

MICRO- ORGANISMS IN FOODS

2

Sampling for microbiological analysis: Principles and specific applications

Second edition

The International Commission on
Microbiological Specifications for Foods (ICMSE)
of the International Union of
Microbiological Societies

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Glossary

acceptance sampling The application of a predetermined sampling plan to decide whether or not the lot meets defined criteria of acceptance.

aerobic plate count (APC) The number of colony-forming units of aerobic mesophilic microorganisms present per gram or per ml in the analytical unit as determined by a standard method.

aliquot The portion of food that is inoculated into a container of bacteriological medium in accordance with a specified method. For example, from a 1 kg sample unit, a 25 g analytical unit may be blended with 225 ml of diluent to give a 1:10 dilution. A 1 ml portion of this suspension would be an aliquot of 0.1 g.

analytical unit That amount of product withdrawn from a sample unit for an analysis.

attributes plan A sampling plan in which each selected sample unit is classified according to the quality characteristics of the product and in which there are only two or three grades of quality: for example, acceptable, defective; absent, present; acceptable, marginally acceptable, defective; low count, medium count, high count.

c The maximum allowable number of defective sample units (2-class plan) or marginally acceptable sample units (3-class plan). When more than this number are found in the sample, the lot is rejected.

case A set of circumstances related to the hazard a food represents and to its anticipated subsequent treatment.

consignment A quantity, large or small, of food destined, in commerce, to a particular recipient, usually consisting of multiple containers of food from one or more lots.

consumer's risk The probability that a lot will be accepted on the basis of results of testing analytical samples when in reality the lot as a whole is substandard relative to the stated criteria of acceptability.

defective Not suitable for the intended purpose.

frame That portion of the lot from which the sample units are drawn. Ideally it should be the whole lot; in practice it may be the accessible portion of the lot.

Good Commercial Practice (GCP) A general term defining conditions of Good Manufacturing Practice combined with acceptable conditions of distribution and storage.

- Good Manufacturing Practice (GMP)** Those procedures in a food-processing plant which consistently yield products of acceptable quality. GMP is usually described in a code defining processes, equipment, plant layout, sanitation, hygiene, and laboratory tests; but, as used here, it does not apply to any particular code now in use.
- hazard** The potential to cause (i) disease when eaten or (ii) organoleptic spoilage in a period shorter than the normal shelf-life of the food.
- Hazard Analysis Critical Control Point (HACCP)** A system in which observations and/or tests are made to identify actual or potential hazards in operations and to identify critical control points in a process. Control measures are designed and implemented, and the control points are monitored to ensure that control is maintained.
- indicator** Historically, an organism itself non-pathogenic, but often associated with pathogens, used to portray a risk of the presence of pathogens for which feasible methods of detection were not generally available (sometimes called 'index organisms'). This usage is currently expanded to denote groups or species of organisms whose presence in a food reveals exposure to conditions that might introduce hazardous organisms and/or allow their growth. Specific indicators are now used to reveal excessively contaminated raw materials; unsanitary manufacturing practice; contamination from faecal, nasopharyngeal, or suppurative sources; unsuitable time-temperature conditions of storage; or failure of a process. The indicator groups and their methods of enumeration are described in ICMSF, *Microorganisms in Foods, 1. Their Significance and Methods of Enumeration* (1978).
- lot** In the commercial sense, a lot is a quantity of food supposedly produced under identical conditions, all packages of which would normally bear a lot number that identifies the production during a particular time interval, and usually from a particular 'line,' retort, or other critical processing unit (see Chapter 3, Section A). Statistically, a lot is considered as a collection of units of a product from which a sample is to be drawn to determine acceptability of the lot.
- m** A microbiological limit which, in a 2-class plan, separates good quality from defective quality or, in a 3-class plan, separates good quality from marginally acceptable quality. In general, values equal to *m*, or below, represent an acceptable product and values above it are either marginally acceptable or unacceptable.
- M** A microbiological limit which, in a 3-class plan, separates marginally acceptable quality from defective quality. Values above *M* are unacceptable.
- microbiological criterion** A criterion concerning the presence or quantity of microorganisms or their toxins per unit of mass, volume, or area, established by use of defined procedures and applied in acceptance sampling of foods (see Appendix 6: General Principles for the Establishment and Application of Microbiological Criteria for Foods).
- microbiological guidelines** A microbiological criterion used by a manufacturer or regulatory agency to monitor a food, ingredient, process, or system; often used also to describe a microbiological criterion where no standard has been prescribed. The Codex Alimentarius definition is more restrictive (see Appendix 6: General Principles for the Establishment and Application of Microbiological Criteria for Foods).
- microbiological purchasing specification** The microbiological criterion or criteria

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- conditional to acceptance of a specific food or food ingredient by a food manufacturer or other private or public purchasing agency.
- microbiological standard** A microbiological criterion in a law or regulation controlling foods produced, processed, or stored in the area of jurisdiction of a regulatory agency, or imported into the area.
- moderate hazard** The hazard associated with ingestion of a food containing a pathogen or toxin which can cause a short-term disease not critically severe in its manifestations and normally without sequelae: for example, salmonellosis, staphylococcal food-poisoning.
- Most Probable Number (MPN)** A statistically estimated number (per unit of mass or volume) of the test organism present in a sample unit, based upon its presence or absence in replicate aliquots (see also ICMSF, *Microorganisms in Foods, 1. Their Significance and Methods of Enumeration* [1978]).
- n*** The number of sample units which are examined from a lot to satisfy the requirements of a particular sampling plan.
- population (epidemiological)** The number of people estimated to be at risk from a particular food.
- population (microbiological)** The number of microorganisms, total or of a species or group(s), dispersed within a defined quantity of food and detectable by the methods used. Hence, a total microbial population or a population of staphylococci, coliforms, etc.
- population (statistical sampling)** The aggregate of units about which an inference is to be made from analytical results. In this book, population usually relates to the totality of hypothetical individual portions within a lot, each identical in quantity with the defined sample unit.
- probability of acceptance** The likelihood that a lot of known quality would be accepted on the basis of results of testing analytical samples relative to the stated criteria.
- producer's risk** The probability that a lot of acceptable quality will be rejected on the basis of results of testing analytical samples relative to the stated criteria.
- random sample of size *n*** A collection of *n* sample units obtained in such a way that every sample of size *n* has an equal chance of selection, hence excluding bias. Reference to a table of random numbers is usually involved (see Chapter 3, Section C).
- sample** The total number (one or more) of individual sample units drawn from a lot (ideally at random) which will be tested in accordance with a specific sampling plan and method(s).
- sample unit** The individual portion or container of food taken as part of the sample and from which one or more analytical units may be drawn for analysis.
- sampling plan** Used synonymously in this text with *lot acceptance sampling plan*, and meaning a statement of the criteria of acceptance to be applied to a lot, based on examination of a required number of sample units by defined analytical methods.
- severe hazard** The hazard associated with the presence of a pathogen or toxin in a food which when ingested is likely to cause severe disease, either in a healthy population or in a particularly susceptible group to which the food in question is often destined. Severity of hazard is largely determined by clinical severity of the disease induced, but many ancillary factors are pertinent (see Chapter 5 and Tables 6 and 7). Pathogens of concern in this category include *Brucella* spp.,

Clostridium botulinum, *Cl. perfringens* type A, *Salmonella typhi*, *Shigella dysenteriae*, *Vibrio cholerae* O1 (Table 7); they are normally sought by application of investigational sampling (see Chapter 5, Section N).

shelf-life The period after processing during which a food remains in acceptable condition under appropriate conditions of storage.

stratification A technique for dividing consignments into logical groupings such as size of cans, grades, box, cases, which controls known sources of variation. It may be used where prior knowledge exists that the consignment is potentially not of uniform quality.

stringency The probability that a lot of food of defined microbiological quality will be rejected by a prescribed sampling plan, relative to other sampling plans.

subsample The several individual swabs or portions of food taken from a single carcass or carton and which make up a single sample unit.

variables plan A sampling plan in which the criteria employ statistics of a sample, such as the mean and standard deviation, rather than the segregation of sample units into attribute classes (see attributes plans). In the context of this book the variables plans referred to are based on the application of the mean ($\bar{x}$) and standard deviation (s) of the sample log counts. These parameters are combined with a constant or constants (k_1 , k_2) selected for the appropriate number of sample units (n) for comparison with a limit value (v or V).