Chapter 28: Hard or Sharp Objects

Updated:

Author: Alan R. Olsen, U.S. Food and Drug Administration
Updated by Bob Price, University of California, Davis

Potential Food Safety Hazard

Top

Foreign objects in foods are considered adulteration. Foreign objects can be broadly classified as 1) food safety hazards (e.g., glass) and 2) food nonsafety hazards (e.g., filth). Foreign objects that are physical hazards are referred to as hard or sharp objects. Hard or sharp objects are divided into metallic objects (Tables 28-1 and 28-2) and non-metallic objects (Table 28-3). Metallic objects are further divided into ferrous metals (Table 28-1) and non-ferrous metals (Table 28-2).

Hard or sharp foreign objects in food may cause traumatic injury including laceration and perforation of tissues of the mouth, tongue, throat, stomach and intestine as well as damage to the teeth and gums. From 1972 through 1997, the FDA Health Hazard Evaluation Board evaluated approximately 190 cases of hard or sharp foreign objects in food. These include cases of both injury and non-injury reported to FDA. The Board found that foreign objects that are less than 7 mm, maximum dimension, rarely cause trauma or serious injury except in special risk groups such as infants, surgery patients, and the elderly. The scientific and clinical literature supports this conclusion.

Hard or sharp natural components of a food (e.g. bones in seafood, shell in nut products) are unlikely to cause injury because of awareness on the part of the consumer that the component is a natural and intrinsic component of a particular product. The exception occurs when the food's label represents that the hard or sharp component has been removed from the food, e.g., pitted olives. The presence of the naturally occurring hard or sharp object in those situations (e.g., pit fragments in pitted olives) is unexpected and may cause injury. FDA has established Defect Action Levels for many of these types of unavoidable defects in other Compliance Policy Guides and therefore they are not subject to the guidance in this document (FDA, 1999).

The following tables list examples of the types of hard or sharp objects that pose a potential physical hazard.

Table 28-1. Ferrous metal objects

Top

Ferrous Metal Objects	Potential Hazard	Possible Source(s)
Hook	Trauma	Raw materials (fish hook)
Wire	Trauma	Raw materials (e.g., twist tie) Processing (e.g., screen/sieve)
Sliver	Trauma	Processing (e.g., container strap)
Staple	Trauma	Personal effects
Thumb tack	Trauma	Personal effects
Nail	Trauma	Maintenance
Key	Dental	Personal effects
Hand tool	Dental	Maintenance
Machinery part	Dental	Processing

Table 28-2. Nonferrous metal objects

Top

Nonferrous Metal Objects	Potential Hazard	Possible Source(s)
Shaving	Trauma	Maintenance (e.g., plumbing repair)
Wire	Trauma	Maintenance (e.g., electrical wire offcut) Processing (e.g., screen/sieve)
Sliver	Trauma	Processing
Jewelry	Trauma/ Dental	Personal Effects

Button	Dental	Personal effects
Stainless steel	Dental	Processing
Coin	Dental	Personal effects
Machinery part	Dental	Processing
Loose solder/ welding slag	Dental*	Maintenance
Lead weights/shot	Dental*	Raw materials

***May also pose a potential chemical hazard**

Table 28-3. Nonmetallic objects

Top

Nonmetallic Objects	Potential Hazard	Possible Source(s)
Bone (sliver/chip)	Trauma	Processing (e.g., hard/sharp bone pieces separated from flesh)
Wood splinter	Trauma	Raw materials (e.g., crate) Processing (e.g., table, tool handle)
Glass	Trauma	Processing (e.g., light fixture, jar)
Puncture vine	Trauma	Raw materials
Hard plastic	Trauma	Processing (e.g., tote bin, packaging) Personal effects (e.g., false fingernail)
Insulation	Trauma	Maintenance (e.g., asbestos fiber)
Insect	Trauma	Raw materials (e.g., sharp spine) Processing (e.g., dermestid setae)
Hard shell	Trauma/Dental	Raw materials (Crustaceans)
Burr	Trauma/ dental	Raw materials
Thorn	Trauma/ dental	Raw materials
Button	Dental	Personal effects
Stone	Dental	Raw materials

Metal Inclusion

Top

Metal fragments can cause injury to the consumer.

Metal-to-metal contact, especially in mechanical cutting or blending operations, other equipment with metal parts that can break loose, such as moving wire mesh belts, injection needles, screens, portion control equipment, metal ties and can openers are likely sources of metal that may enter food during processing.

FDA's Health Hazard Evaluation Board has supported regulatory action against product with metal fragments of 0.3" (7 mm) to 1.0" (25mm) in length. See FDA Compliance Policy Guide #555.425 (FDA, 2001a).

Glass Inclusion

Top

Glass fragments can cause injury to the consumer. FDA's Health Hazard Evaluation Board has supported regulatory action against products with glass fragments of 0.3" (7 mm) to 1.0" (25 mm) in length. See FDA Compliance Policy Guide #555.425.

Glass inclusion can occur whenever processing involves the use of glass containers. Normal handling and packaging methods, especially mechanized methods, can result in breakage. Most products packed in glass containers are intended as a ready-to-eat commodity.

Glass fragments originating from other sources must be addressed where applicable in a prerequisite sanitation program. The Seafood HACCP Regulation requires such a program (FDA, 2001b).

Control Measures

Top

Metal Inclusion

Top

Control measures for "metal inclusion" can include:

- Periodically checking cutting or blending equipment or wire-mesh belts for damage or missing parts;
- Passing the product through metal detection or separation equipment.

Visually inspecting equipment for damage or missing parts may only be feasible with relatively simple equipment, such as band saws, small orbital blenders, and wire-mesh belts. Other, more complex, equipment may contain to many parts, some of which may not be readily visible, to make such visual inspection reliable in a reasonable time period (FDA, 2001a).

Glass Inclusion

Top

Control measures for "glass inclusion" can include:

- Visual examination of empty glass containers;
- Cleaning (water or compressed air) and inverting empty glass containers;
- Periodically monitoring processing lines for evidence of glass breakage;
- Proper adjustment of capping equipment (not a complete control);

- Visual examination of glass containers containing transparent liquid fishery products;
- Passing the product through x-ray equipment or other defect rejection system (FDA, 2001b).

Nonmetallic objects

Top

Control measures for nonmetallic objects can include:

- Passing the product through an X-ray detector.

FDA Guidelines

Top

Hard or sharp objects

Top

Foods are considered adulterated if:

- The product contains a hard or sharp foreign object that measures 7 mm to 25 mm, in length, and
- The product is ready-to-eat, or according to instructions or other guidance or requirements, it requires only minimal preparation steps, e.g., heating, that would not eliminate, invalidate, or neutralize the hazard prior to consumption (FDA, 1999).

Metal Inclusion

Top

- No metal fragments in finished product. (Note: FDA's Health Hazard Evaluation Board has supported regulatory action against product with metal fragments of 0.3" [7 mm] to 1.0" [25mm] in length. See also FDA Compliance Policy Guide #555.425.), or
- No broken or missing metal parts from equipment at the CCPs for "metal inclusion" (FDA, 2001a).

Glass Inclusion

Top

- No glass fragments in finished product. (Note: FDA's Health Hazard Evaluation Board has supported regulatory action against products with glass fragments of 0.3" [7 mm] to 1.0" [25 mm] in length. See also FDA Compliance Policy Guide #555.425.)
- No broken glass at the CCPs for "glass inclusion" (FDA, 2001b).

Critical Aspects of Processes

Top

Metal Inclusion

Top

Critical aspects of processes may include:

- The presence of metal fragments in product passing the CCP.
- The presence of broken or missing metal parts from processing equipment (FDA, 2001a).

Analytical Procedures

Top

Rapid determination of glass in particle-free food products (HC ExFLP-7) Top

Other analytical procedures Top

- Bones and scales in grated tuna (Freeman, 1978)
- Glass contamination of food (Gecan *et al.*, 1990)
- Glass in meat scraps (AOAC, 1995a)
- Filth in shrimp (Olsen, 1988)
- Shell in clams and oysters (AOAC, 1995b)
- Shell in crabmeat (AOAC 1995c)

References, Including General Physical Hazard References

Top

Anonymous 1983. X-ray sorter detects and rejects rocks and foreign matter in almonds. Food Engineering 55(10):131.

Anonymous. 1987. Automatic detection of foreign matter in food. British Food Journal 89(938):52-53,55.

Anonymous. 1987. Meat and Poultry Inspection Manual. U.S. Dept. Agriculture. Washington DC, 328 pp.

AOAC 1995a. Glass in meat scraps. Sec. 16.9.02, Method 950.88. In *Official Methods of Analysis of AOAC International.* 16th ed., P.A. Cunniff (Ed.), p. 16-24. AOAC International, Gaithersburg, MD.

AOAC 1995b. Shell in clams and oysters (canned): Digestion method. Sec. 16.9.05, Method 968.37. In *Official Methods of Analysis of AOAC International.* 16th ed., P.A. Cunniff (Ed.), p. 16-25. AOAC International, Gaithersburg, MD.

AOAC 1995c. Shell in crabmeat (canned): Digestion method. Sec. 16.9.03, Method 968.36. In *Official Methods of Analysis of AOAC International.* 16th ed., P.A. Cunniff (Ed.), p. 16-24. AOAC International, Gaithersburg, MD.

Baker, S.P. and Fisher, R.S. 1980. Childhood asphyxiation by choking or suffocation. JAMA 244(12):1343-1346.

Bearn, F.A. 1949. Foreign bodies in the abdomen. Lancet, ii, p. 1244.

Bhatia, P.L. Hypopharyngeal and oesophagial foreign bodies. East African Medical Journal 66(12):804-811.

Broderick, M. 1992. Contaminant management systems within the confectionery industry. In *Proceedings of the Forty-Sixth Annual Production Conference*, p. 95-97, Pennsylvania Manufacturing Confectioners' Association, Hershey, PA.

Chapple, C.F. and McGowen, W.B. 1949. Foreign bodies in the abdomen. Lancet, ii, p. 627-628.

Cohen, H. 1968. Glass gluttony and gastrointestinal gouging. JAMA 206(7):1582.

Corlett, D.A. and Stier, R.F. 1991. Risk assessment within the HACCP system. Food Control 2(2): 71-72.

Eisenberg, W.V. 1974. Inorganic particle content of foods and drugs. Environmental Health Perspectives 9:183-191.

Eldridge, W.W. 1961. Foreign bodies in the gastrointestinal tract. JAMA 178(6):665-667.

Esclamado, R.M. and Richardson, M.A. 1987. Laryngotracheal foreign bodies in children. AJDC 141(3):259-262.

FDA. 1999. Foods - Adulteration Involving Hard or Sharp Foreign Objects. FDA/ORA Compliance Policy Guide, Chapter 5, Sub Chapter, 555, Section 555.425 (Issued: 3/23/1999). Department of Health and Human Services, Public Health Service, Food and Drug Administration, Washington, DC. http://www.fda.gov/ora/compliance_ref/cpg/cpgfod/cpg555-425.htm

FDA. 2001a. Metal Inclusion. Ch. 20. In *Fish and Fishery Products Hazards and Controls Guide.* 3rd ed., p. 249-258. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Seafood, Washington, DC.

FDA. 2001b. Glass Inclusion. Ch. 21. In *Fish and Fishery Products Hazards and Controls Guide.* 3rd ed., p. 259-268. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Seafood, Washington, DC.

Freeman, C.C. 1978. Brine extraction method for bones & scales in grated tuna. *Laboratory Information Bulletin No. 2200.* USFDA, Rockville, MD.

Gardner, L.I. and Heinicke, H.J.. 1950. Chipped glass as a probable cause of retropharyngeal abscess in an infant. New England J. Med. 242: 975-976.

Gecan, J.S., Cichowicz, S.M., and Brickey, P.M. 1990. Analytical techniques for glass contamination of food: A guide for administrators and analysts. J. Food Protection 53(10):895-899.

Gorham, J.R. 1994. Hard Foreign Objects in Food as a Cause of Injury and Disease: A Review. Ch. 13, In *Foodborne Disease Handbook: Diseases Caused by Hazardous Substances*, Vol. 3,

Y.H. Hui, J.R. Gorham, K.D. Murrell, and D.O. Cliver (Eds.), p. 615-626. Marcel Dekker, Inc., New York, NY.

Gunn, A. and Cantab, M.B. 1966. Intestinal perforation due to swallowed fish or meat bone. Lancet, ii, p. 125-128.

Haines, W.S. 1926. Death from Pounded Glass and Other Mechanical Irritants. In *Legal Medicine and Toxicology*, 2nd ed., Vol. 2, F. Peterson, W.S. Haines, and R.W. Webster (Eds.), p. 888-897.W.B. Saunders Co., Philadephia, PA.

Hancock, G.C. 1927. Occurrence of glass fragments in foods packed in glass containers. Reports on Public health and Medical Subjects No. 37. Ministry of Health, London. 36 pp.

Harris, C.S., Baker, S.P., Smith, G.A., and Harris, R.M. 1964. Childhood asphyxiation by food. JAMA 251(17):2231-2235.

Hart, R.H. 1968. Glass gluttony and gastrointestinal gouging. JAMA 206(7):1582.

Honaas, T.O. and Shaffer, E.A. 1977. Endoscopic removal of a foreign body perforating the duodenum. CMA Journal 116(2):164, 169.

Houghton, L.W. 1949. Foreign bodies in the abdomen. Lancet, ii, p. 1154-1155.

Hyde, J.S. 1949. Peritonitis due to ingestion of glass chipped from baby-food container. J. Pediatrics 34:219-222.

Hyman, F.N., Klontz, K.C. and Tollefson, L. 1993. Food and Drug Administration surveillance of the role of foreign objects in foodborne injuries. Publ. Health Rpt. 108(1): 54-59.

Janssen, W.F. 1981. The detection and elimination of foreign materials. The Manufacturing Confectioner 61(1):41-44.

Keith, F.M., Charrette, E.J.P., Lynn, R.B., and Salerno, T.A. 1980. Inhalation of foreign bodies by children: a continuing challenge in management. CMA Journal 122(1):52-57.

Lehman, H.J. 1958. Glass and metal fragments in food and beverages. Quarterly Bull. Assoc. Food and Drug Off. 22(1): 24-26.

Lifschultz, B.D. and Donoghue, E.R.. 1996. Deaths due to foreign body aspirations in children: The continuing hazard of toy balloons. J. Forensic Sci. 41(2): 247-251.

Lima, J.A. 1989. Laryngeal foreign bodies in children: a persistent, life-threatening problem. Laryngoscope 99(4):415-420.

Mayo, G. 1988. New methods make advances in foreign body detection. Food Engineering 60(11):136,138.

Meislin, H. and Kobernick, M. 1983. Corn chip laceration of the esophagus and evaluation of suspected esophageal perforation. Annals of Emergency Medicine 12(7):455-457.

Melzer-Lange, M., Van Howe, R., and Losek, J.D. 1988. Esophageal foreign body presenting with altered consciousness. A.J.D.C. 142:915-916.

Mittleman, R.E. 1984. Fatal choking in infants and children. J. Forensic Medicine and Pathology 5(3):201-210.

Olsen, A.R. 1988. Rapid procedure for the examination of shrimp for filth. *Laboratory Information Bulletin No. 3172.* USFDA, Rockville, MD.

Olsen, A. R. (Ed.). 1998. FDA Technical Bulletin Number 5: Macroanalytical Procedures Manual. http://vm.cfsan.fda.gov/~dms/mpm-toc.html (7 September, 1999)

Olsen, A.R. 1998. Regulatory action criteria for filth and other extraneous materials. I. Review of hard or sharp foreign objects as physical hazards in food. Regulatory Toxicology and Pharmacology 28:181-189.

Olsen AR, Gecan JS, Ziobro GC, Bryce JR. 2001. Regulatory action criteria for filth and other extraneous materials. V. Strategy for evaluating hazardous and nonhazardous filth. Regulatory Toxicology and Pharmacology 33:363-392.

Olsen AR, Zimmerman ML. 2001. Hard or Sharp Foreign Objects in Food. Ch. 5. In Food Plant Sanitation. YH Hui, BL Bruinsma, JR Gorham, W Kit, PS Tong, P Ventresca (Eds.), p. 61-67. New York: Marcel Dekker, Inc.

Read, K.E.E. 1946. Ulceration of a foreign body through the small intestine. Brit. Med. J. 1(4443): 315.

Reilly, J.S., Cook, S.P., Stool, D. and Rider, G. 1996. Prevention and management of aerodigestive foreign body injuries in childhood. Pediatr. Clin. North Amer. 43(6):1403-1411.

Rhodehamel, E.J., 1992. Overview of biological, chemical, and physical hazards. Ch. 3. In HACCP Principles and Applications, p. 8-28. Pierson, M.D. and Corlett, D. A. (Eds.) Van Nostrand Reinhold. New York.

Rhodeheaver, J.R., 1996. Inspection procedures for foreign materials. U.S. Dept. Agric. File Code 172-A-1: 1-18.

Rider, G. and Wilson, C.L. 1996. Small part aspiration, ingestion and choking in small children: Findings of the small parts research project. Risk Anal. 16(3): 321-330.

Rothman, B.F. and Boeckman, C.R.1980. Foreign bodies in the larynx and tracheobronchial tree in children. Ann. Otol. Rhino. Larynx. 5(1):434-436.

Simmons, J.S. and von Glahn, W.C. 1918. The effect of "ground glass" on the gastrointestinal tract of dogs. JAMA 71: 2127.

Slater, L.E. 1976. Product probing X-rays become on-line sleuths. Food Engineering 48(4): 80-83.

Snyder, O.P. 1992. HACCP - an industry food safety self-control program - Part IV. Dairy, Food and Environmental Sanitation 12(4):230-232.

Steele, J.D. 1948. Mediastinitis due to ingestion of glass. J.A.M.A. 136:554-555.

Travers, E.H. 1949. Perforation of intestine by fish-bone. Lancet, ii, p. 466.

Vane, D.W., Pritchard, J., Colville, C.W., West, K.W., Eigen, H, and Grosfeld, J.L. 1988. Bronchoscopy for aspirated foreign bodies in children. Arch. Surg. 123:885-888.

Webb, W.A. 1988. Management of foreign bodies of the upper gastrointestinal tract. Gastroenterology 94(1):204-216.

Wetli, C.V. and Mittleman, R.E. 1962. The fatal café coronary. JAMA 247(9):1286-1288.

Wollen, A. 1982. New ART form in bottle inspection. Soft Drinks 36(11):473,475.