cake, steamed rice, peanuts, biscuit, and ship's biscuit for chewing. The texture of each food in the mouth was determined at three points in time: in the middle of chewing ("M"), immediately before swallowing ("L"), and the point in time arrived at by adding 20% of the total time spent chewing to the point at which the judgment was made to swallow ("+20%") (Fig. 17). All the foods tested were softened after chewing. The adhesiveness of sticky rice cake decreased after chewing although that of the remaining foods reached a peak at the time of swallowing. Aggregability differed from food to food. Aggregability after chewing decreased in some foods but gradually increased in other foods. When healthy people chew the structure of food is broken down, the food becomes less hard, and adhesiveness increases to form a bolus. In the case of sticky rice cake which has intense intrinsic adhesiveness, however, it is chewed to reduce its adhesiveness until the point at which it is judged that it can be swallowed. (Reference 7, 11, 118, 119)

Human beings have a natural ability to recognize the texture of food in the mouth and adjust it by chewing and mixing in saliva, and to judge whether or not the food is ready to be swallowed. Individuals who are either going through the stage of developing of this function or suffer an impairment of this function are likely to experience aspiration or difficulty in swallowing, leading to accidental choking.

Fig. 17: Change in food texture by chewing (Reference 7, 11, 118, 119)



(2) Age

As mentioned in Section III, 5(1), the number of deaths from food-related choking accidents—or the rate of death from food-related choking accidents—is extremely high among the elderly. The number of deaths from food-related choking accidents as a percentage of the total number of deaths is high among infants. As described in Section III, 5(2), no cases of accidental choking on konjac mini-cup jelly were reported among the healthy young and middle-aged population (15-64 years). People in this age group differ widely in terms of social behavior and amount, type and form of food consumed, but the incidence of food-related choking accidents among them is lower than among the elderly and infants. Accordingly, the characteristics that are not shared with the young and middle-aged people but are common to the elderly and infants are likely to be involved in food-related choking accidents.

a. Elderly People

(a) Age Related Physiological Changes

Decreased Chewing Force

In an experiment, healthy elderly and young people were asked to eat apples, cheese, steamed rice, ship's biscuit, peanuts, and beef to measure the amount of muscle activity per stroke of chewing (Fig. 18) and the frequency of chewing (Fig. 19). According to the results, the amount of muscle activity used for eating these foods was smaller in the elderly than in the young, while the frequency of chewing was higher in the elderly than in the young. (Reference, 7, 11, 120, 121)

Fig. 18: Amount of muscle activity per stroke of chewing in elderly and young people

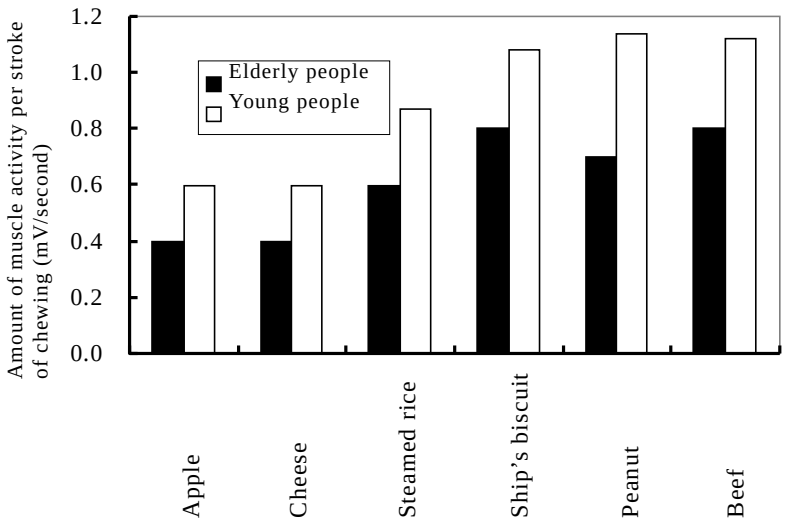
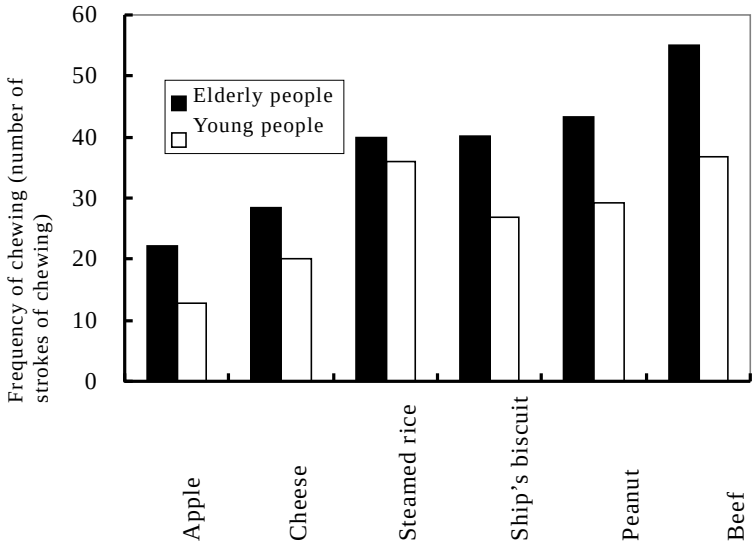


Fig. 19: Frequency of chewing in elderly and young people



Extended Distance of Laryngeal Elevation

The larynx retreats with age. Generally, it is located around the fifth cervical vertebra, particularly among the males in their 20s to 60s. Among those in their 70s and 80s, however, the larynx is reported to retreat to the sixth cervical vertebra. The elevation of the larynx in the pharyngeal phase of eating/swallowing stage (second phase of swallowing) consists of the following five continuous movements: gradual elevation, rapid elevation, retention of maximum elevation, rapid decline, and gradual decline. Because of age-related retreat, the larynx needs to move a long distance for a longer time in the process of "gradual elevation" in older people. The elevated position of the larynx, however, does not change with age. As a result, prolongation of the time taken for the elevation of the larynx and the extension of the distance of movement may have some adverse effect on swallowing function and increase the risk of aspiration. (Reference 122)

Decreased Sensitivity of Swallowing Reflex

In an experiment, water was dripped in the epiglottic vallecula and pyriform sinus in 22 healthy elderly people (age: 65-90 years, mean age: 72 years) and 24 healthy young people (age: 19-46 years, mean age: 31 years). These people did not suffer from any swallowing disturbance and had no history of cerebrovascular disorder or pneumonia. In the younger group, the reflex was observed immediately after dripping in 14 cases and after the water reached to epiglottic vallecula in 8 cases. No reflex was observed in 2 cases. In the elderly group, the respective number of cases was as follows: 0 cases, 9 cases, and 13 cases. For the pyriform sinus reflex, in the younger group, the reflex was observed immediately after the water reached the bottom of the pyriform sinus in 11 cases and before passing through the arytenoid region in 13 cases. There were no cases in which water passed through the arytenoid region and reached the laryngeal cavity without producing a reflex. In the elderly group, the respective number of cases was as follows: 0 cases, 12 cases and 10 cases. (Reference 123)

Delayed Induction of Swallowing Reflex

In an experiment, 8 g of corned beef, 8 g of biscuit, or a mix of 4 g of corned beef and 5 mL of barium solution was given to 12 healthy middle-aged people in their 60s (mean age: 64.8 years), 13 healthy elderly people in their 70s (mean age: 79.2 years), and 15 healthy young people (mean age: 30.3 years). They were asked to chew and swallow these foods. In the healthy young group, the number of cases in which food bolus was delivered to the hypopharynx area (area between the epiglottic vallecula and the esophageal entrance) before the swallowing reflex was zero cases in those who were given corned beef alone and 3 cases (10.0%) in those who were given biscuit alone. In the group of the elderly in their 70s, the respective number of cases was 4 cases (15.4%) and 9 cases (36.0%). There was a significant difference between the 2 groups ($p<0.05$). This reflected the effect of aging on the position of food bolus prior to the swallowing reflex. Delay in swallowing reflex has been identified as one of the contributing factors that cause choking.

There was no significant difference in the number of cases in which the bolus was delivered to the hypopharynx area before the swallowing reflex among those who were given the mix of corned beef and barium solution [18 cases (64.3%) in the healthy young group, 15 cases (62.5%) in the group of healthy middle-aged people in their 60s group, 17 cases (68.0%) in the group of healthy elderly people in their 70s]. When a bolus containing a lot of liquid is delivered to the upper part of the oropharynx, it is transported mainly by the passive movement by gravity rather than by any active movement. Therefore, irrespective of the condition of individual swallowing function, a bolus containing a lot of liquid can be delivered to the hypopharynx more easily than one that is dry. (Reference 124)

(b) Loss of Teeth etc.

Decreased chewing force due to dental caries and dentures and inappropriate fitting of dentures have been pointed out as causes of age- related decline in swallowing function. (Reference 125) As mentioned in Section III, 1(1), there is a significant correlation between “collapse of occlusal support in the molar region” and history of food-related choking accidents. In the autopsy case reported in Section III, 6, a 65-year-old male who had lost all his teeth died after presumably choking on a piece of uncooked meat that was swallowed without being chewed sufficiently.

(c) Background Diseases

As described in Section III, 1(1), there is a significant correlation between a “history of cerebrovascular disorder” and history of food-related choking accidents among the elderly living at home (users of ambulatory nursing facilities for the elderly). Of the types of stroke (cerebral infarction, intracerebral hemorrhage, subarachnoid hemorrhage, etc.), the three pathological conditions of pseudobulbar palsy, bulbar palsy, and unilateral cerebral lesion cause swallowing

disturbance. Generally, patients with stroke also suffer complex pathological conditions including diabetic peripheral neuropathy, age-related decline in function, and loss of teeth due to periodontal disease.

Because of the factors related to the central nervous system, patients with pseudobulbar palsy experience increased spasticity of the muscles involved in swallowing, from catching food with the lips to swallowing reflex and decreased coordination of movement. These patients exhibit the following symptoms: spilling food, failure to chew effectively, and difficulty in delivering bolus to the tongue root. Generally, pseudobulbar palsy does not occur after the initial unilateral stroke as it is bilateral disease. According to a report, of the patients aged 70 and over who experienced the initial attack, more than 80% had multiple cerebrovascular diseases comprising small lesions which were revealed by CT and MRI scanning. On the assumption that all elderly people with cerebrovascular disease suffer pseudobulbar palsy, appropriate measures to prevent swallowing disturbance should be developed in order to effectively prevent aspiration.

Bulbar palsy is impairment below the swallowing center of the medulla oblongata that disrupts the induction of the swallowing reflex and the opening of the esophageal entrance.

Even a unilateral cerebral lesion that does not affect the state of consciousness may cause swallowing disturbance. A contrast study of swallowing revealed occasional significantly prolonged transit time of food bolus in the oral cavity and pharynx in patients with such lesions, compared with healthy volunteers. People with lesions in the brain's left hemisphere reportedly experience difficulty during the eating/swallowing stage while the food is in the oral cavity, while those with lesions in the right side of the brain experience difficulty in the same stage while the food is in the pharynx. The people with unilateral cerebral lesions need appropriate advice as they may suffer mild swallowing disturbance. (Reference 126)

As described in Section III, 1(1), there is a significant relationship between "cognitive function" and history of food-related choking accidents among elderly residents living in nursing homes. In order to prevent aspiration in elderly people with decreased cognitive function, the following measures should be appropriately introduced and combined together as necessary: preparation of a comfortable environment that enables them to concentrate on eating, practice of swallowing exercises before meals (systemic relaxation, relaxation of the anterior neck muscles, exercise of tongue, lips, cheeks, glottis, abdominal muscle, etc.), and swallowing training, after confirming its safety by contrast study (videofluorography [VF]) (e.g. basic training without food [swallowing saliva alone, respiration/sputum training, etc.] and eating training with food [adjustment of posture, such as adopting a supine position at an angle of 30 degrees/bending of the head and neck, increased awareness of swallowing, which is usually performed unconsciously, repeated swallowing of mouthfuls of food, intentional coughing during meals, holding breath during swallowing, etc.]). (Reference 127)

(d) Responding to Swallowing Dysfunction

As described in Section III, 1(1), there is a significant correlation between "swallowing function" and history of food-related choking accidents among the elderly living at home (users of ambulatory nursing facilities for the elderly).

The causes of age related decline in the swallowing function include loss of muscle strength involved in swallowing, reduction in salivary secretion, change in salivary property, decreased mucosal recognition, change in taste, decline in attentiveness/concentration and systemic strength, and the effect of medication as well as the above-mentioned causes [(a)-(c)]. (Reference 125) Salivary secretion does not decrease among healthy elderly people who do not take medication. Therefore, decreased salivary secretion is unlikely to be related to aging and the possibility has been suggested that salivary secretion may decrease as a result of an underlying disease or be an adverse reaction to treatment of an underlying disease. (Reference 128)

Because swallowing disturbance can causes choking accidents as well as various diseases and injuries, appropriate measures should be taken as soon as possible. At home, carers should check the level of conscious awareness, posture, chewing, presence/absence of spilled food, "presence of food in the respiratory tract" (attention shall be directed to the fact that some people rarely notice food in the respiratory tract after aspiration), and duration of eating, and should conduct the swallowing questionnaire, the saliva swallowing test (repeatedly), the revised water drinking test, and the step-based food test, even in the absence of advanced diagnostic measurement instruments. Doing so can lead to the detection of swallowing disturbance so that appropriate action may be taken. (Response 129)

In medical institutions, choking accidents occur because nursing staff fail to order patients' meals be changed in accordance with the aggravation of their physical condition and decline in their swallowing function. People with swallowing dysfunction often refuse to accept the fact that they can no longer eat their favorite foods and it is difficult for healthcare workers to persuade them to accept a switch to a diet better suited to those with swallowing disturbance. (Reference 7, 12)

Tilting the chin upward has been known to frequently cause aspiration during swallowing. For this reason, it has been recommended that the best position for the chin while eating is down, and glasses and cups that do not require the chin to be elevated in order for their contents to be imbibed have been commercialized. Keeping the chin down has been regarded as effective in the case of delayed transfer to the pharynx during the eating/swallowing stage and the case of decreased backward movement of the base of the tongue because the it enables the narrowing of the pharyngeal cavity following retreat of the tongue root and epiglottis, narrowing of the entrance to the respiratory tract and protection of the respiratory tract. The distance between the tongue root and the posterior wall of the pharynx and the distance to the entrance to the respiratory tract decrease significantly when the head alone is bent, as opposed to the intermediate position. Bending the head alone seems to be useful in preventing the retention of the food bolus in the pharynx, although the epiglottic vallecula becomes narrow and prolongation of latent time until induction of swallowing reflex is observed. For this reason, the possibility is suggested that the formation of the bolus in the pharynx may be more difficult. Therefore, in addition to adjusting the position of the head and neck, it is effective to also adjusting of bending angle and/or the angle of the trunk. (Reference 130)

It is a well known fact that sticky rice cake causes choking accidents with higher frequency than other foods. Therefore, carers are advised to cut sticky rice cake into small pieces before giving it to elderly people. As mentioned in Section III, 3(3), in one incident, sticky rice cake cut into small cubes 1-2 cm in size and boiled in soup until soft that was given to an elderly person was accidentally inhaled and became lodged in the bronchus. Even if sticky rice cake is cut into small pieces, therefore, it should not be fed to elderly people with high risk of aspiration. (Reference 42)

(e) Self Feeding (independent feeding)

As shown by the findings of the survey on elderly residents at nursing homes in Section III, 1(1), elderly people are likely to experience food-related choking accidents if they meet the following conditions: decreased cognitive function, collapse of occlusal support in the molar region, and "independent" eating. The authors define true "independent eating" as follows: "The elderly person is able understand their own capacity for chewing and swallowing and selects foods appropriately. Meals are served on a large dish so that the individual can reprocess the meal as needed (by dividing the food into small portions, cutting it small pieces, or mixing). In this manner, the individual can take appropriate-sized mouthfuls." "The elderly people with appropriate coordination of hands and mouth are permitted to eat independently. However, elderly people requiring nursing occasionally suffer cognitive dysfunction and swallow food

without chewing or swallow an excessive amount of food."

According to a report, patients at medical institutions who ate meals in dining rooms experienced food-related incidents less frequently than those who ate their meals in bed. (Reference 7, 12)

It has been frequently pointed out that elderly people with dementia "eat too fast," sometimes putting too much food into their mouths. In this case, insufficient chewing may result in serious ill-effects such as "smothering" and "suffocation." (Reference 131) Besides elderly people, another group of people who experience choking accidents are patients admitted to psychiatric wards. They experience choking accidents due to the following causes: "eating and chewing habits," "not chewing for long enough" and "swallowing before sufficient chewing." (Reference 132)

b. Infants

Infants experience food-related choking accidents due to the following causes: (i) insufficient development of functions such as closure of nostril cavities with the uvula and closure of larynx with the epiglottis during swallowing, (ii) swallowing of food bolus before grinding of food or adjustment of size of food during the period before the growth of molars or permanent teeth. (Reference 133)

(a) Development of Dental Occlusion

The relationship between "Hellman's dental age," which is used as the index of the developmental stages of dental occlusion, and the corresponding ages of Japanese children is shown in Table 34. (Reference 134, 135) As mentioned in Section III, 5(2), of 10 children who died after choking on konjac mini-cup jelly identified by Social Policy Bureau under the Japanese Cabinet Office, 4 were aged between 6 and 7. The children who died after choking on mini-cup jelly reported in the U.S.A. (Section III, 3[4]) and Korea (Section VI, 3[3]) were aged between 5 and 6. According to Hellman's dental age, these victims were near Stage IIC, the stage during which the anterior teeth are replaced by permanent teeth.

Table 34: Hellman's dental age and the calendar ages of Japanese children
(Reference 134, 135)

Hellman's Dental Age			Japanese infants' calendar age
I	A	Early period of deciduous eruption	6-8 months
	C	Early period of attainment of deciduous occlusion	Between 6-7 months and 2 years to 2 years and 8 months
II	A	Period of attainment of deciduous occlusion	2 years and 6 months to around 6 years
	C	Period of commencement of eruption of first molar and anterior teeth	Around 6 years
III	A	Period of attainment of eruption of first molar	6 years to around 7-8 years
	B	Period of exchange of lateral teeth	9 years and 6 months to around 12 years
	C	Period of commencement of eruption of second molar	Around 12 years
IV	A	Period of attainment of eruption of second molar	Around 12-13 years
	C	Period of commencement of eruption of third molar	
V	A	Period of attainment of eruption of third molar	

(b) Development of Eating Function

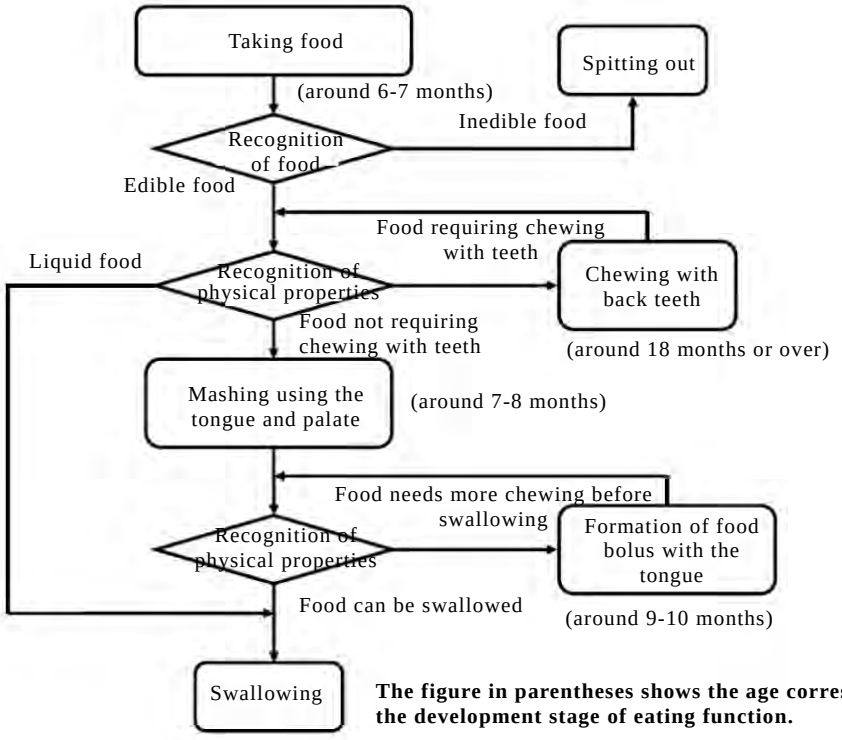
Helped and guided by their parents and other caregivers, infants generally develop eating function in accordance with their progress through the developmental stages (Fig. 20).

In the early and intermediate stages of weaning, an infant's mouth will

close when his or her sensitive lips come into contact with food. Inside the mouth, the food is placed on the tip of the tongue, and the size, shape and hardness of the food is ascertained. By acquiring this kind of information, the infant learns how to chew and consume food in an appropriate way. It is essential for the infant to learn this function as it will impact on his or her lifelong eating habits.

During the late weaning period and later, infants learn to take an appropriately sized mouthful of food and grind it into small pieces that can be swallowed. During this stage, the infant has few opportunities to "take food by hand" if the caregiver always places food directly into the infant's mouth. The caregiver may cut food into small pieces or give soft food requiring no repeated chewing. In this case, the infant will fail to learn how to judge the appropriate size of a mouthful of food and the amount of chewing required, and sufficient development of chewing force may be inhibited. As the infant grows older, his or her physical function will decline, leaving the infant vulnerable to accidental choking. (Reference 15, 16)

Fig. 20: Development of eating function in infants



The figure in parentheses shows the age corresponding to the development stage of eating function.

Adults, 5-year-old children, and 8-year-old children were asked to eat steamed rice, bread (bun), fish sausage, and apple and the size of the mouthfuls they took of each food was measured (Table 28) (p.46). The relative variation among mouthfuls of food was more pronounced in infants and children than in adults. Adults have learned to put a consistent amount of food into their mouths while they are eating the same type of food. On the other hand, children are in the process of learning how much food they should put into the mouth. It is likely that they put more food into the mouth than they can easily grind. Then, they try to swallow the food before they have chewed it sufficiently, which leads to choking accidents. (Reference 7, 11, 112, 113)

(c) Behavior

As mentioned in Section III, 4(1), incidents in which a foreign body has become lodged in the trachea/bronchus without resulting in a choking accident have occurred when the following activities have been performed with food in the mouth: playing, coughing/smothering, crying, falling, standing/walking,

suddenly standing up, jumping off something, being hit, and inhaling a large amount of air while laughing [Table 20 (p.29)]. (Reference 136) In Section III, 3(2), an infant who put a large number of peanuts into their mouth was reported to have died from obstruction of the area from the bronchial bifurcation to the bronchi. As mentioned in Section III, 5(2), one of the fatal accidents of choking on konjac mini-cup jelly (Appendix 2) involved a 4-year-old boy who was fighting over the jelly with his brother and therefore trying to eat them quickly. In another case, a male student participating in a "speed-eating lunch contest" at a junior high school choked to death after having stuffed his mouth with bread, salad and milk. The bread got stuck in the laryngeal cavity and could not be removed. (Reference 110)

The actions listed in Table 20 (p.29) seem to be involved in the majority of aspiration cases, including those resulting in choking accidents.

Infants who inhale foreign bodies frequently do so while at home [Fig. 10 (p.38)], while few such incidents have occurred in group childcare facilities. This is probably because the rule about keeping items that could be inhaled by children out of their reach is more strictly followed in these facilities than at home. (Reference 137)

(3) Environment

a. Recognition of Danger by Parents

In one survey, 1,015 mothers with children aged 15 and under were asked about their awareness of 15 dangers, including food-related hazards. They were given the following choices: "dangerous," "probably dangerous," "probably not dangerous," "not dangerous," and "don't know." Those who regarded "inhalation of food/choking on food (getting food stuck in the throat)" as "dangerous" accounted for 64.6%. When those who regarded it as "probably dangerous" are added, the total percentage reached 90%. (Reference 4, 5, 27) The awareness these women had of the danger of inhalation/choking was lower than that of "avian flu" and "*E. coli* O157 infection." The actual number of deaths from food-related choking accidents exceeds these numerical data and it is therefore important that parents' awareness about the dangers of such accidents be increased.

Table 35: Mothers' awareness about danger (%) (n=1,015) (Reference 4, 5, 27)

Awareness about foods	Dangerous	Probably dangerous	Probably not dangerous	Not dangerous	Unknown
Natural toxin (mushrooms, balloon fish)	48.6	23.8	14.1	9.3	4.2
Food additives	18.3	58.6	16.1	2.5	4.5
Residual pesticides	50.2	41.3	5.5	1.0	1.9
Health foods	3.0	12.9	34.8	32.6	16.7
Mercury contained in fish	35.8	45.2	11.5	1.7	5.7
Food allergy	31.0	40.6	16.7	6.7	5.0
Genetically-modified foods	15.8	43.9	19.9	4.6	15.8
E. coli o-157	71.8	22.5	3.4	0.8	1.5
Avian flu	76.3	17.5	2.8	0.8	2.6
Veterinary medicines (antibiotics etc.)	34.7	29.3	14.1	3.2	18.7
Norovirus	66.8	28.2	3.2	0.7	1.2
Irradiated foods	52.2	26.0	4.9	1.7	15.1
Accidental ingestion of food/choking on food (getting food stuck in the throat)	64.6	25.4	6.7	2.4	1.0
Bovine spongiform encephalopathy (BSE)	51.1	27.2	7.4	1.6	12.7
Meat (beef/pork) of animals cloned from somatic cells	33.6	32.8	10.9	2.2	20.4

b. First-aid Treatment

As mentioned in Section III, 2(1), whether successful or not, the survival rate definitely increases if a bystander attempts to remove the causative food in the event of choking accident [Table 5 (p.16)]. As described in Section III, 5(2), in a number of accidents involving choking on konjac mini-cup jelly that did not result in death, bystanders attempted to take actions such as "slapping on the back," "sweeping with a finger," or "turning [the victim] upside down." Of 48 patients who experienced aspiration of food and were transported by ambulance to emergency medical centers in Tokyo, 24 received first-aid treatment for the removal of the foreign body on the scene. Generally, in these cases, a bystander attempted to put a finger into the victim's mouth to remove the foreign body or put a finger into the victim's mouth to induce vomiting. Bystanders succeeded in removing foreign bodies in 8 cases. Of these, 4 recovered from choking without any neurological sequelae. Of the 28 patients who were delivered to the medical centers with the foreign bodies still stuck in their respiratory tract, 3 (10.7%) recovered and 21 (75.0%) died from choking. (Reference 37)

In the event of choking on food or other foreign bodies, bystanders can practice the following first-aid treatments. (Reference 88, 138, 139, 140, 141)

(i) If a foreign body in the oral cavity can be observed directly, remove it by sweeping with a finger.

(ii) If the victim is conscious and can cough by himself/herself, make him/her cough continuously until it is ejected. (Coughing violently is the most effective way of removing a foreign body in the trachea/bronchus.)

(iii) If the victim is not a small infant and spontaneous breathing is confirmed, the victim can be slapped on the back (Fig. 21) or the Heimlich maneuver (technique using abdominal thrusts) (Fig. 22) can be performed. If the victim is an infant who can communicate, let him/her know that the foreign body in the throat will be removed. If the victim is unconscious, place him/her in a supine position and

lift the chin to establish an airway.

Fig. 21: Slapping a choking person on the back (Reference 141)

Fig. 22: Heimlich maneuver (technique using abdominal thrusts) (Reference 141)

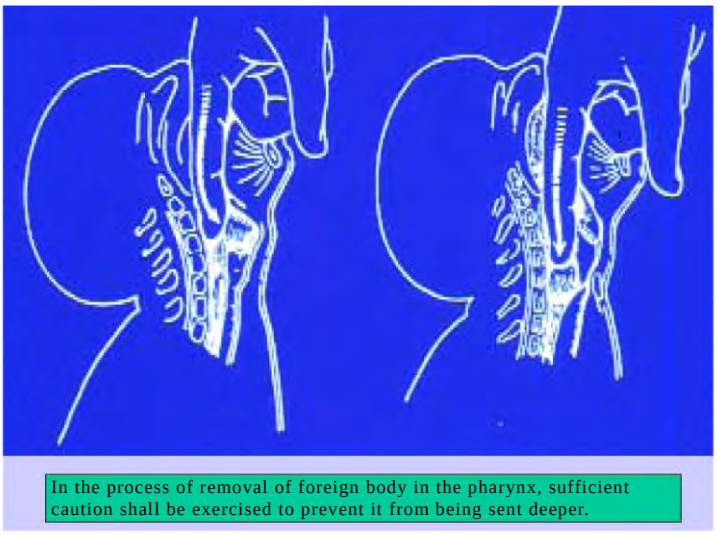
(iv) If the victim stops responding, cardiopulmonary resuscitation for cardiac arrest should be started. If you are the only person around, call the 119 emergency number for help. If an automated external defibrillator (AED) is available, use it to start cardiopulmonary resuscitation. You may find the foreign body while performing cardiopulmonary resuscitation. If this happens, remove it. Do not stop thrusting of the breastbone in order to look for the foreign body.

(v) If the victim is a child: If the child responds, in principle, follow the same procedure as for adults. If the victim is a small infant, his/her abdominal organs are relatively large and may be injured in the process of first-aid treatment. Do not perform the Heimlich maneuver; just slap the child on the back (Fig. 23). (Place the child facedown on one arm. Support the child's face with one palm. Keep the child's head downward and hit on the center of the back several times sharply with the base of the palm of the other hand.) There is no specific frequency with which to slap the child, but the slapping should be continued until the foreign body is removed or the child stops responding. If the child stops responding, start cardiopulmonary resuscitation for cardiac arrest. If you are the only person around, perform regular cardiopulmonary resuscitation for about two minutes, and then call the 119 emergency number for help. If an AED is available, use it to start cardiopulmonary resuscitation. If the victim is an infant, do not use AED. You may find the foreign body while performing of cardiopulmonary resuscitation. If this happens, remove it. Do not stop thrusting of the breastbone in order to look for the foreign body.

Fig. 23: Slapping on the back (if the victim is an infant) (Reference 141)

Sufficient caution should be exercised if the bystander cannot see the foreign body in the oral cavity but needs to perform the actions (i), (iv) and (v) described above. As illustrated in Fig. 24, a foreign body that is pushed into the esophagus may compress the posterior area of the cricoid cartilage and obstruct the respiratory tract (glottis). If a foreign body is pushed into the respiratory tract, it may get stuck in the larynx and obstruct the respiratory tract from their. Therefore, a bystander should not put his/her finger in the oral cavity of a choking person in a blind manner if the foreign body cannot be seen. (Reference 7, 9)

Fig. 24: Precaution for safety in the case of removal of foreign body in the larynx (Reference 7, 9)



On the basis of animal experiments, Heimlich developed the Heimlich maneuver described in (iii) and proposed it in 1974. Its efficacy was reported after it was used to save victims experiencing actual distress. (Reference 142) Since that time, the Heimlich maneuver has been used all over the world. Because clears obstruction of the respiratory tract by pushing out the air trapped in the lungs, it is not effective if the pharyngeal cavity and laryngeal cavity are not thoroughly obstructed. (Reference 7, 9)

The back slapping technique was practiced in 109 cases of a foreign body in the trachea/bronchus. This technique was successful in removing the foreign body in 48.6% of them (53/109). In the remaining 56 victims, foreign bodies were successfully removed by the Heimlich maneuver (67.9%, 38/56) and by the finger sweep method (8.9%, 5/56). The Heimlich maneuver was performed on 168 victims of different choking accidents and was successful in removing foreign bodies in 78.6% of them (132/168). For the remaining 36 victims, the foreign

bodies were successfully removed by the back slapping technique (38.9%, 14/36) and by the finger sweep method (13.9%, 5/36). (Reference 143) These results show that none of the three techniques is successful every time, suggesting that the technique employed should be selected depending on the particular circumstances.

The Heimlich maneuver and the back slapping technique can be successfully employed as a first-aid treatment only when the victim has a foreign body lodged in the larynx. They are contraindicated in cases in which the foreign body is lodged in the bronchus as there is a risk of impaction of the larynx by the foreign body. (Reference 136, 144, 145) When the Heimlich maneuver has been performed on elderly people choking on a foreign body, they have been reported to suffer a stomach rupture. It is therefore important to always keep in mind the possibility of such a complication. (Reference 146) In one case, a bystander slapped an elderly person who was choking on sticky rice cake on the back. The victim was immediately rendered unconscious. (Reference 147) Bystanders must therefore provide emergency treatment with sufficient care.

In an experiment using dogs, either a ping-pong ball, a lump of chicken, sticky rice cake, or chewed pork was inserted in the area below the epiglottis. After five attempts using the Heimlich maneuver, the ping-pong ball could be removed and the obstruction was easily cleared. However, more attempts were needed to remove the lump of chicken and clear the obstruction. The sticky rice cake and chewed pork could not be removed. This would indicate that the Heimlich maneuver may be less effective in clearing an obstruction formed by viscous and deformable foreign bodies. (Reference 148)

An aspirator for home use can be used for an elderly person receiving nursing care. In this case, the carer orally or transnasally inserts a catheter, taking care not to scratch the mucosa by controlling the tip. The foreign body is sucked through the catheter. The carer then slowly twists the catheter to withdraw it. (Reference 127) Vacuum cleaners for home have been used remove foreign bodies. However, this technique has not been effective in removing a foreign body in the trachea or bronchus. It may injure the tongue or cause difficulty in spontaneous breathing when used on infants. (Reference 145)

As described in Section III, 5(1), 70-80% of “unexpected fatal accidents (other than traffic accidents)” involving infants (aged 0-4) occurred at the home. In a survey, illustrations of first-aid procedures to deal with choking were shown to 1,015 mothers with children aged 15 and under and the mothers asked if they were familiar with them. Of the respondents, 16.4% said, “I don’t know them,” while 73.1% said, “I know them but I am not sure if I can actually perform them.” (Reference 27)

According to the data reported by the firefighting headquarters (Section III, 2[1]), bystanders were more likely to attempt to remove foreign bodies when they received oral instructions from emergency response personnel. For the period from 1988 to 1995, 17 persons (mean age: 73 years) who choked on sticky rice cake and were transported to emergency medical centers in Tokyo to receive emergency medical care. Bystanders were present in all of these cases but in 11 (62%), they provided no first-aid treatment to the victims. Three of the victims had their back slapped. The finger sweep method, suction by a vacuum cleaner, and cardiopulmonary resuscitation (CPR) were performed in 1 case each. The Heimlich maneuver was not performed in any of the cases. Of these cases, the emergency dispatchers arrived on the scene and attempted laryngeal development and removal of the foreign bodies with Magill forceps for 15 victims who were unconscious. Doctors confirmed the complete removal of the foreign bodies in 7 of 8 cases in which complete removal was reported to be achieved. Of 7 cases in which complete removal was not achieved by emergency dispatchers, 6 were regarded by doctors cases in which complete removal could be achieved. This indicates that the rate of successful removal of foreign bodies on the scene can be increased if emergency dispatchers make more efforts to improve their first-aid skills. (Reference 147)

A survey was conducted of a total of 74 caregivers, including the staff of healthcare facilities and home helpers in Yamaguchi Prefecture. These personnel were asked about the first-aid procedures they practiced on the scene in the event

of aspiration or difficulty in swallowing. A total of 27 events were reported and the back slapping technique was practiced in all (100%). The Heimlich maneuver was practiced only in 9 cases (33.3%). This indicates that even nursing professionals need to acquire a higher level of knowledge and skills. (Reference 149)

Heimlich recommended that persons who were choking persons use the universal "choking sign" (grabbing the throat with the thumb and the first finger) (Fig. 25) to let the bystanders know they were experiencing food-related accidental choking. (Reference 142)

Fig. 25: "Choking sign" (Reference 141)

c. Help with Eating

A survey was conducted of elderly people who required nursing care at home and used ambulatory nursing facilities (Section III, 1[1]). Among this group, those who received help with eating encountered choking accidents with significantly higher frequency. The authors point out that the pacing of eating (adjustment of eating speed to the optimum pace) depended largely on the carers' ability. (Reference 25)

Elderly people who eat their meals are vulnerable to choking on their food. Delayed discovery of victims may bring serious consequences. In medical institutions, the patients who ate their meals at dining rooms experienced food-related accidents less frequently than those who were allowed to have their meals in bed. (Reference 7, 12) This was probably because the patients with serious symptoms usually ate their meals in bed and were not carefully attended to while eating. Patients eating the dining room, on the other hand, were sufficiently attended to.

d. Others

It is important to have detailed information about preceding events before making a diagnosis of foreign body (including food) in the respiratory tract. In 1963, Haugen reported a case of "café coronary," in which 9 persons suffered considerable distress while eating at restaurants. At first, the serious symptoms were judged to be those of coronary arterial disease. Afterward, however, the symptoms turned out to be caused by choking on meat. (Reference 150) As demonstrated in the case of these events, bystanders do not always observe events preceding aspiration, making it difficult to perform a correct diagnosis of foreign body in the respiratory tract. (Reference 88)

Although radiolucent foods cannot be detected easily in plain X-rays, plain X-ray examination of the chest provides important information about pneumonia and atelectasis and is still regarded as a useful technique for making a diagnosis of foreign body in the respiratory tract. (Reference 80) Expiratory phase chest X-ray examination should be conducted to check for the Holzknecht sign and make a diagnostic judgment. If only an inspiratory chest X-ray examination is conducted, trapped air cannot be detected and the causative food or foreign body cannot be identified. (Reference 86) However, the rate of a positive Holzknecht sign is not significantly high in cases of choking. (Reference 151) Infants who are choking are generally in a distressed state, making it impractical to take expiratory and inspiratory chest X-rays. (Reference 80) If an infant who is choking are not cooperative and expiratory and inspiratory chest X-ray examinations cannot be conducted, a lateral decubitus X-ray should be taken. (Reference 145) MRI scans are used to identify the site of obstruction in cases of choking on peanuts where confirmation is otherwise difficult. Because MRI scans must be conducted while the infant—who will be experiencing difficulty breathing—is sleeping, this option should be weighed carefully before being taken. (Reference 138)

If a foreign body in the respiratory tract is strongly suspected, a bronchoscopy under general anesthesia should be performed promptly. (Reference 68, 138)

2. Food-related Factors

(1) Texture

a. Surface Smoothness

In an experiment, konjac mini-cup jelly and marshmallows, selected for their elasticity, were compared with liquid (barium sulfate solution) with respect to the length of time they spent in the oral cavity. Marshmallow was kept in the oral cavity for a significantly longer period of time, while konjac mini-cup jelly, which has a smoother surface, was retained for a period similar to that of liquid. (Reference 7, 8)

b. Elasticity

An experiment using food boluses with the property of elasticity was conducted on 5 healthy adults aged 22-34. The boluses used in the experiment were konjac mini-cup jelly and marshmallows. These were prepared as cylindrical samples measuring 30

mm in diameter and 5 mm in height. The samples were soaked in barium sulfate solution and placed in the mouths of the subjects. Each subject swallowed three mouthfuls without chewing and the length of time the sample spent in the oral cavity was measured. The swallowed sample easily made it to the hypopharynx but it occasionally could not pass through the entrance of the esophagus. This experiment demonstrated that a food bolus cannot be delivered to the area beyond the entrance of esophagus and may remain in the pyriform sinus. The bolus may then become stuck in the laryngeal cavity and accidental choking may occur. (Reference 7, 8)

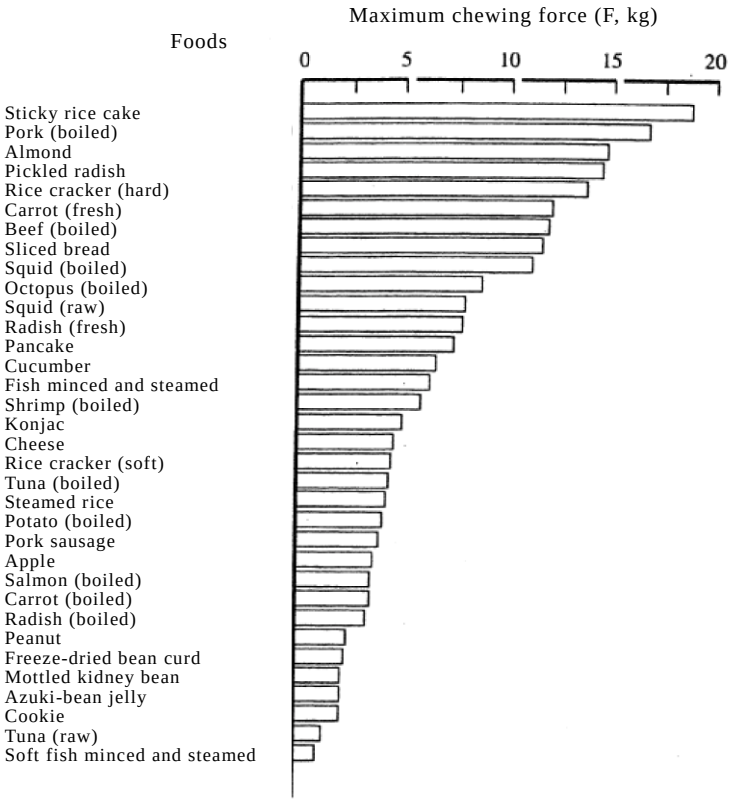
c. Hardness and Difficulty in Biting Off a Piece of Food

One of the factors that affects whether or not a food is likely to pose a choking risk is how hard it is, which can be expressed in terms of how difficult it is to remove it once it becomes stuck in the respiratory tract. Another factor is textures, which can be expressed by how difficult it is to chew the food, break it down into pieces, and swallow it. Although the hardness of food can be measured with all-purpose instruments, hardness is not necessarily corrlelated with the texture. In an experiment, food can be compressed to a large degree to achieve (for example 90%) deformation. Compression resistance is measured with an instrument. This experimental process was reported to be similar to the actual changes in chewing behavior in human beings. (Reference 7, 11)

Some soft foods (sticky rice cake, bread, etc.) require chewing before they can be broken down into pieces. Because such foods can be deformed easily, people with weak chewing force may be tempted to try eating them. The foods then get stuck in the throat. The elderly are particularly at high risk of accidental choking and sufficient caution should be exercised. (Reference 152)

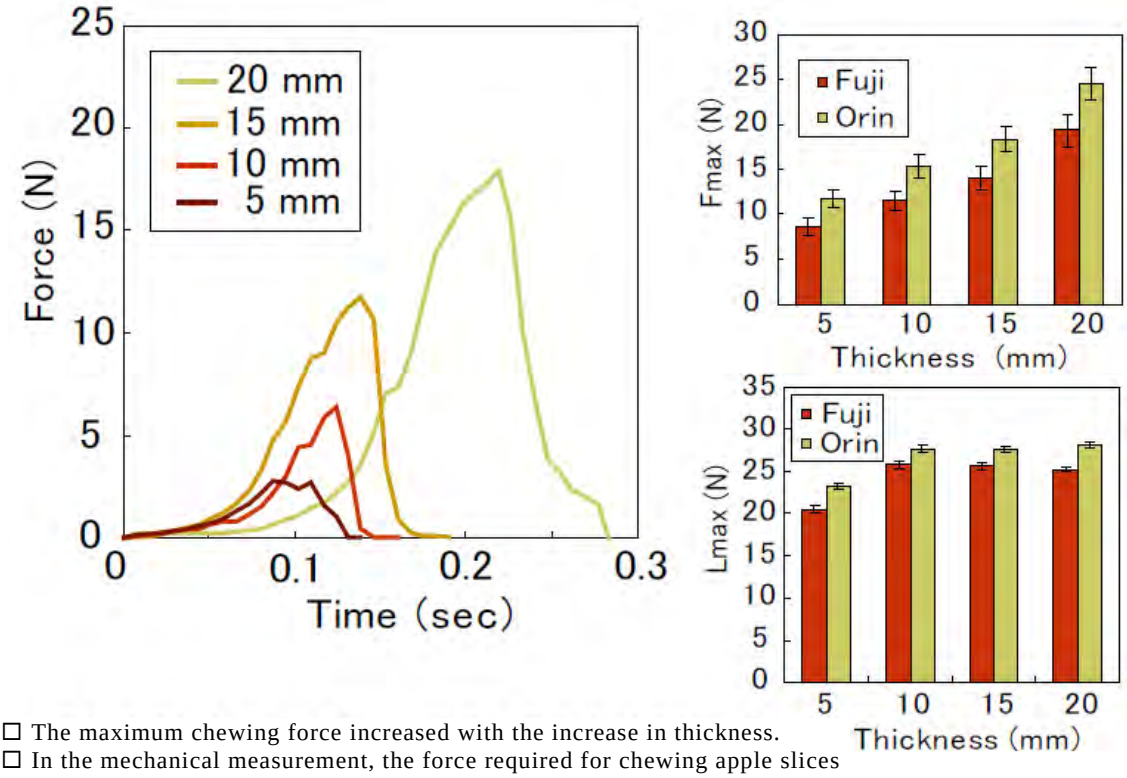
We cannot easily measure “the difficulty in biting off” a piece of food using an instrument. Even sensory evaluation is of no use. The biometric method was used in an experiment on healthy female adults. The chewing force produced by the first molar on the dominant side (the side used most frequently for chewing) was measured. (This chewing force was said to accurately reflect the texture of food irrespective of its thickness.) Although a cookie was categorized as a hard food by the mechanical measurement, it was categorized as a food requiring no chewing force in this biometric experiment. Sticky rice cake, pork (boiled), beef (boiled), and sliced bread—which are categorized as foods that frequently cause choking accidents among the elderly— required the maximum chewing force over more than 10 kgf (Fig. 26). It should also be noted that temperature affects the hardness of sticky rice cake (to be discussed later). The hardness of sticky rice cake was mechanically measured in a state where it was not compressed or significantly deformed. Sticky rice cake was categorized as a food with limited hardness but a food requiring more chewing force. If a person with reduced chewing force eats sticky rice cake, he/she may swallow it before breaking it down into small pieces. The person will then likely experience accidental choking. Steamed rice required the maximum chewing force of 5 kgf. There was no marked difference in the maximum chewing force between steamed rice and the foods that were not identified as being responsible for choking accidents. It is therefore likely that there are factors other than texture at play when a person chokes on steamed rice. (Reference 7, 11, 153)

Fig. 26: Foods requiring chewing force (Reference 153)



In the experiment described above, there was no marked difference in the maximum chewing force needed for apples and for other foods (Fig. 26). In another experiment, an apple was sliced into 5, 10, 15, and 20 mm thicknesses to measure its hardness. The results of mechanical measurement and biometric experiment are presented in Fig. 27. In the mechanical measurement, the maximum force required for chewing apple slices more than 10 mm thick (Lmax) was judged to be unchanged. In the biometric experiment, the maximum chewing force (Fmax) increased with the increase in thickness. (Reference 7, 11, 154)

Fig. 27: Relationship between the thickness of apple slice and the force required for chewing (Reference 7, 11, 154 [partial modification])



☐ The maximum chewing force increased with the increase in thickness.
☐ In the mechanical measurement, the force required for chewing apple slices more than 10 mm thick was consistent.

d. Hard to Swallow

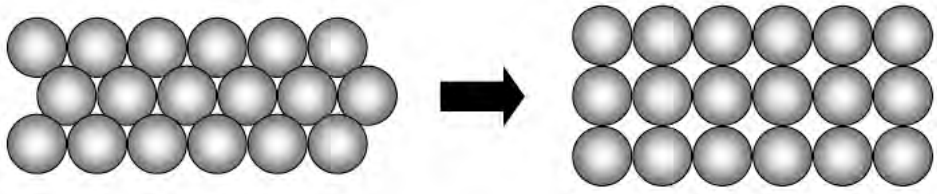
It has been noted that elderly people have difficulties swallowing potato and other "crumbling" foods. An appropriate amount of moisture or oil is needed to promote the formation of bolus when eating such foods. (Reference 152) A questionnaire survey was conducted on a group of elderly people, including residents of nursing facilities and those living alone at home (n=358; mean age: 76.3 years), and a group of middle-aged people (n=243; mean age: 51.8 years). The subjects were asked about "foods that were not easy for them to swallow." According to their responses, in addition to the foods that were frequently responsible for accidental choking (boiled sticky rice cake, sliced bread), other foods (boiled egg yolk, vinegared foods, etc.) ranked high (Fig. 28). (Reference 7, 10, 155, 156) Therefore, the property of food of being "hard to swallow" is not regarded as a factor directly related to accidental choking.

Fig. 28: Hard-to-swallow foods (Reference 7, 10, 155, 156)

Ranking	Elderly group		Middle-aged group
	Residents of nursing homes	Elderly persons living alone at home	
1	Vinegared foods	Baked potato	Baked potato
2	Baked potato	Boiled egg (yolk)	Boiled egg (yolk)
3	Boiled egg (yolk)	Vinegared foods	Vinegared foods
4	Boiled sticky rice cake	Wafer	Wafer
5	Tea	Sponge cake	Sponge cake
6	Sponge cake	Sliced bread	Mashed potatoes
7	Pickled plum	Hamburger steak	Sliced bread
8	Soba noodle	Pickled plum	Peanut
9	Frozen bean curd made by exposing curd to cold outdoor weather	Dried seaweed	Pickled plum
10	Sliced bread	Boiled sticky rice cake	Soba noodle

It should be noted the in survey described above find that the elderly group identified "boiled sticky rice cake" rather than "sticky rice cake" as a "food that is hard to swallow." In the mouth, the surface of boiled sticky rice cake is covered with soup and saliva. As chewing progresses, its elasticity is increased. It is passed to the space beyond the pharynx. Its surface area is increased and friction promotes alignment and dilatancy of component particles. Moisture is contained in the spaces between particles and a relatively small amount of moisture exists on the surface of the sticky rice cake. Sticky rice cake with an increased friction coefficient frequently adheres to the pharyngeal surface. (Reference 7, 10, 157)

Fig. 29: Dilatancy (Reference 10 [partial modification])



Dense packing
Void ratio: 25.95%

Loose packing
Void ratio: 47.64%

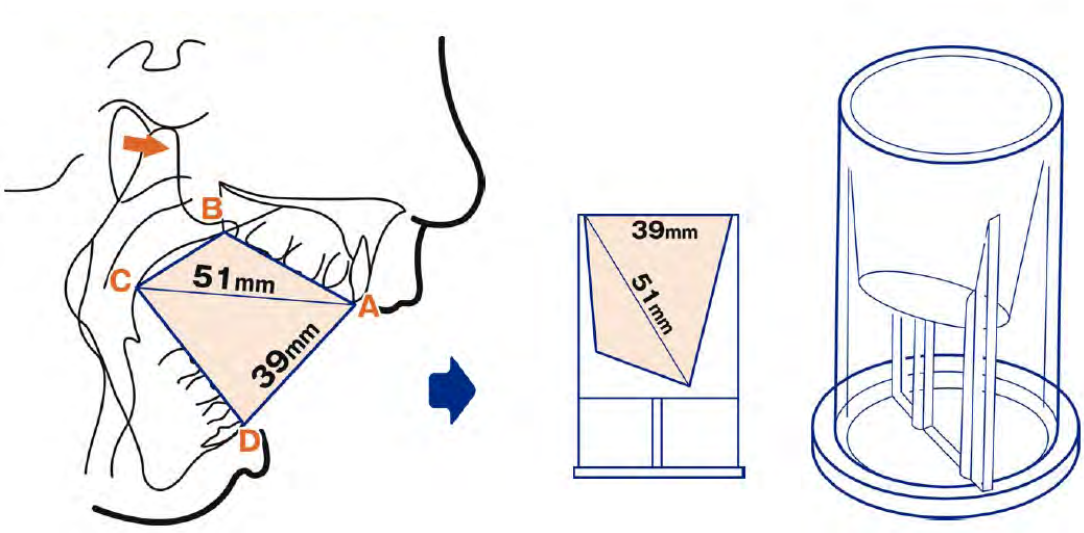
(2) Size and Shape

The U.S. Federal Hazardous Substance Act in 1979 gave the CPSC the authority to define hazardous products, while the Federal Regulations enforced in 1980 designated small parts (parts that are able to fit completely into the small parts test fixture [SPTF])[6] included in toys for infants aged 2 and under as controlled hazardous substances that presented hazards of obstruction of the respiratory tract, aspiration and inhalation.

In Japan, an "inhalation checker" was developed to identify small items that could easily fit in the mouth of an infant. The size of the inhalation checker was determined based on the maximum diameter and depth (distance between the tip of upper deciduous incisor tooth and the intersection of the lower bite plane with the pharyngeal soft tissue) of the mouth of 3-year-old infant of about 39 mm and 51 mm respectively (Fig. 30). Parents were advised to keep items that could be put into this checker out of reach of their children (in places more than 1 m high). (Reference 13, 14, 158, 159)

[6] A cylinder with an internal diameter of 1.25 in. (3.17 cm) and a variable length ranging from 1 in. (2.54 cm) on one side to 2.25 in.(5.71 cm) on the other.

Fig. 30: "Inhalation checker" (Reference 13, 14, 158, 159)
Points of oral volumetry of 3-year-old infant



The CPSC collected data on 355 cases of death by choking on some item other than food that took place over the approximately 17 years from 1972 to 1989 for analysis. The analysis produced the following findings: (i) children aged 3 and over[7] accounted for about one-third of victims (124 cases); (ii) the incidence of choking on soft items (e.g. balloons) was significantly higher among children aged 3 and over (59.7%) than among infants aged 2 and under (33.3%) ($p<0.001$); (iii) the items responsible for 14 of 101 cases in which the data on the size of responsible items were available did not fit into the SPTF (13.9%); (iv) if the internal diameter of SPTF had been extended from 3.17 cm to 4.44cm and the length from 5.71 cm to 7.62 cm, those 14 incidents could have been prevented; (v) most of the items responsible for those 14 incidents were toy figurines with perfectly spherical parts that could completely obstruct the area from the oropharynx to the hypopharynx irrespective of angle of entry. In view of these findings, the CPSC concluded that not all of these accidents could be prevented by adopting the countermeasures based on the SPTF. (Reference 160)

Reilly et al. (1995) collected and analyzed the medical records relating to a total of 522 cases (age: 1 month-18 years [mean age: 2 years]; excluding fatalities) including those of 312 patients with a foreign body lodged in the esophagus (responsible items: food in 53 cases, items other than food in 259 cases) and 210 patients with foreign body lodged in the respiratory tract (excluding patients with a foreign body in the nasal cavity) (responsible items: food in 141 cases, items other than food in 69 cases) requiring surgical treatment at pediatric departments of eight hospitals in the United States for 2 years from 1988 to 1989. They found that most (99%) of the responsible foreign bodies could fit inside the SPTF. Patients aged 2 and under—those infants whom the SPTF was suppose to protect—accounted only for 63% of the cases. In view of these findings, Reilly et al. recommended that the SPTF should be employed to protect a wider range of infants, including those aged 4 and under. (Reference 161)

In one case in Japan, an infant choked on a toy with a diameter of more than 4 cm, although the infant did not swallow it. This incident occurred because the toy accidentally pushed the tongue beyond the pharynx. (Reference 7, 9)

Generally, when a person takes a mouthful of food in their mouth, they chew it and swallow it. In this sense, foods and items that are not meant to be placed in the mouth should be handled differently. However, some spherical or nearly spherical foods whose surfaces are already slippery or become slippery after being mixed with the saliva cannot be sufficiently controlled in the mouth. Such foods may be accidentally swallowed before they are chewed. Applying the above-mentioned size restrictions on such foods may prevent aspiration.

[7] The countermeasures based on the SPTF have not been applied to commercially available toys for children aged 3 and over.

Reilly et al. (1995) analyzed the medical records related to the above-mentioned 522 cases and selected 342 cases (the cases in which the foods involved were unknown) in which the shapes of responsible items were identified. They classified these cases according to the shape of foreign body as follows: "round" (252 cases, 73.7%), "sharp tip" (80 cases, 23.4%), and "square" (10 cases, 2.9%) (Fig. 36). Items with a "sharp tips" accounted for 70% of foreign bodies in the respiratory tract. This figure could be explained by the fact that a thin product which passes through the glottis relatively smoothly cannot be effectively ejected by the cough reflex. (Reference 161)

Table 36: Shapes of foreign bodies in the respiratory tract and esophagus
(Reference 161 [partial modification])

8 pediatric departments in the U.S., from 1988 to 1989 Of the cases of foreign bodies in the esophagus/respiratory tract (excluding foreign body in the nasal cavity), those in which the shapes of foreign bodies were identified (n=342)		Number of cases	Component ratio (%)
Item with a sharp tip		80	23.4
	"V shape"	9	2.6
	Crescent shape	12	3.5
	Bolt	28	8.2
	Teardrop shape	10	2.9
	Wedge shape	9	2.6
	Pin	12	3.5
Round item		252	73.7
	Spherical	8	2.3
	Hemispherical	4	1.2
	Cylinder shape	16	4.7
	Disk shape	212 *	62.0
	Elliptical	8	2.3
	Ring shaped	4	1.2
Square item		10	2.9
	Regular hexahedron	5	1.5
	Rectangular parallelepiped	4	1.2
	Uneven block	1	0.3

Note: Of 212 foreign bodies classified as "disk shape," 199 were coins. All of them got stuck in the esophagus.

The foreign bodies were compared in respect to size ("length," "width," and "height") (Table 37). Large "flat" products were more frequently detected in the esophagus than in the respiratory tract. Disk-shaped products including coins were less frequently detected in the trachea/bronchus because a coin that has a diameter exceeding the width of glottis can be ejected by the cough or vomit reflex. This survey did not include fatal or serious cases. Generally, spherical foreign bodies cause obstruction of the respiratory tract above the glottis and less frequently lead to choking or other serious conditions. (Reference 161)

Table 37: Sizes of items detected as foreign bodies in the respiratory tract and esophagus (Reference 161 [partial modification])

8 pediatric departments in the U.S.A., from 1988 to 1989 Of the cases of foreign bodies in the esophagus and respiratory tract (excluding foreign body in the nasal cavity) (n=522), Those in which the shapes of foreign bodies were identified (coins excluded) (n=143)	Size of foreign body		
	"Length" (mm)	"Width" (mm)	"Height" (mm)
Item with a sharp tip	17.2	8.6 *	5.3 *
Round item	19.1	18.6	2.4
Mean	18.0	12.5	4.1
Foreign body in the respiratory tract	13.6	7.0	5.7
Foreign body in the esophagus	19.5 *	18.7 *	2.7 *
Foreign body with a "sharp tip" in the respiratory tract	14.4	7.0	5.3
Foreign body with a "sharp tip" in the esophagus	22.1 *	12.4 *	5.0 *
"Round" foreign body in the respiratory tract	13.0	8.5	4.3
"Round" foreign body in the esophagus	19.6 *	19.4 *	2.3 *

Note: "Length": The longest distance
"Width": The second longest distance
"Height": The shortest distance
* $p<0.05$ (excluding coins)

(3) Physical Properties Characteristic of Foods that Frequently Cause Choking Accidents

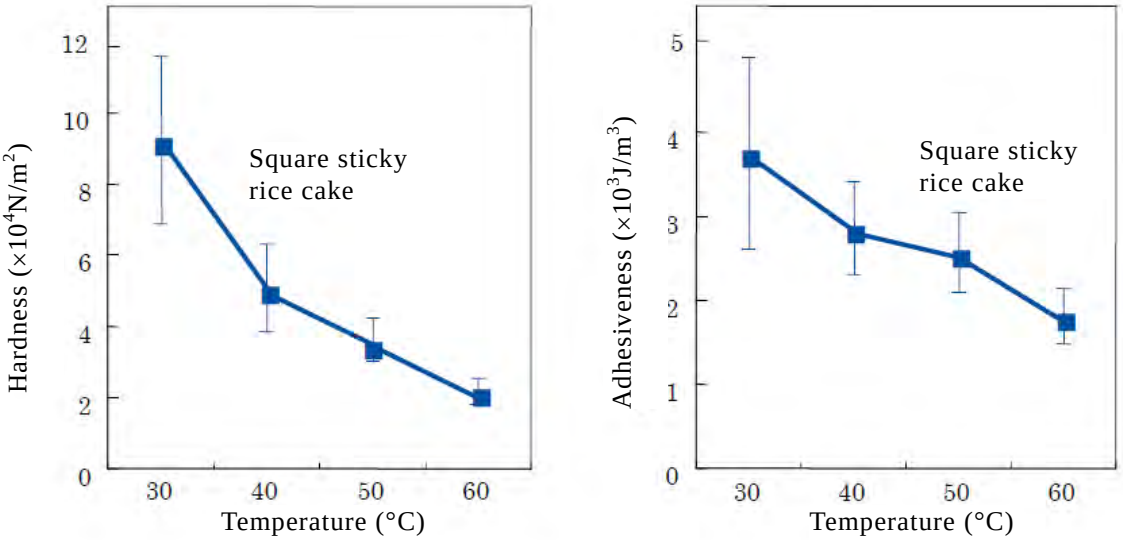
a. Sticky Rice Cake

Three types of commercially available sticky rice cake (a regular type of sticky rice cake and two types of sticky rice cake marketed as "for the elderly") were examined in an experiment. The samples were boiled in hot water (100°C) for three minutes and their texture was assessed at various internal temperatures (30, 40, 50, and 60°C)[8]. The hardness and adhesiveness of regular sticky rice cake at 50-60°C (temperature of boiled sticky rice cake when it is picked up and put in the mouth) were about $2\text{-}4\times10^4$ N/m^2 and about $1.5\text{-}3\times10^3$ J/m^3 respectively. The hardness and adhesiveness of regular sticky rice cake at 40°C (the temperature to which boiled sticky rice cake decreases as a result of being chewed in a body-temperature environment) were $4\text{-}6\times10^4$ N/m^2 and about $2.5\text{-}3.5\times10^3$ J/m^3 respectively (Fig. 31). (Reference 4, 5, 7, 10, 162)

These results indicate that sticky rice cake is soft and elastic (but less adhesive) when first placed in the mouth but its hardness and adhesiveness increase with the decrease in temperature. As mentioned in Section V, 1(1), healthy people ascertain the texture of sticky rice cake in the mouth, adjust the texture by chewing and mixing in saliva, and accurately judge whether the chewed sticky rice cake can be swallowed. As shown in Fig. 17 (p.53), **the** hardness and adhesiveness of food are reduced by chewing before swallowing. The oral function by which the texture of food is ascertained and adjusted declines in some people. These people may swallow sticky rice cake without sufficiently chewing it and mixing it with saliva, even if it becomes cold in the mouth and has increased hardness and adhesiveness. If the sticky rice cake is retained in the portion from the pharynx to the laryngeal vestibule, it adheres to the surface and cannot be removed easily. Such physical properties may be enhanced if the surfaces of the oral cavity and pharynx are not sufficiently wet.

[8] Measurement was conducted according to the method specified in the Ministry of Health, Labour and Welfare's "Foods for the Elderly."

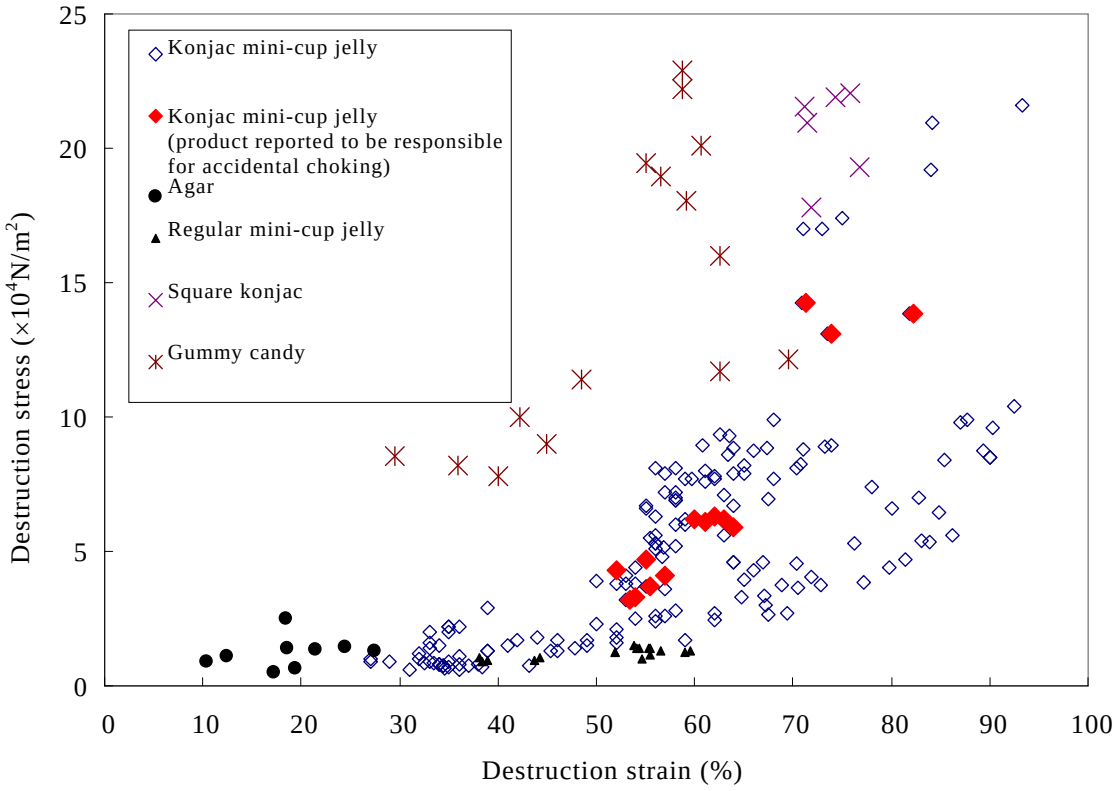
Fig. 31: Effects of temperature on hardness and adhesiveness of sticky rice cake
(Reference 5, 10 [partial modification])



b. Konjac Mini-cup Jelly

Konjac mini-cup jelly (encompassing several products including those that caused choking accidents), non-konjac mini-cup jelly, agar, gummy candies, and square konjac were examined in a destruction test involving the penetration of these products by a metal plunger. The results are illustrated in Fig. 32. In terms of hardness and elasticity, the particular konjac mini-cup jelly that was reported to be responsible for accidental choking incidents was not particularly different from other types of konjac mini-cup jelly. The hardness of some gummy candies and square konjac exceeded that of the konjac mini-cup jelly involved in incidents of accidental choking. Some gummy candies could not be destroyed under the experimental conditions adopted. Some konjac mini-cup jelly was as soft as regular non-konjac mini-cup jelly. (Reference 7, 11)

Fig. 32: Penetration/destruction test of konjac mini-cup jelly, agar, square konjac, and gummy candies (Reference 11 [partial modification])

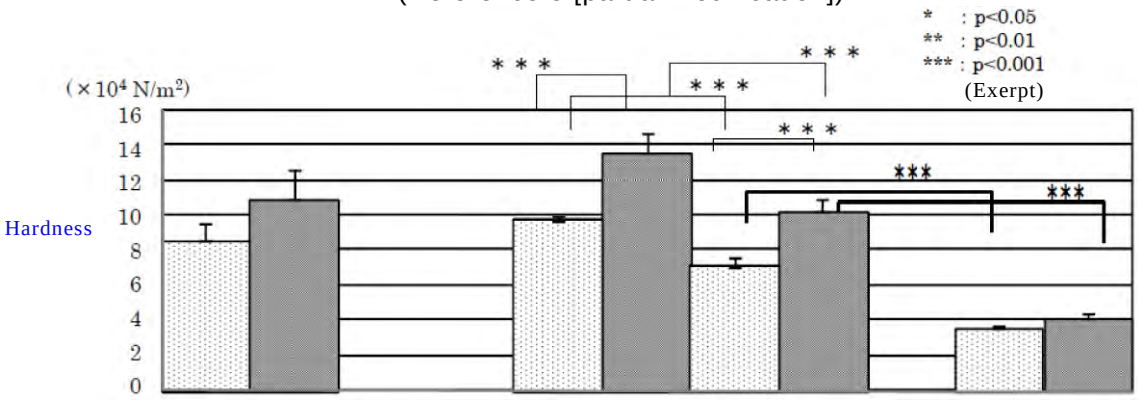


In view of the report of choking accidents, the manufacturer adjusted the physical properties of the konjac mini-cup jelly by reducing the content of glucomannan. The new konjac mini-cup jelly was marketed in November 2008. The new product was compared with the product marketed before November 2008 with respect to hardness (Fig. 33). Although the new product is not as hard as the former product[9], it is still harder than regular konjac-free jelly (gelatin-based jelly)[10]. Konjac jelly and regular jelly is sold in small cups of similar in size and shape. Konjac jelly, however, becomes hard when refrigerated. The new product in which the amount of glucomannan has been reduced also exhibits this property. (Reference 1, 4, 5, 163)

[9] According to the Japanese Cabinet Office's Social Policy Bureau, a comparison of two surveys conducted in June 2007 and January 2009 by the National Consumer Affairs Center of Japan showed that some brands of konjac jelly became soft but others barely changed.

[10] This finding was also made in a survey conducted in January 2009 by the National Consumer Affairs Center of Japan.

Fig. 33: Effect of temperature on hardness of konjac mini-cup jelly (before and after the improvement in 2008) and konjac-free mini-cup jelly
(Reference 5 [partial modification])



	Konjac mini-cup jelly A		Konjac mini-cup jelly B		Konjac mini-cup jelly B Product manufactured after the improvement in 2008		Konjac mini-cup jelly	
	20°C	4°C Preserved for more than one day	20°C	4°C Preserved for more than one day	20°C	4°C Preserved for more than one day	20°C	4°C Preserved for more than one day
Mean value	8.6	11.0	9.8	13.7	7.2	10.3	3.6	4.2
Standard deviation	1.0	1.7	0.3	1.1	0.5	0.7	0.2	0.3

In the penetration/destruction test, a konjac mini-cup jelly was penetrated by a metal plunger and the plunger was then removed. After removal of the plunger, the site of penetration could be observed but the hole created was not remarkable. There was no marked difference in appearance between the pre-treatment surface and the post-treatment surface. In the same experiment, four types of mini-cup jelly including two types of konjac jelly that were reported to have caused accidental choking were pushed through the flat plates with slits (Fig. 34). Some of them were broken but not cut into pieces. The same four products were examined in another experiment. Each of them was placed on a plate with a hole 12 mm in diameter and penetrated by a plunger with a diameter of 9.54 mm, which was then removed. The holes created by the plunger remained in some jellies, while they closed up in others (Fig. 35). (Reference 7, 11)

These experimental results suggest that konjac mini-cup jelly cannot be broken down into pieces even if chewed thoroughly. In other words, it is “difficult to bite a piece off.”

Fig. 34: A konjac mini-cup jelly was pushed through a slit to evaluate its texture
(Reference 11 [partial modification])

All the samples were tested in the same manner as in the penetration test.

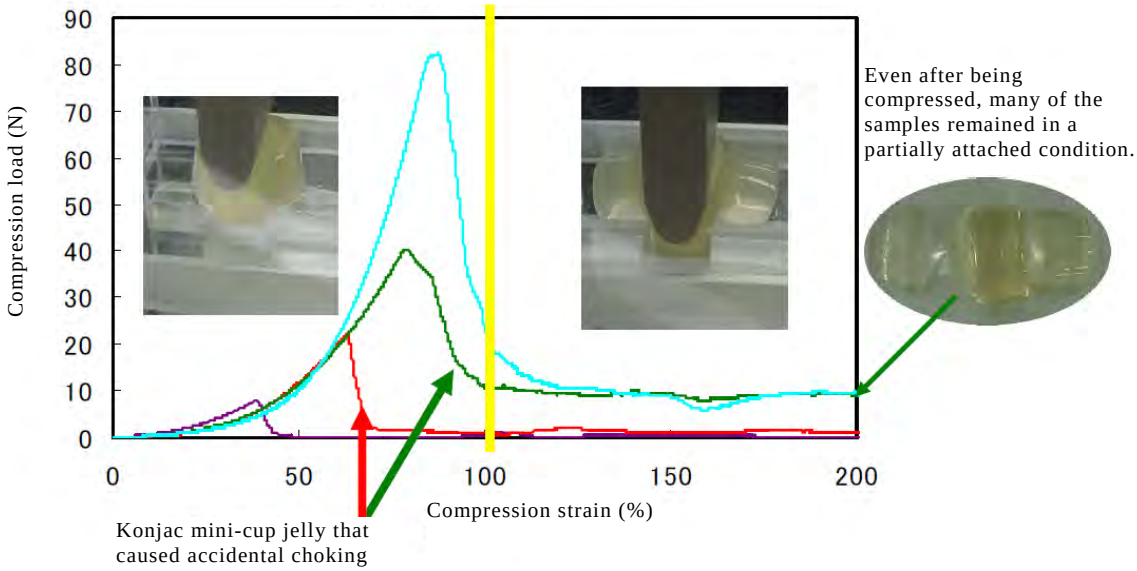
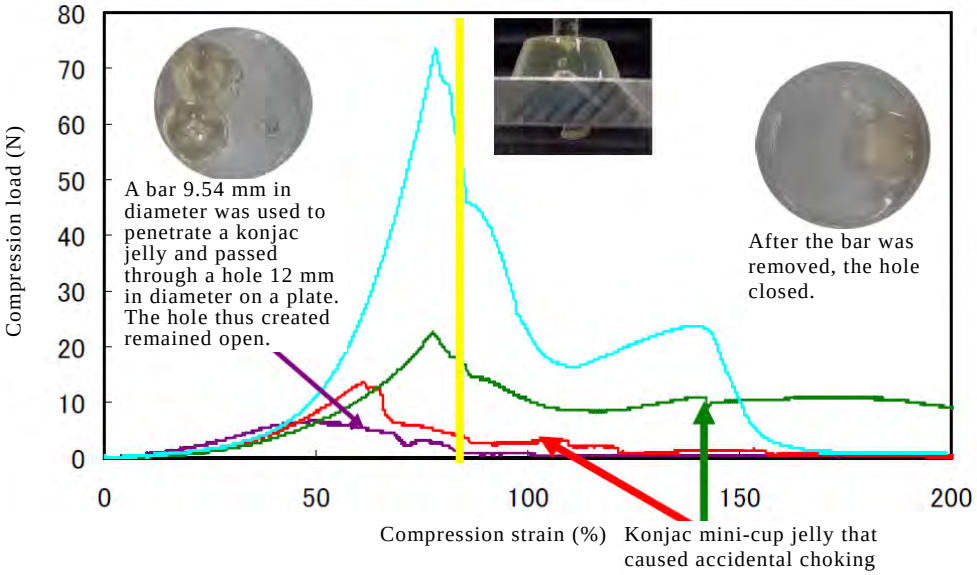


Fig. 35: An experiment in which a konjac mini-cup jelly was penetrated by a plunger
(Reference 11 [partial modification])



This difficultly in biting a piece off cannot be sufficiently evaluated by measuring "hardness" with a standard mechanical system alone. For this reason, the above tests (Fig. 34, Fig. 35) are conducted in Japan. In the U.K., the Food Standards Agency (FSA) employs the same "penetration test"[11] used to confirm that a pacifier is hard enough so that it can't be bitten off by an infant (BS5239: 1988) to examine samples of konjac mini-cup jelly and regular konjac-free jelly. In view of the results of penetration test conducted by the FSA, the European Food Safety Authority (EFSA),

[11] According to EFSA, the standard for "pacifiers" ("BS5239:1988") specifies that the product concerned shall be intact even if a force of 75 N is applied. The mean vertical bite-off force of infants is listed in the handbook published by DTI, the UK. The maximum values are as follows: 111 N (18-month-old infants), 222 N (36-month-old infants), and 445 N (3-8-year-old infants).

referring to the following data (Fig. 36), reported that the force needed to penetrate a konjac mini-cup jelly ranged from 10 to 15 N (excluding konjac jelly containing pieces of fruit, which required a force of 141 N), while a force ranging from 2 to 4 N was enough to penetrate a konjac-free regular jelly. (Reference 164)

Fig. 36: Penetration test by the U.K. FSA
(Reference 164 [partial modification])

Penetration test conducted by U.K. FSA (2001-2002)	Product name	Force needed for penetration (N)
Konjac mini-cup jelly	ABC Mini Fruit Bites	141
	New Choice Mini Fruit	10-15
	New Century's Choice Mini Fruit Gels	10-15
	New Century's Choice Mini Fruit Gels	10-15
	Fuji Coconut Mini Gels	10-15
	Jin Jin Mango Mini Gels	10-15
Konjac-free regular jelly	Combo Trading Mini Jelly Cup	2-4
	Cocon Honey Melon Pudding	2-4
	Combo Trading Mini Puding Cup	2-4
	Sugarland Jellyace	2-4

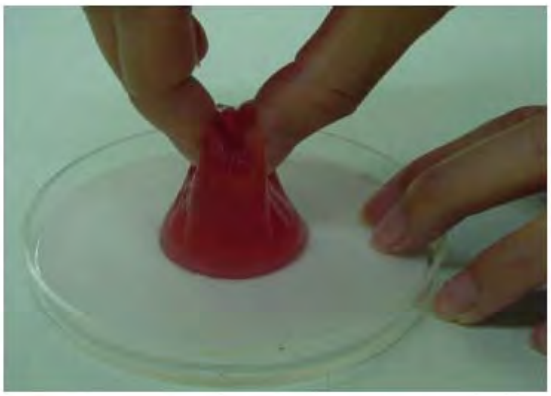
In an experiment, 5 healthy adults aged 22 to 34 were given 5 mL of 140% barium sulfate solution, a konjac mini-cup jelly which was prepared as a cylindrical sample 30 mm in diameter and 5 mm in height and soaked in barium sulfate solution and a marshmallow. They put each of these foods in the mouth one at a time and swallowed them without chewing. Each trial was repeated three times. Compared with the oral movement time of barium sulfate solution, that of a marshmallow was significantly longer but there was no significant difference in the oral movement time between a konjac mini-cup jelly and barium sulfate solution. (Reference 7, 8)

In an experiment, a konjac mini-cup jelly was used as a sample and a combination of a container shaped like the human oral cavity and a plunger was used as the instrument of measurement. When the tester pressed the plunger against the sample to measure its texture, the deformed sample was reported to slip through the space between the plunger and the side wall of container. (Reference 4, 5, 165) This suggests that konjac mini-cup jelly moves around the oral cavity as smoothly as liquid and cannot easily be caught and pressed with the palate and tongue.

As mentioned in Section III, 5(2), the Social Policy Bureau under the Japanese Cabinet Office collected the data on 10 children who died from choking on konjac mini-cup jelly. Of these 10 victims, 4 were children aged 6 to 7 whose permanent anterior teeth were growing in. This dental condition was a contributing factor to the choking accidents, along with the food-related factors including the “difficult-to-bite-off” texture and “surface smoothness.”

When pieces of jelly, including konjac mini-cup jelly, are placed on filter paper, they adhere to it and cannot be removed (Fig. 37). When a tester tried to remove a konjac-free mini-cup jelly using his or her fingers, the part in contact with the fingers started to collapse. Konjac mini-cup jelly, however, did not collapse and on some occasions the filter paper was torn. (Reference 7, 11) Konjac mini-cup jelly adheres to a dry surface but cannot be removed easily. If an elderly person who frequently complains of dryness in the oral cavity/pharynx does not chew a konjac mini-cup jelly sufficiently but instead swallows it before mixing it with saliva, he/she will suffer an obstruction of the pharynx/larynx. If this happens, the konjac mini-cup jelly cannot be destroyed by coughing and cannot be removed from the throat. If konjac mini-cup jelly is consumed during a meal or immediately after a meal, it is chewed and the oral cavity is appropriately wet. If it is served as a snack and consumed without a cup of tea, its physical characteristics may cause a choking accident.

Fig. 37: When konjac mini-cup jelly is placed on the filter paper, it adheres to the paper and cannot be removed easily. (Reference 11 [partial modification])



Whether they contain konjac or not, as shown in the picture, most types of jelly will adhere to the filter paper. Generally, konjac mini-cup jelly will remain stuck even if they are pulled strongly.

The mini-cup package design is adopted as means of reducing labor and preventing contamination. So packaged, an individual serving of jelly can be transferred directly to the mouth without the need of a dish and spoon. The package design seems to encourage two methods of consumption: by either placing the cup below the lips and sucking or placing the cup above the lips and tilting the head back. When the jelly is sucked, it arrives quickly in the oral cavity and may be pulled in the direction of the lung, which is providing the suction, before the larynx closes and the safety of the pharynx is assured. If the head is tilted back, the so-called "securing of the airway position" (chin up) is nearly achieved. This position is likely to increase the risk of aspiration. (Reference 7)

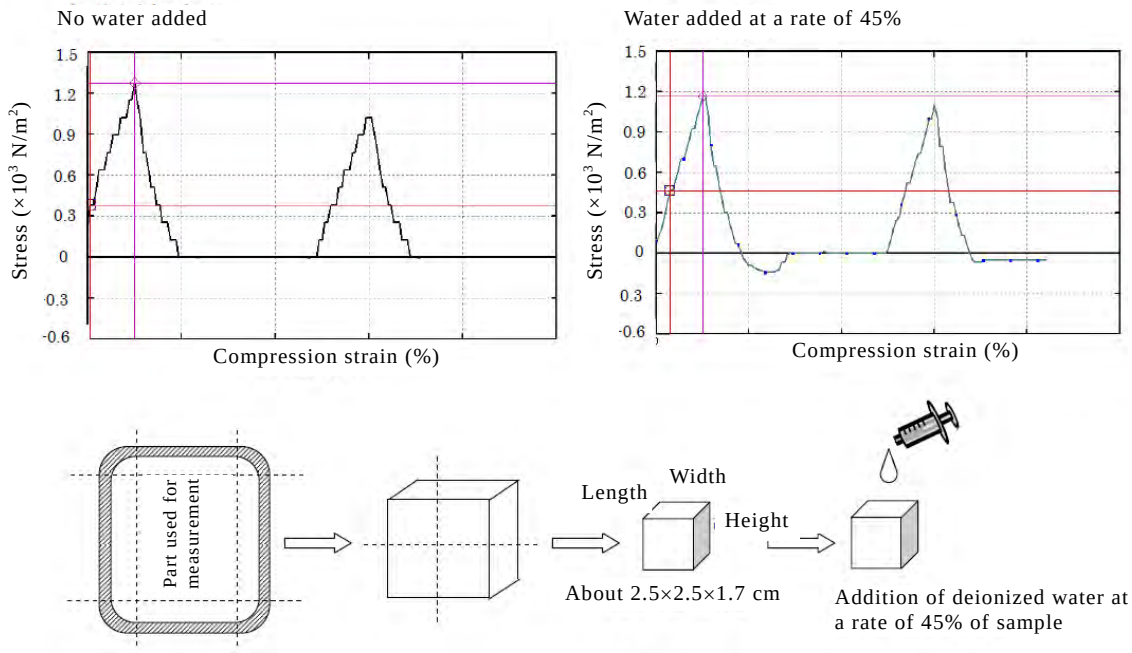
c. Bread

As described in Section III, 2(3), those victims who required an ambulance included many elderly people who choked on bread. The percentage of those who were diagnosed as being in a "serious or more than serious condition after choking on bread" was reported to be high.

In an experiment, a slice of commercially available crustless bread (1/6 of a loaf) was used as a sample. Pressure was applied at various levels to evaluate its textural properties. As the specific gravity increased from 0.2 to 0.8, the hardness increased from about 0.1×10^4 N/m^2 to about 1.0×10^4 N/m^2. Although its aggregability was slightly reduced, its adhesiveness did not change. When water (45%) was added in place of the saliva, its adhesiveness was clearly observed (Fig. 38). (Reference 4, 5, 7, 10, 166)

These results indicate that when bread becomes "stuck in the throat," its hardness increases and its adhesiveness also increases with the addition of saliva. For this reason, the bread cannot be either swallowed or spit out.

Fig. 38: Effect of water on the texture of bread (Reference 5, 10 [partial modification])



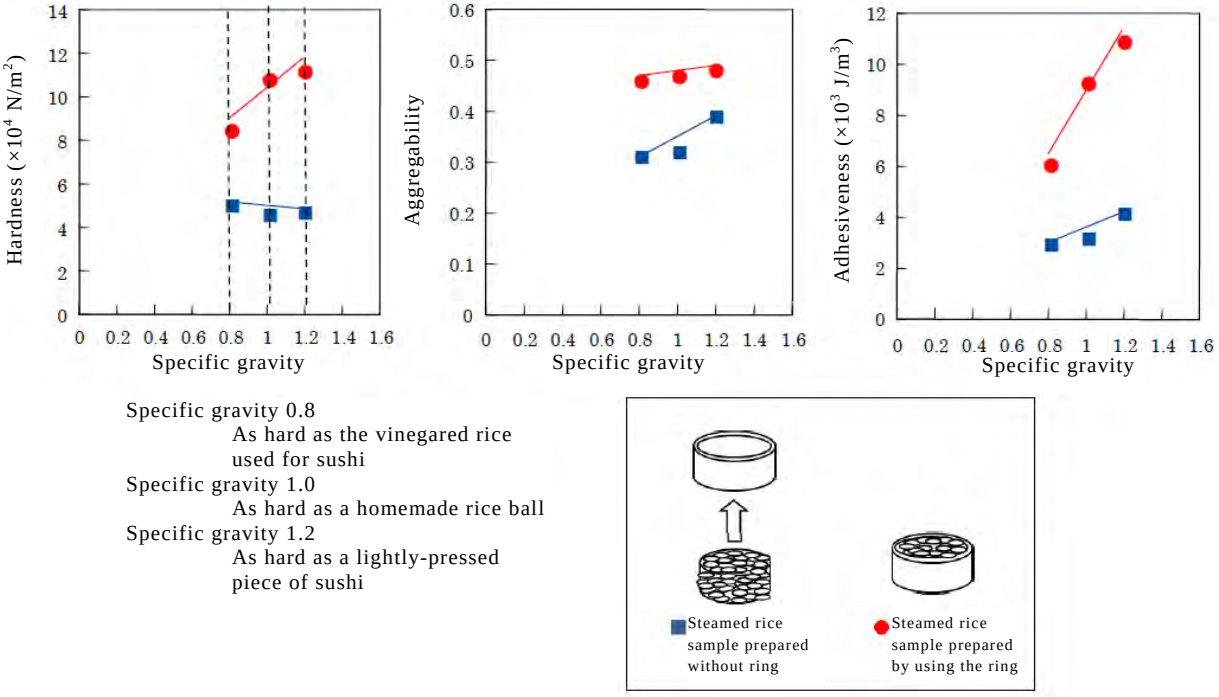
d. Steamed Rice

The victims of choking accidents caused by steamed rice reported in Section III included those who choked on “rice ball” and “sushi.”

In an experiment, a stainless steel ring 4.0 cm in internal diameter and 2.0 cm in height was filled with steamed rice that was left at 20°C for 60 minutes after cooking. The specific gravity of the steamed rice was adjusted to the following levels: 0.8 (“vinegared rice” for sushi), 1.0 (homemade rice ball), 1.2 (lightly-pressed piece of sushi). “The conditions of choking on steamed rice” were simulated to measure the textural properties of steamed rice. As its specific gravity increased from 0.8 to 1.2, the hardness of steamed rice increased from about 8×10^4 N/m^2 to about 11×10^4 N/m^2, and its adhesiveness increased from about 6×10^3 J/m^3 to about 11×10^3 J/m^3 (Fig. 39). The change in specific gravity did not affect aggregability (Reference 4, 5, 7, 10, 166)

This finding indicates that steamed rice in the form of “rice ball” or “lightly-pressed piece of sushi” becomes harder and more adhesive than regular steamed rice and that even regular steamed rice can become caught in the area between the pharynx and the laryngeal vestibule and “choking” occurs when a person tries to swallow a bolus of insufficiently chewed rice. In this situation, the hardness and adhesiveness of regular steamed rice seemed to increase.

Fig. 39: Effect of "pressure" on hardness and adhesiveness of steamed rice
(Reference 5, 10 [partial modification])



VI. Countermeasures (Mainly for Mini-cup Jelly) Adopted by Overseas Regulatory Authorities

1. Countermeasures Adopted in the U.S.

(1) Overall

The U.S. Food and Drug Administration (FDA) clearly expresses its basic concept of risk management measures as follows: It is difficult to eliminate the intrinsic risk factors for accidental choking on foods (e.g. size of grape) but appropriate countermeasures must be introduced if a type of food incurs an unusual risk of accidental choking. (Reference 167)

Aside from the aspect of preventing the obstruction of the respiratory tract, from the aspect of prevention of hazards such as injury or perforation of the oral cavity or digestive tract, FDA defined foods that (i) contain firm or sharp foreign bodies 7-25 mm in length and (ii) are ready to eat or can be eaten without taking any actions to eliminate such hazards (e.g. heating etc.) as poor-quality foods. (Reference 168)

(2) Individual Foods

FDA received from local departments reports of 3 children who died from choking on konjac mini-cup jelly and warned consumers of the potential serious hazards of choking caused by konjac mini-cup jelly imported from Asian countries in August 2001. (Reference 169) In October 2001, the FDA's health hazard evaluation committee and CPSC experts (physiologists) concluded that konjac mini-cup jelly involved a high degree of risk of choking because of the following characteristics: They are spherical, oval-shaped or elliptical, or are circular in cross section. The diameters of spherical or nearly spherical products are less than 1.75 inches, while those of products that are not spherical are less than 1.25 inches. They have a texture that makes them smooth and slippery in the mouth. (It may be difficult to control the direction and position of konjac mini-cup jelly, adjust the texture, and determine when it should be swallowed, which may result in the jelly being sent deep into the oral cavity immediately after it is placed on the tongue.) Konjac mini-cup jelly is harder

than gelatin-based jelly—hard enough so that it will not collapse immediately after being put in the mouth. Having arrived at this conclusion, the FDA issued a warning regarding the termination of import of konjac mini-cup jelly without specified inspection. (Reference 170)

2. Countermeasures Adopted by European Regulatory Authorities

(1) EU

In March 2002, the European Commission proposed a revision of the standards for use of additive E425 konjac (hereinafter referred to as "konjac") to the European Parliament and European Council. In view of overseas reports of choking accidents, the European Commission then temporarily suspended import and distribution of all konjac-based jelly products (including mini-cup jelly) and use of konjac in jelly products (including mini-cup jelly). Moreover, the European Commission examined the possibility of introducing further actions to eliminate the choking risk associated with the addition of gelation agents to all jelly products. (Reference 171)

In July 2003, the European Parliament and European Council issued a directive prohibiting the addition of konjac to all jelly products (including mini-cup jelly). The EU member states were instructed to enforce legislation in response to the directive before January 17, 2004. (Reference 172)

The European Council's April 2004 resolution listed the main factors contributing to the choking risk posed by mini-cup jelly containing additives derived from seaweeds (agar, carrageenan, and alginic acid) and additives not derived from seaweeds (xanthane gum, guar gum, and locust bean gum) as shape, size and method of consumption. At the same time, the physical/chemical properties of these additives were also regarded as the main factors involved in health hazards. The European Council identified these issues and temporarily suspended import of mini-cup jelly containing the above additives and use of such additives in mini-cup jelly. (Reference 173)

In June 2004, the EFSA "Scientific Panel on Additives, Fragrances, Process Aids, and Food Contact Substances" (hereinafter referred to as the "Panel") evaluated the above-mentioned mini-cup jelly containing additives derived from seaweeds and additives not derived from seaweeds. In the penetration test, a force of 10-15 N was required to penetrate mini-cup jelly containing konjac (glucomannan) (excluding konjac jelly containing pieces of fruit, for which a force of 141 N was required for penetration), while mini-cup jelly containing an additive derived from seaweeds or substances other than seaweeds could be penetrated with a force of 2-4 N. In an experiment, konjac (glucomannan) mini-cup jelly was soaked in artificial saliva at 37°C to evaluate its solubility. No visible change was observed after 5-10 minutes of soaking and a slight change in surface texture was observed after 20-60 minutes. The sample jelly partially melted after 120 minutes of soaking. Of four mini-cup jelly samples containing gelation agents other than konjac, two "began to break up" after 5-10 minutes of soaking. It is possible to swallow konjac-free mini-cup jelly without chewing it, creating the possibility of it becoming stuck in the respiratory tract. If this happens, the jelly will not melt easily and the cough reflex will not be stimulated. The Panel agreed that the main factors that may cause physical hazards were the shape, size, and manner of consumption (sucking in one gulp or pushing on the cup) of mini-cup jelly. It concluded that the above-mentioned additives derived from seaweeds, additives derived from materials other than seaweeds, and those for gelation gave the foods they were added to similar characteristics to those of konjac mini-cup jelly and the manner of consumption was also similar or they had similar physicochemical properties, which probably produced the risk of choking (a risk not limited to infants). (Reference 164)

In August 2006, according to the European Parliament/European Council Directive, the standards for the use of additives including agar, carrageenan, alginic acid, xanthane gum, guar gum, and locust bean gum were revised and their addition to mini-cup jelly was prohibited[12]. The EU member states were instructed to enforce

[12] According to the directive, "a mini-cup jelly" is defined as "a hard jelly prepackaged in a small, semi-rigid cup or

legislation in response to the directive before February 15, 2008. (Reference 174)

(2) U.K.

In August 2001, in view of fatal accidents overseas, the FSA issued a public warning that mini-cup jelly not be given to infants. (Reference 175)

(3) Germany

In August and December 2009, the Bundesinstitut für Risikobewertung (BfR) reported that nuts were more frequently involved in cases of a foreign body in the trachea/bronchus in children than toys. This report was supported by a report published by the German Pediatric Respiratory Medicine Society that found that of 98 patients with a foreign body in the trachea/bronchus treated at six medical institutions from 2004 to 2005, 50 choked on nuts (29 cases of choking on peanuts). The BfR pointed out that nuts were more frequently involved in cases of a foreign body in the trachea/bronchus than other foods because of their shape, size and oily surface. The BfR recommended that manufacturers place a warning label on nut packages (e.g. "When consumed by children, there is a risk that nuts may enter the respiratory tract." (Reference 176, 177)

(4) Switzerland

In January 2002, the Bundesamt für Gesundheit (BAG) cautioned about the risk of choking on konjac mini-cup jelly. BAG does not approve the use of "konjac" as an additive used in mini-cup jelly in Switzerland and has instructed manufacturers to voluntarily recall products that have already been distributed throughout the nation. (Reference 178)

In April 2002, irrespective of the additives used in the production process, BAG noted the risk of choking associated with the manner of consumption and size of mini-cup jelly and pointed out that such products deviated from Article 13 of the Food Act [LMG, SR817.0; (Foods shall not present a health hazard by their consumption in the ordinary manner.)] (Reference 179)

3. Countermeasures Adopted in Other Countries

(1) Australia

The Australia New Zealand Food Authority (ANZFA) directed attention to the fact that, in addition to the fatalities in Japan and the U.S., a choking fatality was reported in Australia in 2000. In November 2001, on the assumption that the additive "konjac" is not approved to be used in Australia and foods containing konjac constitute illegal products, the ANZFA advised manufacturers to recall "konjac" mini-cup jelly products throughout Australia. Mini-cup jelly products that do not contain "konjac" were not included among the products subject to the recall. (Reference 180)

(i) **Shape:** Jelly that is spherical, oval-shaped, or elliptical, or has a circular cross section.
(ii) **Size:** A spherical or nearly spherical product having a cross section less than 45 mm in diameter, or a non-spherical product having a cross section less than 32 mm in diameter.
(iii) **Texture:** Jelly whose surface becomes smooth and slippery in the mouth.
(iv) **Viscosity:** Jelly that is harder than a product made of gelatin, does not melt easily, and rarely collapses even after being sucked.

(2) Canada

In view of fatal accidents in Canada in 2000 and incidents overseas, the Canadian Food Inspection Agency (CFIA) decided to recall konjac mini-cup jelly in 2001. In December 2008, the CFIA cautioned consumers about the following three points: (i) persons at high risk, particularly small infants, elderly persons, and those who experience difficulty swallowing, may choke on mini-cup jelly if they eat it in one gulp; (ii) depending on its size, shape and hardness, a konjac mini-cup jelly may become stuck in the throat and unable to be spit out; (iii) konjac mini-cup jelly must

capsule that can be consumed in one gulp by pushing the jelly out of the container into the mouth."

be cut into small pieces prior to eating as a safety precaution. (Reference 1, 181)

(3) South Korea

In October 2001, in response to fatal accidents caused by mini-cup jelly in the U.S, the Korean Food and Drug Administration prohibited the manufacture and import of jellies served in small round or oval cups of less than 4.5 cm in diameter containing konjac or glucomannan. Manufacturers of mini-cup jelly products measuring less than 4.5 cm in diameter that contained no konjac or glucomannan were instructed to place a label on the packaging warning that such products might cause choking. At that time, these jelly products were not manufactured in South Korea and about 13,000 tons of mini-cup jelly were imported from January to September 2001. (Reference 182)

In October 2004, choking fatalities involving raw octopus, sticky rice cake, and mini-cup jelly occurred in South Korea. In response to this, the Korean Food and Drug Administration temporarily prohibited distribution of all mini-cup jelly products with round or oval covers with a diameter of less than 4.5 cm. The total imports for 2003 and the period from January to August 2004 were about 2,100 tons and 1,500 tons respectively. (Reference 183)

The Korean Food and Drug Administration conducted a push-out test, "compression test," penetration test, and aggregability test. According to the results, the hardness and "viscosity," expressed as about 7 N, were judged to present a low risk. The Administration comprehensively examined the overseas countermeasures and the actual conditions of labeling of commercial products and sought comments from the Food Hygiene Council. In April 2005, the Administration removed the temporary control on the distribution of products that met the following conditions, including mini-cup jelly products with round or oval covers with a diameter or maximum length of less than 4.5 cm: They contain no konjac or glucomannan; when subjected to the "compression test" according to the specified procedure, the force required for compression is less than 7 N (the hardness and "viscosity" of Korean "tofu[13]" were referred to in the test); they contain specified warning labels ("This product may cause choking. Do not freeze before eating. Cut into small pieces for children and elderly people suffering illness."). The Administration made the determination the risk of choking and other physical risks posed by food were related to the physical properties of the foods and insufficient attention paid by consumers while eating. It then instructed local governments to issue repeated consumer alerts about the risk of eating raw octopus and sticky rice cake. (Reference 184)

In May 2007, in response to the report of an infant fatality in Korea, the Administration first prohibited the sale by retailers of all frozen mini-cup jelly. It then restricted retailers from selling mini-cup jelly to children not accompanied by their parents or caretakers, or to the ill elderly people. The Administration temporarily prohibited distribution of the products (made in Taiwan) that caused the fatal accident. The Administration also recommended advised parents/caregivers to cut such jelly products into pieces before giving them to children or the elderly. The Administration cautioned the public to adhere to the following rules: do not give this type of jelly to children at home or at kindergarten; cut the jelly into small pieces before giving it to elderly people suffering illness; do not freeze the jelly before serving. (Reference 185)

In June 2007, the Administration inspected imported mini-cup jelly, including the product (made in Taiwan) that was responsible for the above-mentioned case of the death of an infant, and domestic products (27 products manufactured by 16 manufacturers). The product involved in the accident and products that required a compression force exceeding 12 N (15.1-50.8 N)—the "compression strength" of the product responsible for the accident—(which turned out to be 12 products manufactured by 10 producers) were additionally recalled. The Administration determined the following temporary standards. The products 4.5 cm and under in diameter or maximum length must have a "compression strength" of 7 N or less, and products more than 4.5 cm in diameter or maximum length must have a compression strength of less than 12 N. (Reference 186)

In October 2007, the Administration revised its "Food Handling Regulations"

[13] Traditional Korean food made of acorn, soba and beans. These ingredients are ground, mixed, beaten and the mixture is solidified.

and added the following specifications for mini-cup jelly: (Reference 187)

(i) Konjac and glucomannan shall not be used as raw ingredients for mini-cup jelly.

(ii) Mini-cup jelly shall be manufactured in the following size:
The minimum internal diameter of the surface in contact with the upper cover shall be 5.5 cm and over, and the height and the minimum internal diameter of the bottom shall be 3.5 cm and over.

(iii) The "compression strength" of mini-cup jelly shall be 5N or under.

There are several court cases related to accidental choking on mini-cup jelly. Two case studies are described below.

(i) In April 2001, the parents of an infant who choked on a konjac mini-cup jelly and suffered sequelae including hypoxic encephalopathy and limb paralysis put forward a claim for damages against the distributor. In October 2003, the Seoul District Court rejected the plaintiff's claim on the grounds that the jelly concerned was imported before disclosure of the risk of mini-cup jelly and underwent the inspection required by the law at the time of its distribution. (Reference 188)

(ii) In October 2004, a 6-year-old child died from choking on a mini-cup jelly snack (the import document stated that the product contained carrageenan) given by the father of the child's friend. In April 2005, the family of the victim put forward a claim for damages against the central government and the importer. In August 2006, the Seoul Central District Court explained the circumstances at the time of the accident as follows: If the mini-cup jelly concerned was a bite-size product that contained an ingredient that gave the jelly some physical/physicochemical property similar to that of konjac, the risk of choking from sucking or putting the jelly into the mouth by pushing on the cup was always present. The Court found that the central government, that allowed distribution of the jelly despite 2 choking accidents[14] in 2004 when the accident concerned, occurred liable for damages. The Court regarded deaths from choking on foods including raw octopus, sticky rice cake, and "candy" as accidents resulting from carelessness while eating. The Court, however, regarded mini-cup jelly as a product shaped so as to allow consumers to suck it in in one gulp and pointed out that jelly manufactured in this shape posed a risk. (Reference 189)

VII. Evaluation of the Health Effects of Foods

1. Introduction

In the process of this evaluation, the Food Safety Commission collected limited data from the party that requested the evaluation. The Commission also collected reference materials based on a small number of case studies that had not undergone peer review and were not supported by scientific evidence. In this way, the Commission has made efforts to collect as much information as possible and has attempted to conduct a scientifical evaluatation from a fair and neutral perspective. For the purpose of this evaluation, the Commission has tried to identify the actual conditions of food-related choking accidents, and to clarify the foods that frequently caused choking accidents, their physical properties and the factors on the side of consumers.

2. Actual Circumstances of Choking Accidents

The basic outline of the circumstances of food-related choking accidents can be explained as follows. Generally, some percentage of the population experiences aspiration or difficulty in swallowing in their daily lives. Most people recover but a few experience obstruction of the respiratory tract that cannot be cleared. These people are transported to hospital by ambulance. (According to the report, about 12% of the elderly in need of care at home have experienced choking over the past one year, while about 6% of mothers reported choking accidents involving their children over the past one year.)

The number of deaths from food-related choking accidents has increased by a factor of

[14] One involved a disabled 9-year-old child who ate a mini-cup jelly given by a nursery teacher at a care facility, and the other involved a 6-year-old child who ate a frozen mini-cup jelly.

approximately 1.2 over the past 10 years. Much of this increase can be attributed to deaths among the elderly. This phenomenon reflects the recent trend of society becoming older and having fewer children. Mortality from food-related choking accidents is stratified according to age. Mortality among those aged 65 and over exceeded the overall average, and mortality increased with further increase in age. The number of deaths from food-related choking accidents was compared with the total number of deaths, broken down by age. The percentage of infants aged 0 to 4 years who died from food-related choking accidents was higher than the overall mortality of this age group. According to the data on the number of deaths from food related choking by sex, the percentage of males was consistently higher among the overall population, the elderly and infants. This tendency was also observed in the data on the number of deaths from choking on konjac mini-cup jelly, the patients requiring emergency medical care, and the people who experienced a foreign body in the trachea/bronchus that did not result in a choking accident.

When the cases of death from "unexpected accident (excluding traffic accidents)" are stratified according to the site of the accident and the age of the victim, the infants aged 0-4 years generally encountered such accidents at home (70-80%).

Sticky rice cake and steamed rice ranked high among causative foods. The elderly accounted for more than 80% of the victims of choking accidents involving grains, including sticky rice cake, steamed rice and bread. Among infants who required emergency treatment after having choked on some food, the leading causative food was candy, and infants accounted for more than 80% of the victims who choked on candy and were transported to hospitals by ambulance. Some cases of a foreign body becoming lodged in the trachea or bronchus did not result in choking injuries. Most of the victims of such cases were infants and the foreign bodies were beans/nuts and seeds, including peanuts. Although their number is limited, there were some cases involving peanuts in which emergency medical care was required.

3. Foods that Frequently Cause Choking Accidents

Whether a food is frequently involved in a choking accident depends not only on the number of cases of choking accidents but also on frequency of consumption. We selected the main foods (food groups) involved in choking accidents, determined the amount of consumption by food (food group) and mouthful of each food (each food group), and calculated the frequency of choking accidents per mouthful of food. This enabled us to make relative comparisons. According to the results, sticky rice cake was the leading cause of choking followed by mini-cup jelly, candy, bread, meat, fish meat, fruit, and steamed rice. When the data on choking on konjac mini-cup jelly cup were obtained separately, it ranked third, after candy.

Table 38: Incidence of accidents of choking on a mouthful of food (food group) (Case 1-1) (Repeated presentation)

Food (food group)	Frequency of choking accident per mouthful of food ($\times 10^{-8}$)
Sticky rice cake	6.8-7.6
Mini-cup jelly	2.8-5.9
Candy	1.0-2.7
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 39: Incidence of accidents of choking on a mouthful of food (food group) (Case 1-2) (Repeated presentation)

Food (food group)	Frequency of choking accident per mouthful of food (×10-^{8})
Sticky rice cake	6.8-7.6
Mini-cup jelly	2.3-4.7
Candy	1.0-2.7
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 40: Incidence of accidents of choking on a mouthful of food (food group) (Case 2-1) (Repeated presentation)

Food (food group)	Frequency of choking accident per mouthful of food (×10-^{8})
Sticky rice cake	6.8-7.6
Candy	1.0-2.7
Konjac mini-cup jelly	0.16-0.33
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

Table 41: Incidence of accidents of choking on a mouthful of food (food group) (Case 2-2) (Repeated presentation)

Food (food group)	Frequency of choking accident per mouthful of food (×10-^{8})
Sticky rice cake	6.8-7.6
Candy	1.0-2.7
Konjac mini-cup jelly	0.14-0.28
Bread	0.11-0.25
Meat	0.074-0.15
Fish meat	0.055-0.11
Fruit	0.053-0.11
Steamed rice	0.046-0.093

The absolute number of accidents of choking on mini-cup jelly used for calculation was smaller than that of choking on other foods. The above figures for incidence contain a reasonable margin of error. We used the actual number of fatal accidents of choking on konjac mini-cup jelly reported by the Japanese Cabinet Office's Social Policy Bureau (22 cases over 13 years) as the number of choking accidents and attempted to make a conservative estimation (22 ÷ 13 ≈ 1.7 cases/year). Despite such attempt, the incidence of choking on konjac mini-cup jelly so calculated was second- highest after choking on candy. The Food Safety Commission comprehensively considered the results of calculations in the 4 respective cases and speculated that the frequency of cases of choking on a mouthful of mini-cup jelly including konjac jelly was as high as that of choking on candy. If no accidents are reported after the introduction of countermeasures, including labeling that prohibits the consumption of mini-cup jelly by the elderly and infants, it would indicate that the frequency of choking on such jelly is lower than that of choking on candy.

4. Factors Involved in Choking Accidents

(1) Factors Other than Foods

We confirmed that factors other than foods were deeply involved in food-related choking accidents. Most choking incidents occur when food becomes lodged in the

following two areas: (i) the area from the oropharynx to the laryngeal vestibule, and (ii) the area from the infraglottic space to the tracheal bifurcation. Human beings have a wide area of cross-over between the respiratory tract and the alimentary passage. Food taken in via the mouth passes through this high-risk site. This seems to be the basic factor on the side of consumers.

We also confirmed that t he factors on the side of consumers can be reduced and choking accidents can be prevented if the following "eating techniques for the prevention of choking" are strongly promoted: (i) knowing physical properties of foods and how to eat safely, (ii) taking small mouthfuls of food and positioning it in the front part of mouth, (iii) chewing food repeatedly and mixing it with saliva, (iv) concentrating on eating.

Human beings have a natural ability to recognize the texture of bolus in the mouth and adjust it by chewing and mixing in saliva, and to judge whether or not the food is ready to be swallowed. Individuals who are either going through the stage of developing of this function or suffer an impairment of this function are likely to experience aspiration or difficulty in swallowing, leading to accidental choking.

No cases of accidental death from choking on konjac mini-cup jelly have been confirmed so far among healthy young and middle-aged people (between the ages of 15 and 64 years). Due to the small number of food-related choking accidents in this age group, the Food Safety Commission speculates that age is one of the factors involved in food-related choking accidents.

Among the elderly, the following factors are likely to be involved in choking accidents: age-related physiological changes (reduced chewing force, extended distance of laryngeal elevation, decreased sensitivity of swallowing reflex and delayed induction of swallowing reflex), loss of teeth, background disease (cerebrovascular disease), swallowing function disorder and self-feeding.

Among infants, the following factors are likely to be involved in choking accidents: development of dentition and occlusion, rate development of eating function, and behavior.

Of non-food-related factors, environmental factors such as the level of danger awareness of carers, first-aid procedures, and assisted feeding may be involved in choking accidents. Generally, bystanders present at the accidents occurred were family members. If the bystanders attempted to remove the foreign bodies at the scene, the chances of survival could definitely be increased. According to recent data on cases involving children requiring emergency medical care, children have been involved in accidents at the home but have received no first-aid treatment from bystanders. Almost all foods, especially solid foods, pose a greater or smaller risk of obstruction of the respiratory tract resulting in choking. Even if various factors are reduced, the risk cannot be completely eliminated. This means it is important that those involved in the care of elderly people and children be fully aware of the risk of choking accidents. In addition, all people should be encouraged, if they witness a choking accident, to perform the first-aid treatment mentioned in Section V, 1(3). Taking such basic approaches will reduce all the factors involved in food-related choking accidents.

(2) Food-related Factors

General food-related factors such as the texture (surface smoothness, elasticity, hardness/difficulty in biting off), size and shape are likely to be involved in choking accidents.

5. Factors Involved in Choking Accidents by Food (food group)

The foods (food groups) that frequently cause choking accidents were subjected to factor analysis and the following results were obtained.

(1) Sticky Rice Cake

The Food Safety Commission speculated that with regard to choking accidents involving sticky rice cake, in addition to the above factors on the side of consumers, a number of food-specific factors specific contributed to their increased frequency, particularly among the elderly.

(i) Biting off a piece of sticky rice cake requires considerable chewing strength.
(ii) Sticky rice cake is soft and elastic immediately after it is placed in the mouth but a decrease in temperature during chewing results in an increase in hardness (difficulty in biting pieces off). Elderly people with decreased texture recognition/adjustment function cannot sufficiently grind sticky rice cake and mix it with saliva. This means the food is swallowed and delivered to the pharynx before chewing is complete.
(iii) When elderly people have decreased texture recognition/adjustment function, the food bolus increases stickiness and becomes stuck in the area from the pharynx to the laryngeal vestibule. Such a food bolus will occasionally reaches the trachea/bronchus and attach to the surface. This sticky food bolus is difficult to remove and can obstruct the respiratory tract. This physical property of food bolus is enhanced in the respiratory tract if the surface is not sufficiently wet. In individuals with a weak cough reflex, an obstructed respiratory tract cannot be cleared.

(2) Mini-cup Jelly (mannan containing jellies included)

Food Safety Commission speculated that, for accidents of choking on konjac mini-cup jelly, in addition to the above factors on the side of consumers, some factors specific to food concerned contributed to increased frequency.

(i) The packaging is designed so that the eater must tilt their head back and suck the jelly into their mouth. The jelly is therefore swallowed before the larynx is completely closed, obstructing the respiratory tract.
(ii) Konjac mini-cup jelly is generally harder than ordinary jelly. (It is difficult to bite off a piece of konjac jelly.) The jelly is even harder when cold. If a piece of poorly chewed konjac jelly is swallowed and passed to the pharynx, it becomes stuck in the area between the pharynx and the larynx, obstructing the respiratory tract.
(iii) Poorly chewed jelly can obstruct the respiratory tract. Its size and shape match the opening of the respiratory tract. If the area is too dry, it is not possible to remove or break up an elastic foreign body adhering to it. Therefore, obstruction of the respiratory tract cannot be cleared.

It is highly likely that mini-cup jelly that does not contain konjac is consumed in the same manner as mini-cup jelly that does contain konjac. Accordingly, the Food Safety Commission considers that the possibility of choking on mini-cup jelly that does not contain konjac is almost the same if it is a similar size and shape and has similar physical and physiochemical properties.

(3) Candy

Uniquely, candy is ingested by “sucking.” After being mixed with saliva, the surface of the candy becomes smoother and more slippery and cannot be retained in the mouth. Before it becomes small enough to be swallowed safely, it is accidentally sent to the pharynx and becomes stuck somewhere around the larynx. This creates an obstruction of the respiratory tract. Such accidental swallowing of candy is more likely to cause choking accidents among infants.

(4) Bread

The Food Safety Commission speculated that choking involving bread occurred because of the following: When too much bread is forced into the mouth, the food bolus compresses and becomes hard. Bread becomes more adhesive after being mixed with saliva and becomes stuck around the laryngeal vestibule, obstructing the respiratory tract.

(5) Meat/Fish Meat

The Food Safety Commission speculated that choking involving meat/fish meat

occurred because of the following: When meat/fish meat that is difficult to chew is sent to the pharynx without being sufficiently chewed it becomes stuck around the larynx and occasionally in the trachea/bronchus, obstructing the respiratory tract.

(6) Fruit

The Food Safety Commission speculated that with regard to choking accidents involving fruit, in addition to the above factors on the side of consumers, the following factors specific to fruit contributed.

(i) Human beings are vulnerable to aspiration because they cannot retain fruits with smooth surfaces (grapes etc.) in the oral cavity.
(ii) People eat fruit that is too hard and difficult to chew (such as apples, which require different levels of chewing force depending on thickness). In this case, fruit is sent to the pharynx before being sufficiently chewed. The fruit then becomes stuck around the larynx and occasionally in the trachea/bronchus, obstructing the respiratory tract.

(7) Steamed Rice

The Food Safety Commission speculated that with regard to choking accidents involving steamed rice, in addition to the above factors on the side of consumers, the following factors specific to steamed rice contributed, particularly among the elderly.

(i) Steamed rice in the form of “rice ball” or “lightly-pressed pieces of sushi” is harder and more adhesive than regular steamed rice.
(ii) People may put too much steamed rice in their mouths at one time. The rice can become stuck in the area between the pharynx and the laryngeal vestibule and the person chokes. When this occurs, even regular steamed rice becomes harder and more adhesive.
(iii) The food bolus is becomes stuck around the area between the pharynx and the laryngeal vestibule. It is occasionally sent to the trachea/bronchus. This food bolus becomes more adhesive and does not collapse easily. If cough reflex is weak, the obstruction of the respiratory tract cannot be cleared.

(8) Other Foods (food groups)

The foods (food groups) listed above are limited to those that frequently cause choking accidents. It is possible that foods other than those listed above may cause choking accidents. Cases in which beans, nuts, and seeds including peanuts have become lodged in the trachea/bronchus without resulting in a choking accident are frequent. These foods, especially peanuts, were also reported to be involved in cases requiring emergency medical care and resulting in death both in Japan and overseas. Peanuts can cause delayed obstruction of the respiratory tract and expiratory dyspnea. The cases requiring emergency transportation and emergency medical care as well as those in which autopsies were performed involved various foods, including rice dumpling, potatoes including konjac, noodles including soba, and milk, with the latter involved mainly in cases involving infants. In North America, obstruction of the area from the oropharynx to the larynx by hotdogs was the most frequent cause of fatal choking accidents among children.

6. Overseas Countermeasures

We collected and summarized overseas data on choking accidents, mainly concentrating on those involving mini-cup jelly. Generally speaking, the regulatory authorities of foreign countries other than EU member states have taken risk management countermeasures. These included determination of restrictions regarding hardness and portion sizes. However, it remains unknown as to whether these were determined on the basis of scientific evidence supporting a direct causal relationship with choking accidents.

The EFSA Panel conducted a risk assessment that produced the following conclusion: “The substances involve the risk of choking if they are added to products that are as small as konjac mini-cup jelly snacks, are consumed in the same way as the jelly and

give the products the physical or physicochemical properties of konjac mini-cup jelly. (Those people with a high risk of choking are not limited to infants.)

7. Conclusion

Ethical considerations prevent the simulation and testing of food-related choking accidents using human subjects. Neither can an experimental simulation using animals be conducted due to technical barriers. We could not take an epidemiological survey approach because the details of food-related choking accidents have not been thoroughly clarified and the number of total incidents is limited. In addition, we found it difficult to statistically elucidate the causal relationship with various factors. For these reasons, we attempted to identify the actual circumstances and adopted a factor analysis approach on the basis of various relevant factors including those related to food and not related to food (consumers). Accordingly, we shall consider the international trends regarding the evaluation and accumulation of domestic and overseas scientific knowledge and conduct further assessments as necessary in the future.

The Food Safety Commission promoted the investigation and discussion. In this process, the members pointed out the necessity for following investigation and research.

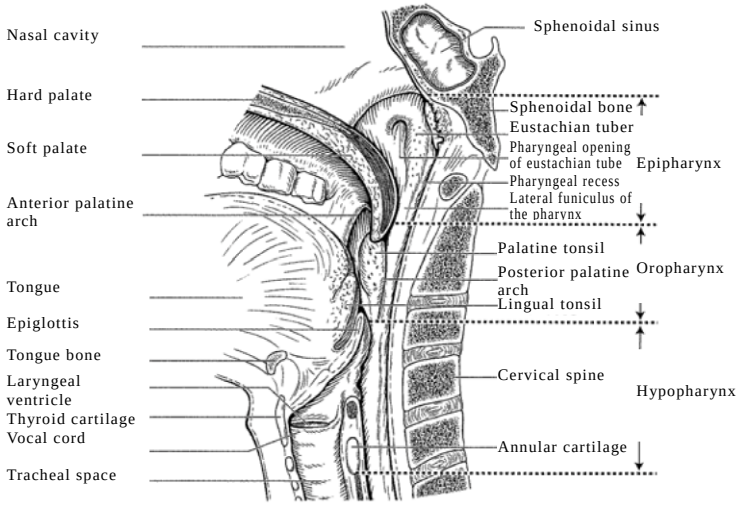
(i) Investigation and research into the factors involved in choking accidents, focusing on the physical properties of food boluses
(ii) Investigation and research into the factors involved in choking accidents, focusing on the comparison of the physical properties of various foods
(iii) Investigation and research concerning the number of deaths from accidental choking by age group/food (food group)
(iv) Investigation and research for the purpose of developing a system that makes it possible to clarify the actual circumstances of choking accidents, collection/analysis of data on the physical properties and manner of consumption of causative foods and children's behavior, evaluation/conduct of a prevention program, and validation of efficacy.

Appendix 1: Glossary

This glossary was prepared to help the general public understand the meanings of technical/scientific terms used in this evaluation document. Plain language is used to clearly explain such terms. The authors note, however, that some of the terms included in this document may not conform to accepted academic and/or scientific use.

- **Neoplasm:** Often called cancer.
- **Prorate:** To divide something into parts proportional to the original amount.
- **Mobile foreign body in the trachea:** An expression synonymous with "dancing foreign body" in the trachea. A foreign body that moves in an upward/downward motion in the trachea in response to coughing and inspiration.
- **Pharynx:** Consisting of the epipharynx, oropharynx, and hypopharynx (Fig. 40)

Fig. 40: Longitudinal section of the pharynx (Reference 190)



- **Trapped air:** The considerable amount of air that remains in the lungs after exhalation.
- **Swallowing:** Process in which food is transferred from the oral cavity to the pharynx, down the esophagus and into the stomach.
- **Difficulty swallowing:** Trouble with swallowing due to illness, aging, or other causes.
- **Contrast study of swallowing:** An X-ray fluoroscopy using a contrast medium to determine whether or not food has entered the trachea, or whether or not a person can swallow safely. The examination is videotaped for subsequent confirmation and evaluation of swallowing function.
- **Vomit reflex:** Physical function that induces vomiting in response to the entrance of a foreign body into the mouth.
- **Odds ratio:** Statistical scale used to compare two groups with respect to incidence.
- **Cough reflex:** Physical function that induces coughing in response to entrance of foreign body in the trachea.
- **Pseudobulbar palsy (or false bulbar palsy):** Bilateral impairment of the corticobulbar pathway that results in articulation disorder or difficulty swallowing. Pharyngeal/laryngeal dysfunction leading to articulation disorder or difficulty swallowing results from disorder of the

medulla in the brainstem. The term bulbar refers to the medulla oblongata, which looks like a bulb. Because impairment of the nerve fiber extending to the medulla from above causes similar symptoms, this disturbance is called "false bulbar palsy." This palsy is frequently accompanied by emotional incontinence characterized by being easily moved to tears and the emotional disorder of forced crying and laughing in response to slight stimulation.

- **Swallowing saliva alone:** Swallowing saliva in circumstances where there is nothing present in the mouth.

- **Carrageenan:** According to the Japanese Standards of Food Additives (Ver. 8, 2007), "purified carrageenan" is defined as "a substance primarily composed of ι-carrageenan, κ- carrageenan, and λ- carrageenan extracted from the entire alga of hypnea charoides, Eucheuma, Mazzaella japonica, gigartina, or chondrus crispus." It is used as a thickener or a stabilizer. It has several alternative names. (Reference 191)

- **Impaction:** A condition in which the tract is blocked by a solid or a semi-solid mass.

- **Penetration test:** A sample is penetrated by a plunger and the ease with which it collapses is measured.

- **Sensory evaluation:** A psychometric method of conducting measurement according to the human senses. Because physical/chemical methods cannot be used to measure materials that are selected for their color, taste or fragrance in a way that is that is deeply associated with personal preference, this method is often used as an evaluation tool.

- **Bronchus:** One of the large air tubes leading from the tracheal bifurcation to the alveolus. The bronchus located on the right side of the body is called the right bronchus, while that on the left is called the left bronchus.

- **Bronchial space:** The space inside the bronchi where they split from the trachea.

- **Xanthane gum:** According to the Japanese Standards of Food Additives (Ver. 8, 2007), "xanthane gum" is defined as "a substance containing polysaccharide extracted from the culture fluid of *Xanthomonas campestris*." It is used as a thickener or a stabilizer. It is has several alternative names, including xanthane polysaccharide. (Reference 191)

- **Foreign body in the respiratory tract:** A foreign body that is retained in the respiratory tract.

- **Obstruction of the respiratory tract:** An obstruction in a part of the respiratory tract (pharynx, trachea, bronchus).

- **Base of the palm:** The part of the palm close to the wrist joint.

- **Collapse of occlusal support in the molar region:** A condition in which the occlusion of the upper and lower molars (back teeth) does not fully support the jaws.

- **95% confidence interval:** An interval with a 95% probability of including an unknown parameter, or an interval within which there is a 95% probability that the values of the whole population exist

- **Bulbar palsy:** See "pseudobulbar palsy."

- **Thrusting of the breastbone:** An emergency technique in which sharp pressure is applied with hands to the area around the heart.

- **Aggregability:** One of the measures of food texture. The intensity of the force working between the molecules of food or the force against mastication. Frail food is broken easily because of low aggregability. So broken, the food can be scattered.

- **Guar gum:** In the section on "guar gum" in the Japanese Standards of Food Additives (Ver. 8, 2007), it is defined as "a polysaccharide-based substance obtained from guar seeds." An additive used as a thickener/stabilizer, it is also called guar flour. (Reference 191)

- **Glucomannan:** A polysaccharide consisting of glucose and mannose present in corms including konjac corm. Konjac glucomannan becomes very sticky when dissolved in water. Konjac paste is produced by adding alkali to the mixture for solidification. In order to make konjac mini-cup jelly with a sour fruity flavor, other gelation agents are used along with konjac.

- **Spasticity:** A symptom that accompanies palsy. Spasticity appears in various forms ranging from mild muscle stiffness to serious uncontrollable leg movement. Spasticity is characterized by increased muscle tone, sudden muscle contraction, increased (enhanced) deep tendon reflex, muscle spasm, unconscious crossing of legs, and fixation of joints.

- **Gelation agent:** A substance that deprives sol (the even dispersion of particles (solids) of one substance within another to increase their fluidity) of fluidity and promotes the formation of jelly-like substance. Gelatin, agar, etc.

- **Uvula:** See Fig. 41.

Fig. 41: Oral cavity/pharynx (Reference 190)

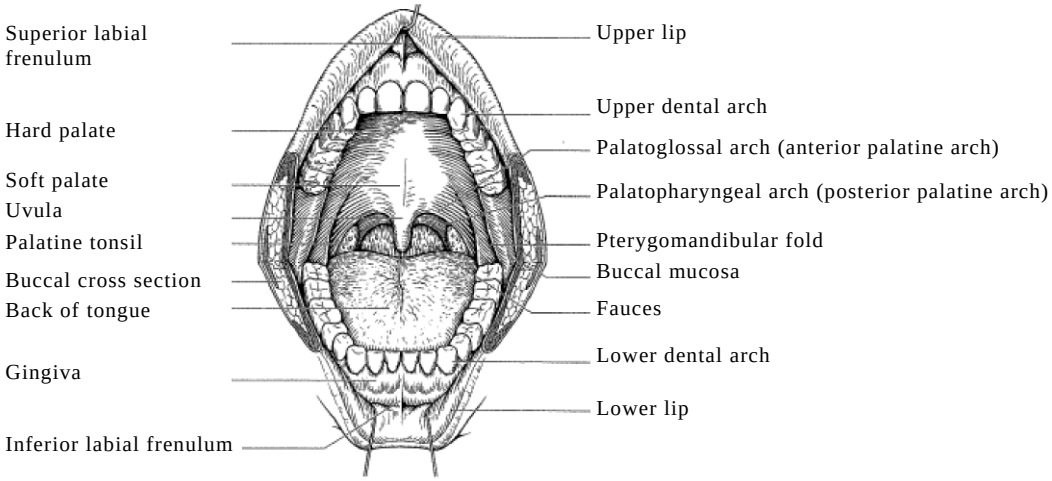


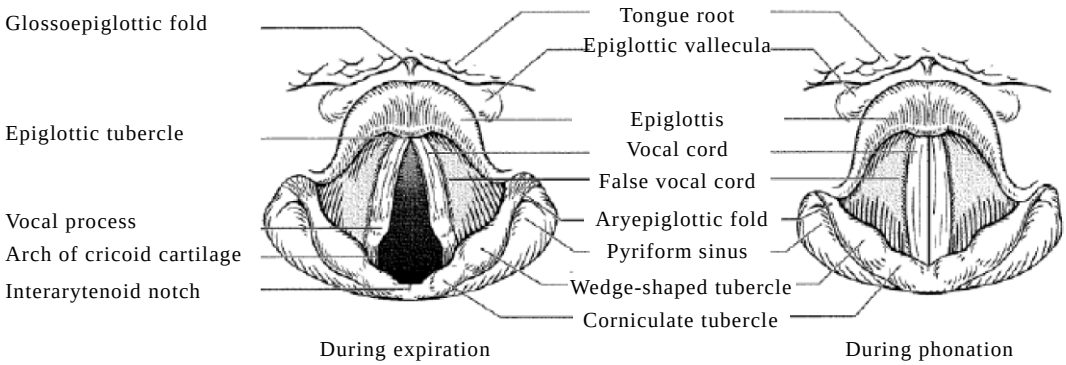
Fig. 1: Oral cavity/pharynx

- **Occlusion:** The way in which the upper and lower teeth line up together.

- **Larynx:** An organ located in the center of the neck between the pharynx and the trachea, or below the tongue bone and above the trachea. It includes the area from the epiglottis, laryngeal vestibule, and vocal cord to the infraglottic space. The larynx can be felt by palpating the neck. It moves in an upward/forward motion when swallowing occurs. It prevents swallowed food from entering the trachea or lungs (aspiration) and produces vocal sounds. During swallowing, the epiglottis falls, closing the glottis so that food cannot enter the trachea.

- **Epiglottis:** See Fig. 42.

Fig. 42: Images of indirect laryngoscopy (Reference 190 [partial modification])



- **Epiglottic vallecula:** A depression between the back of the tongue and the epiglottis. During swallowing, food rests here temporarily. See Fig. 42.
- **Laryngeal impaction:** An event in which a foreign body, moving upward or downward during coughing or inspiration, gets stuck in the larynx.
- **Laryngoscope:** A medical device used to check if there is a foreign body stuck in the laryngeal portion of the respiratory tract, including the vocal cords. It has a light at its tip to clearly illuminate the back of the throat. A laryngoscope is also used to insert forceps in the trachea.
- **Distance of laryngeal elevation:** During swallowing food, the muscle around the tongue bone contracts, the larynx rises, and the entrance of the esophagus opens. The distance of laryngeal elevation is defined as the height to which the larynx rises.
- **Laryngeal vestibule:** See Fig. 43.

Fig. 43: Laryngeal cavity (Reference 190)

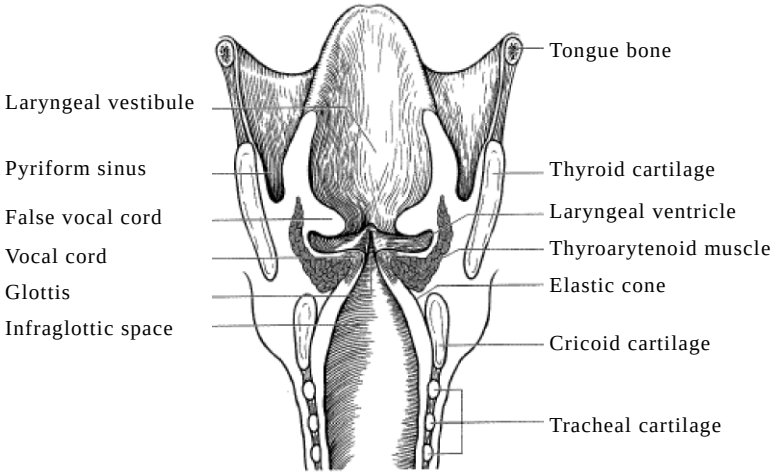


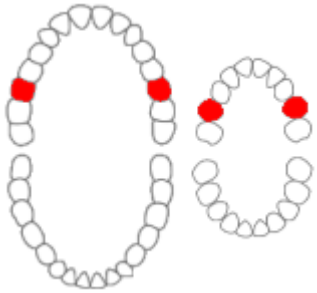
Fig. 7: Laryngeal cavity
[Frontal cross section (from the back)]

- **Development of the larynx:** A bronchoscope is inserted into the respiratory tract and is lifted in an upward/forward direction against the trunk. This lifts the tongue root and epiglottis so that the glottis can be directly observed.
- **Laryngeal closure:** Before the food is sent to the pharynx, the larynx rises forward/upward, the epiglottis is turned over, and the laryngeal vestibule closes.

- **Aspiration pneumonia:** Characteristically recurring pneumonia that develops due to entrance of bacteria into the lungs after aspiration. Incidence is high among the elderly.
- **Expiratory dyspnea:** Condition characterized by the subjective symptom of breathlessness during the phase of expiration.
- **Expiratory phase:** Period from the beginning of expiration to the time immediately before inspiration.
- **Training for breathing/bringing up sputum:** Patients with chronic dyspnea are instructed to practice abdominal respiration. They are also instructed to hold their breath for one or two seconds after a period of deep breathing and then exhale forcefully to eliminate sputum in the respiratory tract.
- **National Nutrition Survey:** As prescribed by the Health Promotion Law, the Ministry of Health, Labour and Welfare conducts this survey to obtain raw data from which it can ascertain the physical condition, nutritional intake and lifestyle of the Japanese people and promote public health in a comprehensive manner. It is currently called the "National Health and Nutrition Survey."
- **Total loss of teeth:** Loss of all the teeth in the oral cavity.
- **Finger sweep method:** A piece of gauze is wound around a finger. The victim's face is placed on the side and the finger is inserted into the mouth to remove a foreign body.
- **Inventory survey:** A complete enumeration. All subjects are subjected to a statistical survey.
- **Automated external defibrillator (AED):** A portable electronic device that automatically analyzes ventricular fibrillation and tells the operator when to apply an electronic shock (defibrillation) to the victim in the effort to recover cardiac function.
- **Dependent variable:** Where the relationship between "y" and "x" can be expressed by $y = f(x) + a$, "x" is defined as an independent variable (or explanatory variable), while "y" is defined as a dependent variable (response variable).
- **J/m^3:** "J" (joule) is a unit of work/energy. One cubic meter (1 m^3) of mass requires 1 J of energy.
- **Food bolus:** A bolus of food that can be swallowed.
- **Neurological sequela:** Functional disorders that still remain in the brain, nerves and muscles after acute symptoms of illness and injury have healed.
- **Vital Statistics:** The Ministry of Health, Labour and Welfare collects data on the "vital events" including birth, death, marriage, divorce and stillbirth and publishes them in the form of Vital Statistics.
- **Infraglottic space:** See Fig. 43 (p.97).
- **Tongue root:** See Fig. 42 (p.96).
- **Consumption of food/swallowing:** A series of processes that make up eating, from chewing to swallowing. The stage consists of the following five phases: "preceding phase," "preparatory phase," "oral phase," "pharyngeal phase," and "esophageal phase."
- **Explanatory variable:** It is also called independent variable. See "dependent variable."

- **Perforation:** The making or formation of a hole. Also, the hole itself.
- **Decubitus position:** Lying down on one side of the body. The right lateral decubitus position refers to lying down on the right side of the body, while the left lateral decubitus position is lying down on the left side.
- **Chewing:** Grinding food into small pieces.
- **Postresuscitation encephalopathy:** A condition wherein a cerebral disorder remains if the recovery of cardiopulmonary function is delayed during resuscitation.
- **First molar:** The tooth in a position distal to the second premolar. The sixth tooth from the mediodens (fourth tooth from the deciduous mediodens). The upper first molars are indicated in red in Fig. 44.

Fig. 44: Dentins (Left: permanent teeth; Right: deciduous teeth)



- **Body trunk:** The part of the body from below the neck down to the abdomen, consisting of abdominal muscles, back muscles, pectoral muscles, and thigh muscles.
- **Dilatancy:** Abnormal viscosity called Reynolds' dilatancy phenomenon, the phenomenon by which the sudden application of force to a mixture of liquid and uniform particles may result in the hardening of the system. This phenomenon can be observed in the interaction between seawater and sandy beaches and between water and starch.
- **Multiorgan failure:** When important organs stop working properly at the same time or within a short period of time.
- **Outcome:** Progress or result of treatment of disease or injury and prospects. Outcomes can be categorized as recovery, death, or termination of treatment.
- **Independent variable:** Also called explanatory variable. See "dependent variable."
- **Ability of daily living (ADL):** Minimum ability needed by humans in order to carry out basic daily activities such as eating, excreting and sleeping.
- **N/m^2:** Stress (pressure) generated after application of 1 Newton (1 N) of force per square meter (1 m^2) area. When foods of different sizes are compared with respect to hardness, stress—expressed by the value per area subjected to the force—is used for comparison, rather than force. 10^4 N/m^2 is equal to 1 N/cm^2. Because 1N is equal to 0.102 kgf (kilogram-weight), a substance with hardness of 4×10^4 N/m^2 (=4 N/cm^2) can apply about 400 gf force per one square centimeter (1 cm^2). The data on hardness include those expressed by the unit of "N" alone. When force is generated between the measurement tools including push sticks or human teeth and the samples (food etc.), the area subjected to the force often cannot be calculated. In this case, the contact area between the instrument or tooth and the sample ranges from about one square centimeter to several square centimeters. We can speculate that the data expressed with

the unit of "N" alone generally indicate hardness of the order similar to stress (pressure) expressed by $\times 10^4$ N/m^2 (= N/cm^2).

- **Consistency:** One of the measures of food texture. Consistency indicates the flow characteristics of food and used to express stickiness and high viscosity (not defined as Newton viscosity). It corresponds to the force needed to make thick food such as cream flow.

- **Hazard:** A hazardous factor. When the term is used in the context of food safety, it means a substance contained in food or food in a condition that may adversely affect human health. Hazardous factors include biological factors (toxic microorganisms), chemical factors (contaminants, residual pesticides), and physical factors (radiation, temperature of the environment where food is placed).

- **Interarytenoid:** The area between the arytenoid cartilages in the larynx. See "interarytenoid notch" [Fig. 42 (p.96)].

- **Adhesiveness:** One of the measures of food texture. It describes the intensity of contact between the oral organs and the surface of food.

- **Dancing foreign body:** See "mobile foreign body in the trachea."

- **Autopsy:** A procedure in which a body is dissected to detect the cause of death and conduct various examinations.

- **Holzknecht sign:** A shadow on the mediastinum (the section encircled by the lungs, thoracic vertebrae and breast bone) that can be seen in plain chest film on the affected side during inspiration and on the normal side during expiration.

- **Magill forceps:** A tool used for extracting foreign material from the throat.

- **Significance:** Observations that are unlikely to occur by chance and that therefore indicate a systematic cause.

- **Pyriform sinus:** See Fig. 43 (p.97).

- **Cricoid cartilage:** See Fig. 43 (p.97).

- **Locust bean gum:** Also known as carob bean gum. In the section on "carob bean gum," in the Japanese Standards of Food Additives (Ver. 8, 2007), locust bean gum is explained as follows: "The endosperm obtained from the seeds of locust beans is ground or dissolved and the precipitate is collected as locust bean gum." This additive is used as an agent to increase thickness and stability. (Reference 191)

- **Logistic regression analysis:** A type of regression analysis frequently used where the dependent variable is a binary (there are only two possible values).

Appendix 2: "List of Fatal Choking Accidents involving Konjac Jelly"

(June 10, 2009, Social Policy Bureau, Cabinet Office, Government of Japan)

	Date of choking accident	Victim		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating(*)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Actions of the victim (e.g. The victim put food in his/her mouth while playing or lying on the floor) (*)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*)	Who gave the food concerned (*)	
1	July 19, 1995	Male	1 year and 6 months	Unknown	Frozen	・My son aged 1 year and 6 months ate a serving of frozen konjac jelly. He died from choking on the jelly. He took it out of the package and put it in his mouth. Then, he took it out of his mouth. He repeated this behavior. Eventually, he put the whole jelly in his mouth. He coughed and looked sick. Some family members took him to a nearby hospital. After emergency treatment, he was transported by ambulance to a general hospital. He was hospitalized for about 40 days but died. ・The jelly was about 3.5 cm in height and 3 cm in diameter.	He suddenly coughed intensely. He choked on the jelly.	He ate a whole jelly in one mouthful.	Unknown	
2	August 7, 1995	Male	6 years	Unknown	Unknown	・A child ate a konjac jelly and choked on it. ・He was taken to a nearby hospital. After emergency treatment, he was transported by ambulance to an emergency medical center. ・He remained unconscious and died 5 days later.	Unknown	Unknown	Unknown	
3	December 23, 1995	Female	82 years	Unknown	Unknown	・My mother, who was admitted to a welfare facility for the elderly, ate a konjac jelly and choked on it. When she was found, she was in a state of apparent death. ・She was admitted to the affiliate hospital for intensive care. She died 6 days later. ・Konjac jelly was not given to residents at the facility. Therefore, my mother probably received the jelly from someone else.	While staying at the welfare facility for the elderly	Unknown	Unknown	
4	March 1996	Male	87 years	Unknown	Unknown	・I attended the funeral of my friend's father. I heard that he died from choking on a konjac jelly. I report this case as I have read a news article about such an accident. My friend's father suffered age-related forgetfulness and was physically weak.	Unknown	Unknown	Unknown	
5	March 17, 1996	Male	68 years	Unknown	Unknown	・My husband ate a konjac jelly and died from choking on it. The manufacturer of the jelly was unknown because it was a present.	Unknown	Unknown	Unknown	

* The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, a factual investigation was not conducted.

	Date of choking accident	Victim		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating(*)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Actions of the victim (e.g. The victim put food in his/her mouth while playing or lying on the floor) (*)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*)	Who gave the food concerned (*)	
6	March 29, 1996	Male	1 year and 10 months	Unknown	Unknown	・ My son choked on a konjac jelly and was transported by ambulance to a hospital. He died of cardiopulmonary arrest. He often ate such jellies as snacks. He used to put a whole jelly in the mouth. Then, he put it back in the package. He bit off pieces. Then, he ate the small pieces of jelly. He probably ate a jelly in the same manner on the day of accident. His mother was not watching over him but another family member was. His mother turned him upside down and slapped him on the back. He closed his mouth firmly and didn't spit it out. He was taken to a nearby private clinic and transferred to a general hospital. He died before he arrived at the hospital.	Unknown	He put a whole jelly in his mouth. Then, he put it back in the package. He bit off pieces. He probably ate the small pieces of jelly.	Unknown	
7	June 10, 1996	Male	2 years and 1 month	Unknown	The jelly was cold in the refrigerator.	・ His parent took out the cold jelly from the refrigerator and cut it in half. The parent gave half of the jelly to the boy. The boy choked on it. The parent turned him upside down and slapped him on the back. The jelly could not be removed. The parent put a finger in the child's mouth to remove it. The child ground his teeth and bit the parent's finger. This attempt was also unsuccessful. The child suffered cardiopulmonary arrest and was transported by ambulance to a hospital. He died after a 7-day hospitalization. ・ The label on the external package included the precautions to be followed at the time of giving a jelly to an infant. His parent started to give the jelly to him about 6 months ago.	Unknown	His parent cut the jelly in half and gave half to him.	Parent	
8	June 29, 1996	Male	6 years	45+5 Fruit Konjac (Ace Bakery Co., Ltd.)	The jelly was cold in the refrigerator.	・ A 6-year-old boy was staying at a relative's house. A 4-year-old cousin brought some konjac jelly snacks from the refrigerator and gave one of them to him. He sucked the jelly directly from the cup and choked on it. He was suffocated and tried to ask someone in the family to help. ・ There were no adults when the accident occurred. When he was found, he could not speak and suffered badly. He was immediately slapped on the back and given other first-aid treatment. An ambulance was soon called. ・ He received emergency treatment in the ambulance. He suffered cardiac arrest when he was transported to the hospital. He was unable to breathe on his own from the ninth day in the hospital. (Afterward, he died on July 17.)	Unknown	He sucked the jelly.	Cousin	

* The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, a factual investigation was not conducted.

	Date of choking accident	Victim		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating(*)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Actions of the victim (e.g. The victim put food in his/her mouth while playing or lying on the floor) (*)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*)	Who gave the food concerned (*)	
9	April 1999	Female	41 years	Unknown	Unknown	・ Two months ago, my sister, who was admitted to a hospital, died from choking on a konjac jelly. I don't intend to ask for compensation but I wanted to let the public know that konjac jelly is a dangerous product. She was admitted to a psychiatric hospital and occasionally swallowed food without chewing it. She received the jelly from one of the patients in the same room and the manufacturer's name was unknown. The medical staff who conducted emergency treatment for her told me that the jelly was so soft that it couldn't be removed by suctioning.	The victim was admitted to a psychiatric hospital.	Unknown	One of the patients in the same room.	
10	December 4, 1999	Male	2 years	Name of product unknown (Mannanlife Co., Ltd.)	The jelly was cold in the refrigerator.	・ In the kitchen, the mother peeled off the top of a konjac jelly and gave it to her son. She went out of the kitchen to get another jelly in a refrigerator in a different room. She came back to the kitchen in a few minutes and found her son lying on his back on the table. He was unconscious.	Unknown	Unknown	Mother	
11	July 2002	Female	80 years	Unknown	Unknown	・ The victim's son cut a konjac jelly into pieces with a spoon and gave the pieces to his mother. She choked on the jelly and was transported by ambulance to a hospital. She was hospitalized because of hypoxia. She died 3 months later.	Unknown	Cutting the jelly into pieces with a spoon.	Son	
12	August 3, 2005	Female	87 years	Name of product unknown (Mannanlife Co., Ltd.)	Unknown	・ She choked on a konjac jelly and died 5 days later. Someone bought a package of the jelly snacks at a convenience store.	Unknown	Unknown	Unknown	
13	May 25, 2006	Male	4 years	Unknown	Unknown	・ The boy and his older brother fought over konjac jelly snacks in one room while their mother was preparing dinner in the kitchen. It appears that the boy put a jelly in his mouth quickly so that his older brother couldn't get it. The older brother told his mother that his brother choked on the jelly. His mother called ambulance but her son was dead.	The boy fought for the jelly with his older brother and put it in the mouth quickly.	Unknown	Unknown	
14	June 22, 2006	Male	79 years	Unknown	Unknown	・ After implantation of a pacemaker, my husband was treated at home. I noticed that he lost his appetite, and gave him a konjac jelly that I had at home. I used a spoon to cut it into 4 pieces and gave him the pieces. Immediately after I gave him the second piece, he choked on it and began to suffer. I slapped him on the back and he spat out one piece. He could not spit out the piece. He was transported by ambulance to a hospital but he died.	The man lost appetite during treatment at home after surgery.	Cut the jelly into 4 pieces and gave him a piece twice.	Unknown	
15	March 23, 2007	Male	7 years	Chigiritate Kajukuen Konjac Jelly (Ace Bakery Co., Ltd.)	Unknown	・ At the after-school care program, he was given a konjac jelly as a snack. He choked on it. He was transported by ambulance to hospital but he died.	The boy was given the jelly during an after-school care program.	Unknown	Unknown	

* The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, a factual investigation was not conducted.

	Date of choking accident	Victim		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating(*)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Actions of the victim (e.g. The victim put food in his/her mouth while playing or lying on the floor) (*)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*)	Who gave the food concerned (*)	
16	April 29, 2007	Male	7 years	Shukaku-no Okage Konjac Jelly (Shimonita Bussan)	Unknown	・ The boy was staying at his grandparents' house. His mother gave him a konjac jelly. He ate it when he was by himself and choked on it. He was found when he tried to go to the bathroom. He was transported by ambulance to a hospital but he died on May 5.	Unknown	Unknown	Mother	
17	July 29, 2008	Male	1 year and 9 months	Konjac Batake (Mannanlife Co., Ltd.)	The jelly was frozen in the freezer. It was taken out of the freezer before eating.	・ The boy and his older brother were staying at their grandparents' house. After lunch, their grandmother took the jelly out of the cups and gave them to the boys. She saw that the boys held the jelly in their hands. ・ When she looked at the boy again, she saw he was suffering. He groaned painfully and fell down. He looked sick. ・ He was transported by ambulance to a hospital but he died on September 20.	The boy held a jelly taken out of the cup in his hand.	Unknown	Grand-mother	

* The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, a factual investigation was not conducted.

Appendix 3:"List of Choking Accidents involving Konjac Jelly"

Non-fatal accidents (June 10, 2009, Social Policy Bureau, Cabinet Office, Government of Japan)

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
1	June 4, 1994 (date of reporting)	Unknown	(2 years)	Unknown	Unknown	・ A 2-year-old infant choked on konjac jelly. I turned the infant upside down and the jelly was eventually removed. The manufacturer should assure safety by improving the size of jelly.	Unknown	Unknown	Unknown	
2	November 1994	Male	9 years	Unknown	Unknown	・ I read a newspaper article about a choking accident involving konjac jelly. ・ Last year, my son (in his second year of elementary school at the time) ate a konjac jelly for a snack. He pushed the bottom of cup and popped the jelly into his mouth. He suddenly choked on it. I turned him upside down and slapped him on the back. Then, he spat it out. ・ I had a frightening experience although the accident was not fatal. I request the manufacturer to improve the product.	Unknown	The boy pushed the bottom of cup and popped it into his mouth.	Unknown	
3	March 1995	(Male)	Unknown	Unknown	Unknown	・ My father-in-law choked on a konjac jelly. He was almost suffocated. ・ My father-in-law was confined to bed. I placed him in a wheelchair to take him out for a walk. During walk, I gave him a konjac jelly. When I put it in his mouth, he choked on it and groaned painfully. He turned pale. ・ A nurse who happened to be passing by put her finger in his mouth to remove the jelly. The jelly was successfully removed and he could breathe again. ・ He generally took only liquid food and jelly.	The man was sitting in a wheelchair.	Unknown	Unknown	
4	May 1995	Unknown	1 year	Unknown	Slightly cold	・ I read a newspaper article reporting that an infant died from choking on konjac jelly. My child aged 1 year and 8 months also choked on the jelly. ・ I put one-third of a piece of cold konjac jelly in my child's mouth. My child choked on it. I turned my child upside down and patted. My child spat it out. ・ The accident occurred probably due to increased hardness of the jelly, which was kept in the refrigerator. I report this accident to provide information. I don't know the name of the manufacturer.	Unknown	The jelly was divided into pieces in advance.	Mother	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
5	May 29, 1995	Male	0 year	Unknown	Unknown	・ I divided a konjac jelly into pieces and gave them to my son (10 months old) with a spoon. He suddenly turned pale and lost consciousness. He stopped breathing. ・ I called an ambulance. The paramedic instructed me over the phone me to try first-aid treatment. I turned him upside down and made him spit out the jelly. He started to breathe but his nose was bleeding. He was transported by ambulance to a hospital. He suffered aspiration pneumonia but recovered.	Unknown	The jelly was divided into pieces with a spoon in advance.	Mother	
6	August 1995	Female	2 years	Unknown	Unknown	・ I read a newspaper article reporting that an infant choked on konjac jelly. My child (girl aged 2 years and 2 months) also choked on konjac jelly. I turned her upside down and patted her on the back. She could not spit it out. My wife put her finger in the girl's mouth to remove the jelly. My daughter badly suffered for about one minute. ・ I would ask the manufacturers to improve their products.	Unknown	Unknown	Unknown	
7	August 1995	Unknown	2 years	Unknown	Unknown	・ My wife worked in a kindergarten. A program for the children to be enrolled was held there. An infant (2 years and 8 months) ate konjac jelly and choked on it. The infant suffered but could spit it out safely. I provide this information because I think it is relevant.	Unknown	Unknown	Unknown	
8	August1995	Male	1 year	Unknown	Unknown	・ My son (1 year and 10 months) choked on konjac jelly. He suffocated for about 2 minutes. He was hospitalized for 3 days. ・ In August, I returned to my hometown during the Bon holiday period. My son ate a konjac jelly at my parents' house. He choked on it. I quickly removed it from his mouth but I was afraid that a piece might enter his lung. I took him to the hospital. He appeared to be all right but he was hospitalized for follow-up observation for about 3 days. He has suffered no further ill effects so far.	Unknown	Unknown	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
9	September 12, 1995	Male	9 years	Unknown	Unknown	・My son aged 9 was admitted to a nursing facility because of severe motor and intellectual disabilities. During hospitalization, I took a cold konjac jelly out of the refrigerator and put it in his mouth. He nearly choked on it. ・I took bite-size konjac jelly snacks from a package. I cut one in half and gave a piece to my child as a snack. Five or ten minutes later, he turned pale and suffocated. ・I called for a doctor. My son recovered because of the emergency treatment provided by the doctor. ・I read a newspaper article about a similar accident and this information because I think it is relevant.	During hospitalization	The jelly was halved in advance.	Unknown	
10	September 21,1995	(Male)	0 year	Unknown	Unknown	・A 9-month-old boy sucked a konjac jelly and suffered difficulty in breathing. ・While staying at his grandparents' house (in a different prefecture), his grandmother put it in his mouth. He sucked it. The jelly could not be removed. He suffered cyanosis. He was turned upside down. A finger was inserted to remove the jelly. He could breathe a little. ・He was transported by ambulance to a hospital. He came down with a fever the following day and was hospitalized for 5 days. H stopped breathing temporarily but didn't suffer pneumonia. Electroencephalography revealed no abnormality. The treatment fee was around 20,000-30,000 yen.	Unknown	Unknown	Grand-mother	
11	October 17, 1995 (date of reporting)	Male	1 year	Unknown	Unknown	・My son (aged 1 year and 4 months) nearly choked on konjac jelly. Fortunately, he could spit it out by himself but I provide this information because I think it is relevant. ・The jelly was given as a sample in a market. Generally, one of his parents would cut jelly into pieces with a spoon. On the day of accident, my son wanted to eat a whole piece and he was permitted to eat it in one gulp. The jelly entered his mouth okay, but he started to groan. I slapped him on the back and he spat out nearly the whole jelly. He cried and was in pain. ・I read a newspaper article about fatal choking accidents. I was surprised to know that similar accidents occurred.	Unknown	The child put a whole piece jelly in his mouth.	Mother	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
12	October 1995	Unknown	3 years	Unknown	Unknown	・ My wife worked in a kindergarten. A program for the children to be enrolled was held there. An infant (aged 3 years and 4 months) ate konjac jelly directly from the cup. The infant choked on it and blinked frequently. The infant could spit it out safely.	Unknown	Unknown	Unknown	
13	October 13, 1995	Female	50 years	Unknown	Unknown	・ At an exhibition, my friend gave me some konjac jelly snacks. I ate them at night one week later. I choked on it and suffered badly. Konjac jelly is a dangerous food even for an adult. That's why I'm providing this information. ・ My friend shared a package of konjac jelly snacks (20 cups) with her four friends. I received three cups and brought them home. One week later, I noticed the expiration date and ate a cup of jelly at around 10:30 at night. I sucked it up in one gulp but nearly choked on it. I managed to swallow it but it hurt a lot. ・ The manufacturer should adopt some safety measure to prevent choking accidents. For example, the jelly should be smaller or softer.	Unknown	The reporter swallowed in one gulp.	Self	
14	November 11, 1995	Female	1 year	Unknown	Unknown	・ My daughter used to eat konjac jelly. She choked on the jelly and was transported to a hospital. Fortunately, she escaped death but was admitted to the emergency treatment room.	Unknown	Unknown	Unknown	
15	November 1995	Female	2 years	Unknown	Unknown	・ In November 1995, my daughter (aged 2 years) choked on konjac jelly and temporarily stopped breathing. Since then, she has been hospitalized but has shown no response. ・ The external package was discarded. From the individual cups and seals, the manufacturer was identified. The manufacturer's representative once visited us. He said that a cup from the same package was needed to demonstrate the causal relationship, and tried to deny responsibility. My daughter is conscious but shows no response. She receives nutrition through a nasal tube.	Unknown	Unknown	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
16	January 5, 1996	Male	2 years	Unknown	Unknown	・My son (2 years) ate a bite-size konjac jelly snack. He choked on it and suffocated for a few minutes. ・His grandmother peeled off the top and handed the jelly to him. He ate it but suddenly started to suffocate. He seemed to choke on the jelly. He was turned upside down. The jelly didn't come out, even after he was slapped on the back. While waiting for the ambulance, he was placed upright and a finger was inserted into the mouth to remove it. Then, the jelly fell into his esophagus and he could breathe again. He underwent a medical examination but no abnormality other than a slight injury of the throat was detected.	Unknown	The grandmother peeled off the top and handed the jelly to the boy. He was allowed to hold the jelly and eat it.	Grand-mother	
17	March 6, 1996 (date of reporting)	Unknown	6 years	Unknown	Unknown	・A 6-year-old child ate a konjac jelly snack and choked on it. This dangerous food should be improved and its safety should be assured.	Unknown	Unknown	Unknown	
18	March 21, 1996 (date of reporting)	Female	5 years	Unknown	Unknown	・A 5-year-old girl ate a konjac jelly snack with a spoon and choked on it. She was forced to spit it out immediately. There seems to be some safety concerns about this jelly. ・I have read a newspaper article about fatal accident where someone choked on konjac jelly. I am providing this information because no action has been taken to improve the product.	Unknown	The girl ate the jelly with a spoon.	Unknown	
19	May 18, 1996	Male	5 years	Unknown	Unknown	・A 5-year-old boy ate a konjac jelly snack and choked on it. His caregiver hit him on the back of the neck. The boy only narrowly escaped death. If he had been on his own, he probably would have died. ・Children are likely to choke on konjac jelly. Therefore, we didn't allow him to eat them however he liked. We always supervised him while he ate them. He happened to eat the jelly while he was alone for a short period of time. He probably swallowed one or two pieces without chewing.	Unknown	The child probably swallowed one or two pieces of jelly without chewing.	Self	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
20	May 24,1996	Male	1 year	Unknown	Unknown	・I tore a piece of konjac jelly with my fingers and gave the pieces to my son aged 1 year and 7 months. He choked on the jelly. I would request the manufacturer to producing such a dangerous food. ・Around noon, I bought a package of konjac jelly at a vegetable store in the public market. I sat on the bench with my son and cut a cup of jelly into about three pieces. I put a piece in my son's mouth and he choked on it. He kept his eyes open and he was foaming at the mouth. He turned pale. ・Fortunately, a nurse was passing by and noticed the accident. She turned my son upside down and slapped him on the back. He started to cry. He was taken to a hospital by ambulance. He escaped death and suffered no lasting ill effect. I'm not asking for compensation for the accident but I would ask the manufacturer to stop production of such dangerous food and distributing it without placing warnings on the package.	Sitting on the bench	The parent cut a piece konjac jelly into about three pieces.	Mother	
21	May 28, 1996	Female	10 years	Unknown	Unknown	・My daughter (in her second year of elementary school) ate a jelly-like snack containing konjac and choked on it. She nearly died. The shape of konjac jelly should be improved. ・Because the mother put her finger in her daughter's mouth and removed it, this event didn't result in a fatal accident. ・Some fatal accidents have been reported so far. I would ask the manufacturers to improve the size and shape of konjac jelly. More people have probably experienced near-misses, incidents and accidents that have not resulted in death. I need to report what actually happened to the Center. Such accidents should be put in the record.	Unknown	Unknown	Unknown	
22	June 1996	Female	94 years	Unknown	Unknown	・From my brother-in-law, I heard that my mother-in-law who was confined to bed choked on a konjac jelly snack. She suffocated but didn't die. Konjac jelly is a dangerous food. ・My mother-in-law was admitted to a nursing facility for the elderly. While she was lying on the bed, a whole serving of konjac jelly was put into her mouth. She tried to chew at first but choked on it. Her caregiver slapped her on the back and gave her some water or tea. She narrowly escaped death. ・According to the newspaper, konjac jelly was reported to be dangerous for infants. They are also dangerous for the elderly.	The old woman ate the jelly while lying on the bed.	A whole serving of jelly was put into the mouth.	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
23	July 30, 1996 (date of reporting)	Female	10 years	Unknown	Unknown	・ The konjac jelly was bought at a market. A girl (in her fifth year of elementary school) ate the jelly and nearly choked on it. ・ I carefully checked the package and found the precautions printed in tiny letters but konjac jelly is extremely dangerous food. I provide the relevant information.	Unknown	Unknown	Unknown	
24	April 3, 1997	Female	1 year	Unknown	Unknown	・ I gave a piece of konjac jelly to my daughter (1 year and 10 months). She choked on it and was hospitalized. ・ I found the following precaution on the package: "Please cut into small pieces when you give the jelly to children or the elderly." I thought that this product was safe and bought it. I used a spoon to cut it into pieces and gave a mouthful of jelly to my daughter. Then, she choked on it.	Unknown	A spoon was used to give a mouthful of jelly to the infant.	Unknown	
25	June 1997 (date of reporting)	Unknown	(2 year)	Unknown	Unknown	・ A 2-year-old infant ate a bite-size fruit jelly snack (Note: already identified as konjac jelly) and nearly choked on it. There was no label indicating that it was konjac jelly on the package. It was purchased because it was the type of jelly that melts in the mouth.	Unknown	Unknown	Unknown	
26	May 9, 2003 (date of reporting)	(Female)	(1 year)	Unknown	Unknown	・ My friend's daughter (aged 1 year and 10 months) used to eat konjac jelly. Two weeks ago, the girl ate after waking up. Then, she fell on her back and suffered cardiopulmonary arrest. She was transported by ambulance to a hospital and underwent cardiopulmonary resuscitation. She miraculously started breathing again. Because she suffered cardiopulmonary arrest for as long as 30 minutes, she entered a vegetative state. This kind of accident should never happen again.	Unknown	Unknown	Unknown	
27	October 27, 2005 (date of reporting)	Male	9 years	Unknown	Unknown	・ A boy (in his third year of elementary school) ate a konjac jelly snack and choked on it. Fortunately, he had no life-threatening experience but I report the relevant information. ・ Konjac jelly is rather hard. Even adults need to use a certain amount of force to chew it. It seems to be a dangerous food for children.	Unknown	Unknown	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
28	October 1, 2006	Male	2 years	Unknown	Frozen	・A 2-year-old boy was playing the crane machine game at a market. He was trying to catch frozen konjac jelly snacks with the claw. He ate the frozen konjac jelly and choked on it. He suffered hypoxia and was transported to a hospital. ・I complained to the manufacturer about the risk of choking. The manufacturer insisted that there was a warning on the outer packaging. The person who operated the machine insisted that he was not responsible for the products inside. Both of them denied responsibility. My son was diagnosed with hypoxic encephalopathy. He was at a risk of suffering further ill effects. Their responses were unsatisfactory.	Unknown	Unknown	Unknown	
29	October 3, 2008 (date of reporting)	Male	15 years	Unknown	A frozen jelly started to melt slightly.	・Last year, my son (junior high school student) choked on a froze konjac jelly. He was able to spit it out. I need to provide the relevant information. ・My son (in his second year of junior high school at the time) choked on a konjac jelly. The frozen jelly probably started to melt slightly. He appeared to be suffocating. I told him to spit it out. Finally, the jelly melted and he was able to escape death. My son was said to have narrower bronchi. As seen in this case, konjac jelly is dangerous for infants and the elderly. I would advise the distributor to stop distribution.	Unknown	Unknown	Unknown	
30	May 1, 2007	Male	73 years	Unknown	Unknown	・My husband ate konjac jelly snack and it got stuck in his esophagus. He was transported by ambulance to hospital and received emergency treatment. I should provide the relevant information. ・At the hospital, they gave him an X-ray and the jelly was detected in his esophagus. A tube was immediately inserted down from his mouth to push the jelly into his stomach. After the treatment, the serious suffocating he had been suffering was relieved. ・I found a newspaper article about a similar accident. I thought I should report this case and provide the relevant information.	Unknown	Unknown	Unknown	
31	May 24, 2007 (date of reporting)	Male	Unknown	Unknown	Unknown	・I have a relative whose child choked on konjac jelly and suffered lasting ill effects. ・Today, I heard about an accident involving choking on konjac jelly. Because my relative doesn't intend to report the accident, I feel like I should provide the relevant information.	Unknown	Unknown	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

	Date of development of choking accident/date of reporting	Victim (*1)		Cause of choking accident		Circumstances at the time of choking accident				Remarks
		Sex	Age	Name of product Name of manufacturer	Temperature of food immediately before eating (*2)	Summary of the circumstances at the time of accident (Note) The summary is based on the information provided by the reporter.	Condition of the victim of choking accident (e.g. The victim ate while playing or lying on the floor) (*2)	How the food was put in the mouth (e.g. The food was sucked, swallowed in one gulp or divided into pieces with a spoon) (*2)	Who gave the food concerned (*2)	
32	October 2008	Female	Unknown	Unknown	Unknown	・ I choked on konjac jelly. A bystander put their finger in my mouth to remove it. A vacuum cleaner was also used to suction it. Finally, the jelly was removed. ・ I temporarily lost consciousness. After the jelly was removed, I visited a hospital. The doctor told me that diagnostic imaging was needed to detect injuries in the respiratory tract and that the discomfort in my throat might remain for about one week. I informed the manufacturer of the accident. The manufacturer intended to compensate me by paying the treatment fee and providing new products. If I had been alone, I might have died. I can't forget this terrible experience.	Unknown	Unknown	Unknown	

(*1) The sex and age in the parentheses were derived from the information provided by the reporter.

(*2) The authors considered the contents of the "summary of the condition at the time of accident" and predicted the contents of the following sections: "temperature of food immediately before eating" in the section of the "cause of choking accident," and the "condition of the victim of choking accident," "how the food concerned was put in the mouth," and "who gave the food concerned" in the section of the "condition at the time of choking accident." Therefore, the factual investigation was not conducted.

Appendix 4: Method for Calculation of the Incidence of Choking Accidents per Mouthful of Food (food group)

1. Sticky Rice Cake

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "sticky rice cake" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on sticky rice cake.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on "processed rice" were selected. From these data, the data on "sticky rice cake" and "other snacks" were selected. Furthermore, from these data, the data on "sweet sticky rice cake," "flavored sticky rice cake," and "sticky rice cake containing sweet bean paste" were selected. Then, the mean daily intake of sticky rice cake was defined as the total of the weighted averages of daily consumption of the final three types of sticky rice cake. Sticky rice cake resembles steamed rice. With the increase in hardness of food, however, the size of a mouthful of food generally decreases. It would be expected, therefore, that a mouthful of sticky rice cake would be smaller than a mouthful of steamed rice. In an experiment, 11 healthy adults (mean age: 26.7 years) were asked to eat either 3 g or 9 g of sticky rice cake and their chewing/swallowing function was evaluated. (Reference 192) According to the result of the preparatory test, a mouthful of sticky rice cake ranged from 9 g to 10 g for adult females. Similar data on adult males were unavailable. Although use of this figure for adult males may be an underestimation, the authors speculated that an average mouthful of sticky rice cake ranged from 9 g to 10 g in males and females.

2. Steamed Rice

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "steamed rice" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on steamed rice.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on all "rice" and "processed rice" were selected. From these data, the data on "steamed rice containing red beans" were selected. The daily consumption of "steamed rice containing red beans" was corrected by using the "rate of change in weight" due to cooking listed in Standard Tables of Food Composition in Japan. (Reference 193) The mean daily intake of steamed rice was then defined as the total of the weighted averages.

According to Table 28 (p. 46), a mouthful of steamed rice ranged from 11 g to 22 g.

3. Bread

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "bread" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on bread.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on "bread" and "sweet bun" were selected. The mean daily intake of bread was defined as the total of the weighted averages of the daily consumption of "bread" and "sweet bun." According to Table 28 (p. 46), a mouthful of bread ranged from 4 g to 9 g.

4. Meat/Fish Meat

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "meat" and "fish meat" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on meat and fish meat.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on "meat" and "fish meat" were selected. The mean daily intake was defined as the weighted averages of the daily consumption of "meat" and "fish meat."

According Table 28 (p. 46), a mouthful of meat/fish meat ranged from 8 g to 16 g.

5. Fruit

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical

care due to choking on "fruit" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on fruit.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on "fruit," excluding those on "fruit juice," were selected. The mean daily intake was defined as the weighted averages of the daily consumption of "fruits" excluding "fruit juice."

According to Table 28 (p. 46), a mouthful of fruit (apple) ranged from 8 g to 16 g.

6. Candy

The number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "candy" included in the data collected from "75 Emergency Medical Centers (2007)" to estimate the number of deaths from choking on candy.

From the special tabulation presented by the National Nutrition Survey (1998-2000), the data on "snacks" were selected. From these data, the data on "candy" were selected. The mean daily intake of candy was defined as the weighted averages of the daily consumption.

According to the actual measurement of a unit of candy contained in a commercially available package, a mouthful of candy ranged from 3 g to 8 g. (Reference 18)

7. Mini-cup jelly (including konjac jelly)

Mini-cup jelly products were divided into the following two categories to calculate the incidence of choking accidents per mouthful of jelly: (i) "all mini-cup jelly," including konjac mini-cup jelly (Case 1-1, Case 1-2); and (ii) "konjac mini-cup jelly" (Case 2-1, Case 2-2).

In Case 1-1 and Case 1-2, the number of deaths due to "obstruction of respiratory tract caused by inhalation and ingestion of food" (2006 Vital Statistics) was prorated according to the proportion of patients in need of critical care due to choking on "mini-cup jelly" included in the data collected from the "75 Emergency Medical Centers (2007)" (0.8%) to estimate the number of deaths from choking on mini-cup jelly. According to the relevant data, 3 of 371 patients died of choking on "mini-cup jelly." The absolute number of such cases was small and reasonable error must accounted for. According to the data collected from "12 firefighting headquarters (2006)", however, 8 people out of 432 died of choking on "mini-cup jelly" (1.9%). This figure indicates that the above figure was not necessarily an overestimation. In Case 2-1 and Case 2-2, the number of deaths from choking on "konjac mini-cup jelly" was calculated in the following manner: For about 13 years, the Social Policy Bureau under the Japanese Cabinet Office collected data on 22 fatalities. (Reference 1) Because of the wide variation between years, the mean annual number of deaths was calculated as 1.7 (22÷13 = 1.7).

The mean daily consumption of "mini-cup jelly (including konjac jelly) was estimated: (i) as half of the weighted average of daily consumption of "jelly" included in the section of "snacks," presented by the National Nutrition Survey (1998-2000) in the special tabulation (Case 1-1); and (ii) from data on the sales of "bite-size jelly snacks" collected by the Japanese Consumer Affairs Agency (Case 1-2). The mean daily consumption of "konjac mini-cup jelly was estimated: (i) from the amount of production estimated by the Japanese Cabinet Office's Social Policy Bureau, (15,000 tons) (Reference 1) divided by the total population and 365 days (one year) (Case 2-1); and (ii) as 80% of the total sales of "bite-size jelly snacks" as calculated out by the Japanese Consumer Affairs Agency divided by the total population and 365 days (one year) (Case 2-2).

In 2007, several konjac mini-cup jelly products were purchased at stores. Their mean maximum diameter was 3.5 cm. The volume of the material that can be put in the mouth of a 3-year-old Japanese child (maximum diameter: 3.9 cm) (Fig. 30 [p.71]) is about 14-29 cm^3 [15]. (Reference 1, 194) The material weighs about 14-29 g when its specific gravity is 1. Depending on their own physical size, some children cut the jelly into pieces before eating it. Others have eaten the jelly whole and choked on it. In view of the frequent reports of such accidents, a mouthful of konjac jelly seemed to be larger and was estimated at 14-29 g (Case 2-1, Case 2-2). A mouthful of mini-cup jelly (including konjac jelly) was estimated at a similar weight (Case 1-1, Case 1-2).

[15] In the June 2007 survey, data on brands, shapes, maximum diameters and volume were collected. The trend observed in these data was scarcely different from that observed in the data derived from the survey conducted in January 2009.

<References>

1 Social Policy Bureau, Cabinet Office, Government of Japan, Risk profile of foods that frequently cause choking accidents including konjac jelly

2 The 285th Meeting of the Food Safety Commission
http://www.fsc.go.jp/iinkai/i-dai285/index.html

3 The 286th Meeting of the Food Safety Commission
http://www.fsc.go.jp/iinkai/i-dai286/index.html

4 The 1st Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai1/index.html

5 Mukai Y.: Material for the 1st WG Oral Presentation.

6 Tokyo Fire Department: Material for the 1st WG Oral Presentation

7 The 2nd Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai2/index.html

8 Karaho T., Kono N., Material for the 2nd WG Oral Presentation

9 Hirabayashi H., Material for the 2nd WG Oral Presentation

10 Ogoshi H., Material for the 2nd WG Oral Presentation

11 Kohyama K., Material for the 2nd WG Oral Presentation

12 Fujitani J., Material for the 2nd WG Oral Presentation

13 The 3rd Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai3/index.html

14 Yamanaka T., Material for the 3rd WG Oral Presentation

15 The 4th Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai4/index.html

16 Iwatsubo T., Material for the 4th WG Oral Presentation

17 The 5th Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai5/index.html

18 The 6th Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai6/index.html

19 The 7th Meeting of the WG for Food-related Choking Accidents, Food Safety Commission
http://www.fsc.go.jp/senmon/sonota/chi_wg-dai7/index.html

20 World Health Organization, International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Version for 2007
http://www.who.int/classifications/apps/icd/icd10online/

21 Hinohara T: Foreign body in the respiratory tract and esophagus. Practica Otologica Kyoto, 1995; 88(11): 1383-91

22 Ishiyama E: Foreign body in the respiratory tract, foreign body in the ear/auditory meatus. Japanese Journal of Pediatric Medicine, 1996; 28 Extra number: 1266-67

23 Ariga T., Nakamura S.: Understanding the actual circumstances of food-related choking accidents among infants. 2008 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) “Analysis of factors involved in food-related choking: human factors and degree of food risk (chief researcher: Mukai Y),” Team research report

[24] Takino K.: Important points to be considered in the process of removal of foreign bodies in the respiratory tract and esophagus. Journal of Otolaryngology of Japan, 1979; 82: 728-31

[25] Suda M., Kikutani T., Tamura F., Yoneyama T.: Study on choking accidents among the elderly requiring nursing care at home and related factors. Geriatric dentistry, 2008; 23(1): 3-10

[26] Kikutani T., Tamura F., Katagiri Y.: Choking accidents at care facilities for the elderly and the causative factors. 2008 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) "Analysis of factors involved in food-related choking: human factors and degree of food risk (chief researcher: Mukai Y)," Team research report

[27] Horiguchi I.: Questionnaire for mothers. 2008 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) "Analysis of factors involved in food-related choking: human factors and degree of food risk (chief researcher: Mukai Y)," Team research report

[28] Takeda Y., Ochi M., Hatanaka T., Shirakawa Y.: Evaluation of removal of foreign bodies from the respiratory tract by emergency paramedics and general public. 1999 Fire Defense Agency, Ministry of Home Affairs, commissioned research report

[29] Horiguchi I., Ichikawa K.: Understanding the actual circumstances of food-related choking. 2007 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) "Understanding the actual circumstances of food-related choking and analysis of causes (chief researcher: Mukai Y)," Team research report

[30] Tokyo Fire Department: 2008 Circumstances of development of serious accidents of choking on foods

[31] Consumer Safety Division, Consumer Affairs Agency: Risk profile of foods that frequently cause choking accidents including konjac jelly (updated on March 4, 2010)

[32] Kamijima G and Kawamoto Y: Aspiration, foreign bodies in the airway, and asphyxia among the elderly. Asian Med J 1995; 38(7): 339-45

[33] Kamijima G., Kawamoto Y.: Inhalation, aspiration and choking among the elderly. Journal of Japan Medical Association. 1994; 112(5): 775-8

[34] Suzuki J.: Choking on sticky rice cake. Iwate Medical Journal. 1992; 43(6): 661-4

[35] Ishikawa H., Saito H., Hikawa Y., Yasuda K.: Study of airway obstruction by a foreign body. Japanese Journal of Acute Medicine. 1996; 20: 1553-6

[36] Kawasaki T., Ishikawa M., Soga Y., Amamori A., Yaguchi U., Hanabusa S. et al.: Response to choking on a foreign body in the respiratory tract. Kanto Branch Journal, Japanese Association for Acute Medicine. 1999; 20(2): 548-9

[37] Hanabusa S., Ishikawa M., Kon M., Yasukawa K., Amamori A., Moroi R., et al.: Study of inhalation of food. Kanto Branch Journal, Japanese Association for Acute Medicine. 1995; 16(2): 450-1

[38] Suzuki T., Muramatsu S.: Epidemiology of aspiration: actual conditions at community hospitals. JIM 1998; 8(12): 984-7

[39] Morishita H., Shiomi M.: Special issue, important handbook! What can we do in the event of convulsion/disturbance of state of consciousness <Important points for the treatment/management of diseases that induce convulsion/disturbance of state of consciousness> hypoxic encephalopathy (choking, drowning). Japanese Journal of Pediatric Medicine. 2006; 38(2): 478-82

[40] Wakita K., Sugiyama C., Akai A., Yamakita T.: Evaluation of patients who choked on a foreign body in the respiratory tract treated at this hospital. Gifu Pref. Medical Association Journal. 2003; 16: 95-8

[41] Ueda F., Mori K., Tamiya H., Sano T., Yondeda K., Bando H.: A case of negative pressure

pulmonary edema (NPPE) resulting from obstruction of the upper respiratory tract caused by food aspiration. Magazine of Tokushima Prefectural Central Hospital 2003; 25: 41-3

[42] Ueda F., Inoue R.: A case of acute respiratory failure resulting from multiple bronchial obstruction caused by aspiration of a small piece of sticky rice cake. Bronchology 2008; 30(1); 36-40

[43] Okubo J., Kimura T., Hirakawa H., Hiramoto H., Rihaku M., Eto K., et al.: A case of foreign body in the trachea: successful removal of foreign body in cooperation with multiple specialists. Chugoku Rosai Hospital Magazine 2007; 16(1): 24-6

[44] Centers for Disease Control and Prevention (CDC): Nonfatal choking-related episodes among children---United States, 2001. MMWR 2002; 51(42): 945-8 http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5142al.htm

[45] Altkorn R, Chen X, Milkovich S, Stool D, Rider G, Bailey CM et al.: Fatal and non-fatal food injuries among children (aged 0-14years). International Journal of Pediatric Otorhinolaryngology 2008; 72: 1041-6

[46] Seidel JS and Gausche-Hill M: Lychee-flavored gel candies – a potentially lethal snack for infants and children. Arch Pediatr Adolesc Med 2002; 156; 1120-2

[47] Qureshi S and Mink R: Aspiration of fruit gel snacks. Pediatrics 2003; 111(3); 687-9

[48] Department of Trade and Industry (DTI), Government consumer safety research – choking risks to children under four from toys and other objects, November 1999

[49] Sano M.: 2. Statistics on foreign bodies in the respiratory tract/esophagus. Edited by Matsunaga T., Foreign body in the respiratory tract/esophagus: actual conditions of clinical practice. Shinoharashinsha Inc., Tokyo. 1983; 19-41

[50] Sato T., Usui N., Nakamura O., Ishiduka Y., Yamaguchi O., Nagafune H.: Statistical observation of the cases of entrance of foreign matter into the body treated at this department over the past 20 years. Oto-Rhino-Laryngology Tokyo 1974; 17 (Supplementary Number 1): 89-97

[51] Maki K., Yasuoka Y., Harada N., Kamei T., Ishii H., Kaneko H., et al.: Statistical observation of the cases of entrance of foreign matter into the trachea/bronchus treated at this department over the past 25 years. Practica Otologica Kyoto. 1984; 77 (Extra Number 2): 666-71

[52] Kataura A., Kosugi T., Matsuyama H., Ito T.: Statistical observation of the cases of entrance of foreign matter into the esophagus, trachea and bronchus treated over the last 10 years. Oto-Rhino-Laryngology Tokyo. 1971; 14(4): 363-6

[53] Awataguchi S., Miyano K., Maruyama H., Hakamada M.: Clinical Evaluation of 63 cases of foreign body in the trachea/bronchus. Journal of the Japan Broncho-Esophagological Society 1980; 31(4): 315-21

[54] Saijo S., Tomioka Y., Kosaka T., Kono K.: Statistic observation of 100 cases of foreign body in the respiratory tract removed using a ventilation bronchoscope. Journal of the Japan Broncho-Esophagological Society 1977; 28(3): 211-6

[55] Sakaguchi M., Kawarada K.: Statistic observation of the cases of foreign body in the trachea/bronchus treated at this department over 21 years. Journal of the Japan Broncho-Esophagological Society 1988; 39(4): 332-8

[56] Takahashi T., Kaneda Y., Otajima Y., Murai K.: Tabulation of the cases of foreign body in the trachea/bronchus treated at this department over 29 years. Journal of the Japan Broncho-Esophagological Society 1997; 48(6): 445-50

[57] Komura R., Sato E., Sakai T., Shirane M., Suzuki M., Yajin K., et al.: Tabulation of the cases of foreign body in the esophagus and trachea/bronchus treated at this department over 18 years. Practica Otologica Kyoto 1988; Supplementary Number 27: 170-82

[58] Oto T., Uchida Y., Endo A., Moriyama H., Ishigaki K., Kaneko S., et al.: Clinical statistical

observation of the cases of foreign body in the trachea and esophagus treated at this department over 10 years. Journal of the Japan Broncho-Esophagological Society 1981; 32(3): 241-8

[59] Nihei S., Hiwatari S., Oyagi A., Araki T.: Statistic observation of the cases of foreign body in the trachea/bronchus treated at this hospital over 10 years and interesting cases. Practica Otologica Kyoto 1983; 71 Extra Number 1: 753-63

[60] Tanaka O., Kashiwagi R., Ota K., Wakuta K., Hyo K., Matsunaga T.: Diagnosis of 25 cases of radiolucent foreign body in the lower respiratory tract. Journal of the Japan Broncho-Esophagological Society 1985; 36(3): 309-16

[61] Kano T., Adachi Y., Ide M., Nagai T., Mori M., Tono T., et al.: Clinical statistical observation of the cases of foreign body in the respiratory tract treated at Miyazaki Medical College Hospital and Miyazaki Prefectural Miyazaki Hospital. Journal of the Japan Broncho-Esophagological Society 1987; 38(4): 366-73

[62] Nonoyama T., Harada T., Okawa C., Ukai K., Sakakura Y.: Tabulation of the cases of foreign body in the trachea/bronchus treated at this department over 16 years. Journal of the Japan Broncho-Esophagological Society 1997; 48(3): 249-55

[63] Hamamoto M., Kawai N., Sido F., Asakura K., Kataura A.: Statistical observation of the cases of foreign body in the esophagus and trachea/bronchus over the last 10 years. Oto-Rhino-Laryngology Tokyo; 35(4): 297-302

[64] Nishimura Y., Nakano Y., Samejima Y., Yumoto E.: Evaluation of the cases of foreign body in the respiratory tract over the past 20 years. Practica Otologica Kyoto 2004; 97(2): 155-60

[65] Takagi S., Tsuda K., Matsuyama T., Sawatsubashi M., Otani S., Shin T.: Statistic observation of the cases of foreign body in the trachea/bronchus treated at this department over 17 years. Journal of the Japan Broncho-Esophagological Society 1999; 50(5): 565-8

[66] Ishikawa M., Kobayashi M., Ogiwara H., Yuda A., Takeuchi M., Majima Y.: Clinical evaluation of the cases of foreign body in the larynx/trachea/bronchus. Journal of the Japan Broncho-Esophagological Society 2004; 55(6): 454-60

[67] Saito S., Watanabe A., Toyama T., Nonaka S., Hokunan K., Hayashi H., et al.: Study on the cases of foreign matter in the body in Soya district. Practica Otologica Kyoto 1995; 88(12): 1633-9

[68] Iwata S., Mishima Y., Nishimura T., Kawakatsu K., Ishigami H., Sato T., et al.: Statistics of the patients with foreign body in the esophagus/trachea/bronchus treated at the departments of otolaryngology of seven university hospitals in the Tokai district over the last 10 years. Journal of the Japan Broncho-Esophagological Society 1996; 47(6): 510-25

[69] Kikuchi K., Harabuchi Y., Hamamoto M., Shirasaki H., Wakashima J., Saito H., et al.: Statistical observation of the cases of foreign body in the esophagus and bronchus. Practica Otologica Kyoto 1998; 91(12): 1271-5

[70] Manaka K., Hamada N., Watanabe Y., Kida A.: Cases of foreign body in the respiratory tract treated at this department over the past five years. Journal of the Japan Broncho-Esophagological Society 1999; 50(4): 486-91

[71] Hamamoto K., Hashimoto K., Emura M., Osako T., Morimoto K.: A case of foreign body in the respiratory tract: detection of so-called health food in the respiratory tract. Kyoto City Hospital Bulletin 1999; 19(1): 81-6

[72] Kaneko K., Akaishi T., Nakamura S., Nitanda H., Sakaguchi K., Ishida H.: Foreign body in the trachea: recent case report. Bronchology 2005; 27(7): 518-23

[73] Yoshioka F., Yonegawa H., Yoshioka Y., Okabe K., Ota F.: Clinical statistic observation of the cases of foreign body in the lower respiratory tract/esophagus treated at this department over 15 years. Practica Otologica Kyoto 1991; Supplementary Number 45: 88-95

[74] Furusawa S., Kaneko I., Harada K., Furukawa K., Higuchi A., Okamoto M.: Clinical observation

of cases of foreign body in the respiratory tract. Practica Otologica Kyoto 1991; Supplementary Number 42: 130-7

[75] Morikawa H., Hirai T., Yamanaka A., Nakamura Y., Yamaguchi M., Akai M.: Study of 13 cases of foreign body in the bronchus removed by bronchoscopy. Bronchology 2004; 26(6): 505-10

[76] Koide C., Takahashi Y., Imai A.: Clinical statistical observation of the cases of foreign matter in the body treated at this department over nine years, 1st report; foreign body in the bronchus/esophagus. Niigata City General Hospital Magazine 1991; 12(1): 29-34

[77] Inoue K., Sadamitsu D.: How to treat aspiration: making a diagnosis of aspiration and first-aid procedure. JIM 1998; 8(12): 992-5

[78] Kamei T., Toyoda O.: Choking caused by a foreign body that got stuck in the infraglottic space and emergency resuscitation by blowing the foreign body off. Oto-Rhino-Laryngology Tokyo 1971; 14(3): 261-3

[79] Asai M., Adachi Y., Nakagawa H., Kimura H., Itasawa T., Wada R., et al.: Evaluation of pediatric cases of foreign body in the trachea/bronchus. Journal of the Japan Broncho-Esophagological Society 2007; 58(1): 64-70

[80] Tsuchiya A., Honma Y., Kawasaki K.: Evaluation of cases of foreign body in the trachea/bronchus. Practica Otologica Kyoto 2008; 101(12): 955-9

[81] Hiroshiba S., Tanabe M., Minoyama M., Sugimaru T., Tanaka S., Iwanaga M. et al.: Cases of foreign body in the trachea/bronchus among infants. Journal of the Japan Broncho-Esophagological Society 1998; 49(3): 263-8

[82] Asano H., Kaneko T., Kyan T., Kitamura T., Naito J.: Problems related to foreign body in the trachea and bronchus among infants. Journal of the Japan Broncho-Esophagological Society 1973; 24: 40-8

[83] Hyo K.: 3. Making a diagnosis of foreign body in the respiratory tract/esophagus. Edited by Matsunaga T., Foreign body in the respiratory tract/esophagus: actual conditions of clinical practice. Shinoharashinsha Inc., Tokyo, 1983; 43-77

[84] Koshii K., Hinohara T.: Foreign body in the larynx/trachea (bronchus) among the elderly. Edited by Shitara T., Otolaryngology/Head and Neck Surgery MOOK 12/The Elderly and Otolaryngology, Kanehara & Co., Ltd., Tokyo, 1989; 217-21

[85] Matsui M., Sawa F.: Foreign body in the respiratory tract among infants: summary of 45 cases treated over 17 years. Japanese Journal of Pediatrics 2002; 55(1): 75-8

[86] Kuwajima S.: Evaluation of plain chest X-ray findings in cases of foreign body in the respiratory tract among infants. Dokkyo Journal of Medical Sciences 1999; 26(2): 311-31

[87] Hasegawa S., Watanabe Y., Ishida M., Tamaoki H., Matsunaga T., Hirunuma S., et al.: Present condition of the cases of foreign matter in the body treated at Osaka City Emergency Medical Care Center. Journal of the Japan Broncho-Esophagological Society 1984; 35(6): 438-41

[88] Ganaha H.: IV. Accident-related illness treated at the emergency outpatient clinic, 2) Foreign body in the trachea/bronchus. Japanese Journal of Pediatrics 2000; 53: 2245-50

[89] Nakano K., Samejima Y., Masuyama N., Chikamatsu I., Ishikawa T.: Evaluation of the cases of foreign body in the respiratory tract treated over the last 10 years. Journal of the Japan Broncho-Esophagological Society 1993; 44(1): 8-13

[90] Goto S., Okamoto S., Kameyama K., Hayashi E., Yamamoto Y., Huang Cheng-Long, et al.: A case of reactive granuloma caused by a foreign body in the bronchus: prolonged course for 18 years. Journal of the Japanese Association for Chest Surgery 2003; 17(2): 146-50

[91] Kitaguchi S., Toda Y.: Study of adult cases of foreign body in the bronchus: report based on four recently treated cases. Bronchology 2005; 27(7): 524-8

[92] Hatakeyama S., Higuma T., Bito Y., Yasufuku M., Yamamoto T.: Pediatric cases of foreign body in the respiratory tract: report from the field of pediatric surgery, evaluation of 40 cases of foreign body in the respiratory tract treated at this department. Journal of the Japan Broncho-Esophagological Society 2002; 53(5): 406-11

[93] Uno K., Li P., Komuro H., Utsugi T., Tanaka K., Kanamori Y., et al.: Evaluation of 109 pediatric cases of foreign matter in the body. Japanese Journal of Pediatric Surgery 1992; 24(10): 1181-5

[94] Hughes CA, Baroody FM and Marsh BR: Pediatric tracheobronchial foreign bodies: histological review from the Johns Hopkins Hospital. Ann Otol Rhinol Laryngol 1996; 105: 555-61

[95] Abdulmajid OA, Ebeid AM, Motaweh MM and Kleibo IS: Aspirated foreign bodies in the tracheobronchial tree: report of 250 cases. Thorax 1976; 31: 635-40

[96] Blazer S, Naveh Y and Friedman A: Foreign body in the airway, a review of 200 cases. Am J Dis Child 1980; 134: 68-71

[97] Mantel K and Butenandt I: Tracheobronchial foreign body aspiration in childhood. Eur J Pediatr 1986; 145: 211-6

[98] Svensson G: Foreign bodies in the tracheobronchial tree, special references to experience in 97 children. International Journal of Pediatric Otorhinolaryngology 1985; 8: 243-51

[99] Pyman C: Inhaled foreign bodies in childhood, a review of 230 cases. Med J Aust 1971; 1: 62-8

[100] Merchant SN, Kirtane MV, Shah KL and Karnik PP: Foreign bodies in the bronchi (a 10 year review of 132 cases). Journal of Postgraduate Medicine 1984; 30(4): 219-23

[101] Gay BB, Atkinson GO, Vanderzalm T, Harmon JD and Porubsky ES: Subglottic foreign bodies in pediatric patients. AJDC 1986; 140: 165-8

[102] Steen KH and Zimmermann T: Tracheobronchial aspiration of foreign bodies in children: a study of 94 cases. Laryngoscope 1990; 100: 525-30

[103] Mu L, He P and Sun D: Inhalation of foreign bodies in Chinese children: a review of 400 cases. Laryngoscope 1991; 101: 657-60

[104] Vital Statistics, the Ministry of Health, Labour and Welfare

[105] Department of Commerce (ed.), Profiles of general demographic characteristics, 2000 census of population and housing, United States, 2001

[106] Data on Deaths, Vital Statistics, the Ministry of Health, Labour and Welfare

[107] United Nations Children's Fund, Innocenti Research Centre: A league table of child deaths by injury in rich nations. Innocenti Report Card 2, 2001
http://www.unicef-irc.org//publications/pdf/repcard2e.pdf

[108] Harris CS, Baker SP, Smith GA and Harris RM: Childhood asphyxiation by food - a national analysis and overview. JAMA 1984; 251(17): 2231-5

[109] Baker SP and Fisher RS: Childhood asphyxiation by choking or suffocation. JAMA 1980; 244(12): 1343-6

[110] Yamanaka T.: Protection of children from accidents: analysis of cases of accidents and consideration of preventive measures. The 6th installment in series. Japanese Journal of Pediatric Medicine 2003; 35(7): 1240-1

[111] Mizukami H., Shimizu K., Uezono T., Ogawa K., Shiono H.: Case report: two autopsy cases of aspiration. Journal of criminology 2000; 66(4): 167-75

[112] Matsuyama J.: Analysis of a mouthful of food and strokes of chewing among infants. Journal of Niigata Dental Society 2006; 36(1): 59-60

[113] Yagi K, Matsuyama J, Mitomi T, Taguchi Y and Noda T: Changes in the mouthful weights of

familiar foods with age of five years, eight years and adults. Ped Dent J 2006; 16(1): 17-22

[114] Japan Dental Association
http://www.jda.or.jp/about/chissoku.html

[115] Hiiemae K: Mechanisms of food reduction, transport and deglutition: how the texture of food affects feeding behavior. Journal of Texture Studies 2004; 35(2): 171-200

[116] Kohyama K.: Evaluation of palatability by texture analysis. Kagaku to Seibutsu 2009; 47(2): 133-7

[117] Hutchings JB and Lillford PJ: The perception of food texture: the philosophy of the breakdown path. Journal of Texture Studies 1988; 19(2): 103-15

[118] Shiozawa K, Kohyama K and Yanagisawa K: Relationship between physical properties of a food bolus and initiation of swallowing. Jpn J Oral Biol 2003; 45: 59-63

[119] Shiozawa K.: 3. Change of food during chewing and subsequent swallowing. "Book of chewing: importance of eating by chewing" edited by Japanese Society for Mastication Science and Health Promotion, Oral Health Association of Japan, Tokyo 2006; 17-21

[120] Kohyama K, Mioche L and Martin JF: Chewing patterns of various texture foods studied by electromyography in young and elderly populations. Journal of Texture Studies 2002; 33(4): 269-83

[121] Kohyama K and Mioche L: Chewing behavior observed at different stages of mastication for six foods, studied by electromyography and jaw kinematics in young and elderly subjects. Journal of Texture Studies 2004; 35(4): 395-414

[122] Furukawa K.: Swallowing by the elderly. Edited by Shitara T., Otolaryngology/Head and Neck Surgery MOOK 12/The Elderly and Otolaryngology, Kanehara & Co., Ltd., Tokyo, 1989; 145-50

[123] Takakita S., Shoji K.: Swallowing reflex among healthy people: comparison between the young and the elderly. Practica Otologica Kyoto 2005; 98(11): 834-5

[124] Saito E., Baba T., Takeda S.: Evaluation of chewing and swallowing among the healthy elderly. 2003 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Comprehensive Research Project on Longevity Science) "Evaluation of the 'eating' function of patients with eating/swallowing disorder and how to treat them (chief researcher: Saito E.)," Team research report

[125] Edited by Fujishima I.: Oral feeding: swallowing disorder Q & A, Ver. 3. Chuohoki Publishing Co., Ltd., Tokyo, 2002

[126] Edited by Fujishima I.: Eating/swallowing disorder among patients with stroke, Ver. 2. Ishiyaku Pub. Inc., Tokyo, 1998

[127] Takehara I., Fujishima I.: Risk management in geriatric medicine, III. Accidents that frequently develop among the elderly and countermeasures, 2. Aspiration/choking. Geriatric Medicine 2001; 39(12): 1944-8

[128] Edited by Kaneko Y., Mukai Y.: Evaluation of eating/swallowing disorder and eating instruction. Ishiyaku Pub. Inc., Tokyo, 2001

[129] Chisaka H., Hachisuka K.: Eating/swallowing training: from training to nutritional management, bedside evaluation of swallowing. BRAIN NURSING 2005; 21(3): 284-9

[130] Suzuki M., Saito E.: Development of a safe chewing training method: relationship between the positions of the head, neck and foot and the structure of oral cavity and pharynx/swallowing dynamics. 2004 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Comprehensive Research Project on Longevity Science) "Evaluation of the 'eating' function of patients with eating/swallowing disorder and how to treat them (chief researcher: Saito E.)," Team research report

[131] Edited by Kindell J. (translation by Kaneko Y.), Dementia and eating disorder, Ishiyaku Pub. Inc., Tokyo, 2005

[132] Muramatsu Y., Katata T., Okada Y., Kazui M., Kakazu K.: Study of aspiration/choking accidents: evaluation of 5-year report on accidents. Bulletin of Osaka Nakamiya Hospital 1998; 8: 6-11

[133] Edited by Yamanaka T.: Book for prevention of inhalation/accidents (burns/falls, etc.) among children. Books Sanseido, Tokyo, 1999

[134] Hellman M: Development of face and dentition in its application to orthodontic treatment. Am J Orthodont 1940; 26: 424-47

[135] Japanese Society of Pediatric Dentistry: Survey research on the timing of eruption of primary/permanent teeth among Japanese children. Journal of Japanese Society of Pediatric Dentistry 1988; 26(1): 1-18

[136] Osamura T.: Practical pediatric emergency medical care III. Representative emergency diseases, inhalation/aspiration (solid foreign body). Journal of Pediatric Practice 2002; 11(361): 1985-90

[137] Osamura T.: Promotion of prevention of accidents in kindergartens/nurseries. Journal of Pediatric Practice 2005; 58: 703-10

[138] Hirabayashi H.: Foreign body in the respiratory tract/esophagus. Practica Otologica Kyoto 2005; 98(2): 83-93

[139] Uemura K.: Early treatment for inhalation/aspiration on the scene. Child health 2007; 10(3): 163-5

[140] Ota S.: 2 Exogenous diseases that frequently develop among the elderly, higher incidence of exogenous emergency diseases including food-related choking/aspiration. GPnet Special 2005; 5: 29-41

[141] Edited by the subcommittee for the establishment of resuscitation guidelines in Japanese (Revised Version 3), Guidelines for resuscitation, for general public, explanatory brochure. [International consensus on cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) science with treatment recommendations] Herusu Shuppan. Co., Inc., Tokyo, 2006

[142] Heimlich HJ: A life-saving maneuver to prevent food-choking. JAMA 1975; 234(4): 398-401

[143] Hoffman JR: Treatment of foreign body obstruction of the upper airway. West J Med 1982; 136: 11-22

[144] Ono Y.: 1. History of treatment of foreign body in the respiratory tract/esophagus. Edited by Matsunaga T., Foreign body in the respiratory tract/esophagus: actual condition of clinical practice. Shinoharashinsha Inc., Tokyo, 1983; 9-17

[145] Yoshikawa T.: XI. Accidents, foreign body in the respiratory tract. Japanese Journal of Pediatric Medicine 2003; 35 (Extra Number): 1364-7

[146] Kudo S., Yamamoto T.: Effective conservative therapy for gastric rupture that developed after attempt of Heimlich maneuver and cardiopulmonary resuscitation: a case report. Journal of Japanese Journal of Acute Medicine 2005; 16: 557-63

[147] Yamamoto H., Nishimori S., Shigeta M., Miyake K., Sakamoto T., Kiyota K., et al.: Epidemiological evaluation of cases of obstruction of the respiratory tract caused by sticky rice cake. Kanto Branch Journal, Japanese Association for Acute Medicine, 1995; 16(2): 554-6

[148] Uehara M., Aramaki H., Kiyoshi E., Miyano Y.: Evaluation of applicability of Heimlich maneuver to the cases of foreign matter in the body in Japan. Journal of the Japan Broncho-Esophagological Society 1985; 36(4): 406-9

[149] Kaneko M., Iseshima E.: Actual circumstances of care for difficulty in swallowing: analysis of cases based on the experiences of caregivers/helpers. Monthly comprehensive care 1999; 9(8): 66-9

[150] Haugen RK: The café coronary - sudden deaths in restaurants. JAMA 1963; 186: 142-3

[151] Endo S.: Foreign body in the trachea/bronchus. Journal of the Japan Broncho-Esophagological Society 2003; 54: 99

[152] Kohyama K.: Chewing and swallowing: for development of foods for the elderly. Identification of foods that cannot be chewed by the elderly according to the results of chewing analysis. Food industry 2001; 44(20): 18-24

[153] Nakazawa F., Morita A.: Chewing and swallowing: for development of foods for the elderly. Relationship between chewing/swallowing and the physical properties of foods. Food industry 2001; 44(20): 25-32

[154] Dan H, Watanabe H and Kohyama K: Effect of sample thickness on the bite force for apples. Journal of Texture Studies 2003; 34(3): 287-302

[155] Ogoshi H.: [Review] Development of foods for the people in need of care/swallowable foods with desirable texture: Relationship between food for the elderly and meat. Meat Science 2006; 47(2): 189-96

[156] Ogoshi H.: Meals for people with swallowing disorder, from the aspects of food safety and texture for the elderly. Journal of the Japan Association for the Integrated Study of Dietary Habits 2007; 17(4): 288-96

[157] Ogoshi H.: Optimum food texture for the elderly. The 2nd Session, choking due to the deviation between actual texture and recognition. Journal of Japan Association of Geriatric Health Services Facilities 2002; 8: 42-7

[158] Iinuma M., Tamura Y.: Evaluation of oral volume of infants. Child Health 2007; 10(3): 160-2

[159] Iinuma M., Tamura Y., Yamanaka T.: Estimation of the diameter of oral cavity of infants according to the cephalometric radiograph. Journal of Japanese Society of Child Health 2001; 60: 259

[160] Rimell FL, Thome A, Stool S, Reilly JS, Rider G, Stool D et al.: Characteristics of objects that cause choking in children. JAMA 1995; 274(22): 1763-6

[161] Reilly JS, Walter MA, Beste D, Derkay C, Muntz H, Myer CM et al.: Size/shape analysis of aerodigestive foreign bodies in children: a multi-institutional study. American Journal of Otolaryngology 1995; 16(3): 190-3

[162] Ogoshi H.: Study of analyses of causative foods, effect of temperature on the physical properties of sticky rice cake. 2007 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) “Understanding of the present circumstances of food-related choking and analytical study of causes (chief researcher: Mukai Y.),” Team research report

[163] Utsumi A.: Analysis of physical properties of konjac jelly. 2008 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) “Analysis of factors involved in food-related choking: human factors and degree of food risk (chief researcher: Mukai Y.),” Team research report

[164] European Food Safety Authority: Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in contact with Food on a request from the Commission related to the use of certain food additives in jelly mini cups, question number EFSA-Q-2004-054, adopted on 12 July 2004. The EFSA Journal 2004; 82: 1-11

[165] Mukai Y., Ishikawa K., Utsumi A., Yokoyama S.: Evaluation of the effect of temperature on the physical properties of konjac jellies. 2007 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) “Understanding of the present condition of food-related choking and analytical study of causes (chief researcher: Mukai Y.),” Team research report

[166] Ogoshi H., Kawamura A.: Analysis of the physical properties of causative foods. Analysis of the physical properties of rice/bread. 2008 Grant-in-aid for scientific research from the Ministry of Health, Labour and Welfare (Special Research Project) "Analysis of factors involved in food-related choking: human factors and degree of food risk (chief researcher: Mukai Y.)," Team research report

[167] Food and Drug Administration, Prevent your child from choking, FDA Consumer Magazine, September-October 2005 issue

http://www.fda.gov/fdac/features/2005/505_choking.html

[168] Food and Drug Administration, Section 555.425-foods-adultration involving hard or sharp foreign objects, issued 3/23/1999 (updated: 2005-11-29)

http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg555-425.htm

[169] Food and Drug Administration: FDA warns consumers about imported jelly cup type candy that poses a potential choking hazard, FDA Talk Paper, T01-38, August 17, 2001

[170] Food and Drug Administration, "Detention without physical examination of gel candies containing konjac", Import Alert #33-15, October 4, 2001

[171] Commission of the European Communities: Commission Decision of 27 March 2002 suspending the placing on the market and import of jelly confectionery containing the food additive E 425 konjac (2002/247/EC), Official Journal of the European Union, L84/69-70

[172] European Parliament and Council of the European Union: Directive 2003/52/EC of the European Parliament and of the Council of 18 June 2003 amending Directive 95/2/EC as regards the conditions of use for a food additive E 425 konjac, Official Journal of the European Union, L178/23

[173] Commission of the European Communities: Commission Decision of 13 April 2004 suspending the placing on the market and import of jelly mini-cups containing the food additives E400, E401, E402, E403, E404, E405, E406, E407, E407a, E410, E412, E413, E414, E415, E417 and/or E418 (2004/374/EC), Official Journal of the European Union, L118/70-71

[174] European Parliament and Council of the European Union: Directive 2006/52/EC of the European Parliament and of the Council of 5 July 2006 amending Directive 95/2/EC on food additives other than colours and sweeteners and Directive 94/35/EC on sweeteners for use in foodstuffs, Official Journal of the European Union, 26.7.2006

[175] Food Standard Agency: Agency advice to parents on "mini cup jelly products", 24 August 2001

[176] Bundesinstitut für Risikobewertung, Risk of asphyxia in toddlers through the consumption of nuts – BfR recommends product label for consumers, BfR Opinion No. 050/2009, 10 August 2009
http://www.bfr.bund.de/cm/245/risk_of_asphyxia_in_toddlers_through_the_consumption_of_nuts.pdf

[177] Bundesinstitut für Risikobewertung, Danger of suffocation for infants from nuts, 37/2009, 22.12.2009
http://www.bfr.bund.de/cd/33148

[178] Bundesamt für Gesundheit (BAG), Jelly minicups: Erstickungsgefahr durch Geleezuckerwaren in Mini-Plastikbechern.
http://www.bag.admin.ch/dokumentation/medieninformationen/01217/index.html?lang=de&msg-id=4184&print_style=yes

[179] Bundesamt für Gesundheit (BAG), Informationsschreiben Nr.74, Geleezuckerwaren in Minibechern (jelly mini-cups).
http://www.bag.admin.ch/themen/lebensmittel/04865/04894/index.html?lang=de&download=M3wBPgDB/8ull6Du36WcnojN14in3qSbnpWXaGycmk6p1rJgsYfhyt3NhqbdqIV+baqwbKbXrZ6luDZz8mMps2go6fo

[180] Australia New Zealand Food Authority, ANZFA urges recall on jelly cups with konjac. http://www.foodstandards.gov.au/newsroom/mediareleases/mediareleases2001/anzfaurgesrecallonje1164.cfm

[181] Canadian Food Inspection Agency (CFIA), Consumer advisory – choking hazard posed by certain mini-cup jelly products. http://www.inspection.gc.ca/english/corpaffr/newcom/2008/20081224e.shtml

[182] Korean Food and Drug Administration, Press release (October 24, 2001) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=72

[183] Korean Food and Drug Administration, Press release (October 13, 2004) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=544

[184] Korean Food and Drug Administration, Press release (April 8, 2005) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=696

[185] Korean Food and Drug Administration, Press release (May 29, 2007) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=1208

[186] Korean Food and Drug Administration, Press release (June 7, 2007) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=1216

[187] Korean Food and Drug Administration, Press release (October 18, 2007) http://www.kfda.go.kr/open_content/news/press_view.php?menucode=103004000&seq=1291

[188] Seoul Local Court Case No. 50349 (October 28, 2003) http://glaw.scourt.go.kr/jbsonw/jbson.do

[189] Seoul Local Court Case No. 32369 (August 17, 2006) http://www.scourt.go.kr/dcboard/DcNewsViewAction.work?bub_name=&currentPage=0&searchWord=%C1%A9%B8%AE&searchOption=&seqnum=1056&gubun=44

[190] Edited by Japan Broncho-Esophagological Society, Glossary of Broncho-Esophagological Terms, Kanehara & Co., Ltd., Tokyo, 2003

[191] Edited by the Ministry of Health, Labour and Welfare, Japanese Standards of Food Additives (Ver. 8, 2007)

[192] Kohyama K, Sawada H, Nonaka M, Kobori C, Hayakawa F and Sasaki T: Textural evaluation of rice cake by chewing and swallowing measurements using human subjects. Biosci Biotechnol Biochem 2007; 71(2): 358-65

[193] Edited by the Resources Council, Science Council, Ministry of Education, Culture, Sports, Science and Technology Standard Tables of Food Composition in Japan, Fifth Revised and Enlarged Edition, National Printing Bureau, Tokyo 2005

[194] National Consumer Affairs Center of Japan, For prevention of accidents caused by konjac jelly: precaution for consumers and request for introduction of countermeasures by the regulatory authorities/industry (July 5, 2007)