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Short Communication

Bacteria that are Associated with Food

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Just like the irony of Alexander Fleming's discovery roughly a century ago in 1928 at St Mary's Hospital, London [1] some friendly microorganisms being able to produce antimicrobial substances that destroy 'fellow microbes' that are harmful to humans- ironically, bacteria some are helpful to humans in the production or industrial processing of certain food, beverages, wines etc, whereas, some microbes spoil and ruin food for humankind, while some even cause diseases when they find their way into drinks and foods [2].

Industrially useful bacteria

Bacteria or microorganisms that cause diseases or whose activities negatively affect humans are summarily insignificant compared to the total population of all known and yet-to-be known microbes. While the vast majority of all known and yet-to-be known microbes are neither beneficial nor harmful to man, some are of tremendous industrial and economic value to humanity.

Centuries before the discovery of microbes, humans have been making use of fermentation process to prepare or process their food, drinks or food products, without knowing about the interplay of chemistry and microbiology that makes fermentation possible. Though it is now known that, in fermentation, conditions of treatment and storage create an atmosphere in which certain types of organism can thrive to produce desirable effects on food instead of spoilage.

Lactic acid bacteria and yeasts are the leading fermenters in industrial processes that make use of fermentation, though some moulds also carry out fermentative activities.

Microbes-mostly lactic acid bacteria and yeasts- are utilised in the fermnatative processes that produce the following food, drinks or food products; Beer, cheese, yoghurt, iru (a food seasoning made from locust beans in southwest Nigeria), garri (a Nigerian staple food made from fermented cassava), ogi (a Nigerian staple food made from fermented corn/sorghum or millet), salami, palm-wine, bread, dosa, tempeh etc

Lactic acid bacteria

Serological analysis and 16S ribosomal RNA cataloguing have proved that lactic acid bacteria (LAB) are phylogenetically related. They they are Gram-positive, non-spore-forming rods or cocci; most are aerotolerant anaerobes which lack cytochromes and porphyrins and are therefore catalase- and oxidase-negative. Some do take up oxygen through the mediation of flavoprotein oxidases and this is used to produce hydrogen peroxide and/or to re-oxidize NADH produced during the dehydrogenation of sugars.

They derive their cellular energy by fermentation of carbohydrate to produce mainly, lactic acid [2] Lactic acid bacteria are a wide group of bacteria, covering many genera; *Lactococcus spp, Leuconostoc spp, Pediococcus spp, Lactobacillus spp, Enterococcus spp, Streptococcus spp, Carnobacteria spp, Oenococcus spp, Vagococcus spp, Aerococcus spp, Tetragenococcus spp, Alloiococcus spp, Weissella spp* and less acceptably, *Bifidobacterium spp*

Lactic acid bacteria tend to preserve the quality and safety of many food and food products by virtue of the production of lactic and acetic acids, which lower the pH of the food and thereby serve as a form of inhibition to disease-causing bacteria, most of which

survive in low pH environment. LAB are believed to exert their anti-bacterial effect because of their ability to produce or achieve'

- Low pH
- Organic acids
- Bacteriocins
- Hydrogen peroxide
- Ethanol
- Diacetyl
- Nutrient depletion
- Low redox potential.

They also produce bacteriocins- anti-bacterial peptides or proteins which are often active against species closely related to the producing organism.

Since they are produced by food-associated bacteria they could be regarded as 'natural' food preservatives. Though many of them have too narrow spectrum of activity to be of any practical use, one of them, nisin, has practical value in the food and confectionary industry.

Nisin is produced by some strain of *Lactococcus lactis* and was first discovered in a cheese-making factory where it inhibited the growth of other starter-organisms. It's presently available commercially in some countries as food preservative, UK and US inclusive. It is an amphiphilic polypeptide containing 34 amino acids and is remarkably heat stable at acid pH. Lactic acid bacteria are also used as probiotics. Though not all are established benefits, but putatively, lactic acid bacteria are thought by some to have the following beneficial effects;

- Nutritional improvement of foods.
- Inhibition of enteric pathogens.
- Alleviation of diarrhoea/Constipation.
- Hypocholesterolaemic action.
- Anticancer activity.
- Simulation of the immune system.

Bacteria associated with food spoilage

Microorganisms that cause food spoilage are nightmare to farmers, food processors, confectioners, food manufacturers, restaurant-operators, house-wives, in fact, just about anyone in the food value-chain. Millions- or maybe billons- of hard-earned dollars are lost annually due to food spoilage facilitated by spoiler-microbes, mostly moulds and bacteria. Bacteria implicated in food spoilage include but not limited to;

Pseudomonas spp, Alcaligenes spp, Serratia spp, Micrococcus spp, which spoil food by lipolysis *Flavobacterium spp, Serratia spp, Micrococcus spp*, which spoil food and cause visible pigmentation that mar the quality, flavour and safety of food Proteus spp spoil by gas formation. Some lactic acid bacteria- *Lactobacillus spp* and *Leuconostoc spp*, in unregulated conditions can also spoil food with formation of gas. *Enterobacter spp* and *Streptococcus spp* spoil food by making food go slimy or by forming ropes in them:

Bacteria that cause food-borne diseases

Unfriendly or harmful bacteria that cause diseases that can be contracted through food or drinks cause heavy and huge morbidity and mortality to humankind. Apart from tens or hundreds of man-hours that are lost to hospital visits occasioned by these group of bacteria, huge amounts of money are also gulped by various medical interventions to curb, cure or control the diseases they cause. Food-borne infection (FBI) occurs when food, food products contaminated with pathogenic microbes or their toxins are ingested. FBI should be suspected if an acute infection with enteritis or neurological symptoms affect two or more persons or animals who had consumed same food 3 days prior to the manifestation of the infection [3]. Microorganisms themselves sometimes aren't the ones responsible for food-related illnesses but the toxins that they had produced into the food before it's consumption- a condition better known as microbial food poisoning. It's been estimated that averagely, 66% of cases of food-borne infections are caused by bacteria, 26% by chemical substances, 4% by viruses and another 4% by parasites [4]. Foods get contaminated through various sources, plant surfaces, animals, water, sewage, air, soil or from food handlers during handling and processing [5,6]. Typical symptoms of food-borne infections include enteritis, diarrhea, vomiting, headaches, nausea, abdominal cramps, fever, backache [3].

- Bacteria that cause food-borne infections include;
- Brucella abortus.
- Aeromonas hydrophila.
- Enterobacter sakazakii.
- Mycobacteria.
- Plesiomonas shigelloides.

- Vibrio cholera.
- Vibrio parahaemolyticus.
- Yersinia enterocolitica.
- Campylobacter jejuni.
- Clostridium perfringens.
- Escherichia coli O157:H7.
- Salmonella (over 1600 types).
- Streptococcus A.
- Listeria monocytogenes.
- Shigella (over 30 types).
- Staphylococcus aureus.

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