

Microbiological Criteria for Fresh Produce

Fruits and vegetables play an important role in a balanced diet. In the USA, Canada, New Zealand and several European Union states, public health institutions have run campaigns recommending the daily consumption of at least five daily servings of fruit and vegetables. Microbiological criteria of the food indicates its safety and hygienic quality. Consumer's health can be adversely affected by the consumption of microbiologically unsafe fresh produce. Microbial contamination of fresh produce can occur from animals, insects, soil, manures, water and equipment used while growing these horticultural products as well as handling the produce by human in the food chain. These microbial contaminants leads to adverse health effects if the consumer ensure safety prior to the consumption of raw fruits and vegetables. Food safety can be achieved by growers, processors and retailers of fruits and vegetables by adequate washing and hygienic handling of these products prior to sale. These processes and practices help in reducing the likelihood of food-borne illness due to microbial load of the fruits and vegetables.

Fresh produce can act as a vehicle for transmitting bacterial, parasitic as well as viral pathogens leading to human illness. *Listeria monocytogenes*, *Salmonella* and *Escherichia coli* have been reported from raw vegetables which can become contaminant while growing or during harvesting, postharvest handling, or distribution. Frequent produce-related pathogens include bacteria (*Salmonella*, *E. coli*); viruses (Norwalk-like, hepatitis A) and parasites (*Cryptosporidium*, *Cyclospora*). Fresh produce therefore pose a food safety risk if they are consumed raw. There are a number of national microbiological guidelines have been published for ready-to-eat (RTE) food in countries like UK (Public Health Laboratory Service has published microbiological guidelines), Spain, France, Germany and Japan.

Practical Aspect of Microbiological Criteria

Three types of microbiological criteria, as defined by the Codex Alimentarius Commission (Codex, 1981), principally for use in Codex standards and codes of practice are as below:

1. Standard
2. Guideline
3. Specification

Standard is defined as a microbiological criterion contained in a law or regulation where compliance is mandatory and regulated either by governments or regulatory authorities. Example includes criteria in European Community (EC)/European Union (EU) Directives and Statutory Instruments of England and Wales. The food industries should be in full compliance with these standards that are being monitored by enforcement agencies. Products not complying with standards should be rejected as unfit for the intended use. Microbiological guideline is a criterion that can be applied at any stage of the food processing/retailing indicating the microbiological condition of the sample. It helps in identifying situations which require attention for quality or food safety reasons. Results obtained by following microbiological guideline help in trend analysis and results depicting significant deviation from the trend indicate food safety issues. Guidelines are usually self-imposed by the food industries and may occasionally be included in legislation. Specification refers to a microbiological criterion applied to raw materials, ingredients and end product that is used in a purchase agreement. This may include pathogens, toxins, spoilage microorganisms/indicator microorganisms where non-compliance may affect product safety and quality during shelf life.

Basic Elements of Microbiological Criterion

A microbiological criterion reflects a statement of *at least* the following:

1. Microorganism or microbial toxin of concern
2. Food concerned and sample type
3. Sampling plan
4. Microbiological limit(s)

Microbiological criteria conformance is monitored using a specified and relevant well established methods that have been validated for the microorganism or the toxin of concern in the food under examination. Microbiological limits represents the level above which action is required for the food safety concerns. These levels should be realistic and determined from thorough knowledge of raw material microbiology and effects of processing, product handling, its storage and end use on the microbiology of the final product. It should be noted that no microbiological method is capable of detecting all representatives of the target microorganism.

Sampling plan represents a systematic way to assess the microbiological quality of food lots. A “lot” refers to a batch of products manufactured under the same conditions at the same time. During sampling, the samples should be taken from the lot independently and randomly. While developing a sampling plan, a number of factors should be taken into consideration i.e. properties of food, production processes, storage conditions of the final products, associated risks, targeted consumers and practical limitations. Each food product should be considered individually.

A comprehensive sampling plan includes the following components:

- (a) The microbe or group of microbes of concern or interest;
- (b) Number of samples to be tested (n);
- (c) Testing method(s);
- (d) Microbiological limit(s), m & M
 - Acceptable ($\leq m$)
 - Marginally acceptable ($> m$ and $\leq M$)
 - Unacceptable ($> M$);
- (e) Number of samples which fall into each category of microbiological

The microbiological limits of this set of guidelines are organised under the following three components:

- (a) Aerobic Colony Count (ACC)
- (b) Indicator Organism – *E. coli* count is the only indicator organism included and
- (c) Specific Food Poisoning Pathogens – nine specific bacterial pathogens are included in this set of guidelines.

Classification of Food Quality

Microbiological assessment leads to classification of the food quality into following four classes:

1. Class A: Microbiological status of the food sample is satisfactory.
2. Class B: Microbiological status of the food sample is less than satisfactory but still acceptable for human consumption.
3. Class C: Microbiological status of the food sample is unsatisfactory. This may indicate a sub-optimal hygienic conditions and microbiological safety levels. Authorities of food

premises should be advised to investigate and find out the causes and to adopt measures to improve the hygienic conditions.

4. Class D: Microbiological status of the food sample is unacceptable. The food sample contains unacceptable levels of specific pathogens that is potentially hazardous to the consumer.

Conclusion

Based upon above literature it can be concluded that fruit and vegetables can become contaminated at any point during their growth, harvesting, processing, distribution, retail sale and the final preparation. Food retailers endeavour to present fruit and vegetable products, within their stores, in such a way that appeals to the consumers. For this growers require to remove roots, exterior leaves and dirt from the produce so they appear cleaner and more hygienic. This may involve a washing step which may or may not be carried out in a hygienic processing environment. Consumers can easily mistake these products as being ready to eat and therefore not wash them in the home prior to consumption.

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