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| **COURSE:**  | 7075 Foods II - Food Technology | **UNIT C** | Food Microbiology and Food Safety |
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| **COMPETENCY:** | 5.00  | B2 | 13% | Understand how microorganisms affect food quality and safety. |
| **OBJECTIVE**:  | 5.01  | B2 | 9% | Understand microorganisms associated with food quality and safety*.* |
| **Essential Questions:** * How do the five groups of microorganisms affect food?
* What is the difference between food safety and food quality?
* What is the hurdle concept?
* Which five risk factors must be controlled to keep food safe?
* Under what conditions will pathogenic bacteria grow in foods that are removed from their packaging?
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| **UNPACKED CONTENT** |
| * Microbiology is the study of living organisms too small to be seen by the naked eye without magnification. Foods may be naturally contaminated with microorganisms or become contaminated with microorganisms through improper handling. Microorganisms are everywhere. There are three ways that microorganisms affect food. They:
	+ cause food borne illness (pathogen microorganisms).
	+ cause food to spoil and reduce its shelf-life (spoilage microorganisms).
	+ are used for food fermentation and are naturally present in and on the body (beneficial microorganisms).

Some microorganisms grow in food and some do not. This affects how they are controlled in food. The five major groups of microorganisms and their effect on food safety and quality are:

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| **Five Major Groups of****Microorganisms** | **Pathogens** | **Spoilers** | **Beneficial**  | **Grow in Food** |
| Bacteria | Yes | Yes | Yes | Yes |
| Viruses | Yes | No | No | No |
| Parasites | Yes | No | No | No |
| Yeast | No | Yes | Yes | Yes |
| Mold | Yes | Yes | Yes | Yes |

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| * Food microbiologists study foods to determine how to control the microorganisms that might naturally contaminate food or that might be introduced through improper handling. Control measures focus on safety and quality.
	+ Food safety control measures are used to prevent food borne illness.
	+ Food quality control measures are used to maximize shelf-life, slow spoilage, or produce a new product.
* Food processors often use a combination of control measures, called **the hurdle concept**, to control the growth of microorganisms in food. The three primary control measures used are:
	+ Controlling water activity and pH values of the food.
	+ Adding chemicals, such as additives or substances like salt, directly to the food.
	+ Adjusting the atmosphere surrounding the food using special packaging methods.
* The U.S. Food and Drug Administration has identified five risk factors that must be controlled to keep food safe. These risks factors are:
	+ Food from an unsafe source – using food from home or an unlicensed provider.
	+ Inadequate cooking – not heating food to temperatures that kill pathogens.
	+ Improper holding temperatures – holding food at an unsafe temperature for more than four hours.
	+ Contaminated equipment – using unclean utensils or equipment when preparing food.
	+ Poor personal hygiene – unsanitary habits by workers.
* Food must be handled safely after it is removed from its packaging to keep food safe. **Pathogenic bacteria**, which cause food borne illness, can grow well in:
	+ A TCS food, which has a pH above 4.6 and a water activity greater than 0.85 that is in the temperature danger zone (between 41oF and 135oF) for more than four hours. This is summarized as FAT-TOM – food, acid, temperature, time, oxygen, and moisture.
	+ Some pathogenic bacteria have specific oxygen requirements, such as:
		- Aerobic – require oxygen to growth
		- Anaerobic – grow only in the absence of oxygen
		- Facultative – grow whether the atmosphere has oxygen or not
		- Microaerophilic – grow only in reduced oxygen environments
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