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RISK PROFILE ON THE MICROBIOLOGICAL CONTAMINATION OF FRUITS AND ITS JUICES

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ABSTRACT

Fruits and its juices are very demanded for their nutritional content, minerals, and vitamins. Fresh fruits and vegetables are consumed in high quantities in the daily human diet. Globally trades in fruits are changing horticultural practices for enabling the availability throughout the year, even adding new varieties of fresh products to the market. The focus of this study was about the microorganisms which cause contamination and spoilage in fresh fruits and its juices. Food borne illness produced by fruit and fruit juices is due to the presence of pathogenic Microorganisms. This study was to analyze bacteriological quality of fresh fruit and commercially packed fruit juice and to found organism load in it. Fruits carries a natural non-pathogenic epiphytic micro flora on their surfaces. Some pathogenic bacteria cause food borne diseases and they harm human health. The people involved in preparing the fruit juices knew the importance of maintaining hygiene. The fruits were stored at cold temperature; sterilized water was used to dilute the juice and to clean equipment for the process. Fruits can become contaminated with pathogenic microorganisms during harvesting process

through fecal material, human handling, harvesting equipment, transport containers, wild and domestic animals, air, transport vehicles, ice or water

Keywords: Fresh Fruits, Juices, Nutrient value, Hygiene, Microorganisms

INTRODUCTION

Fruit juices contain nutrients, minerals, and vitamins. They are essential for the human diet, and their nutritional benefits have more significant evidence. Mostly, the bacterial count contained in bacteria is approximately 1.0 x 10^5 cm^2 **[1]**. However, these bacterial counts increase drastically when hygienic practices such as the washing of the fruits are not maintained. The use of unclean water, preservation in temperatures that are not cool, houseflies, fruit flies, airborne dust can also be responsible for the contamination. Sources of pathogenic bacteria like *E. coli* 0157:H7, some *Shigella, Staphylococcus aureus,* and *Salmonella* are some fruit juices that are sources **[2]**.

For preparation of fruit juices, removal from mature fruits skin and large stones, separation of pulp and juices, and then they are mixed by a blender **[3]**. After the blending, extracted liquids are not fermented, qualified, and treated.

As a significance of unsuitable manipulation and storage conditions, products are contaminated by pathogenic and deteriorative microorganisms, which consequently increases the decaying of fruits and also causes microbial diseases **[4]**. In recent years, there has been an increase in epidemics and illness cases from consumed unhygienic chopped fruit and unpasteurized juices.

Microbiological, enzymatic, chemical, or physical changes decreases fruit quality. The presence of pathogenic microorganisms and microbial toxins in the product creates difficulties for purchasers. Microbial spoilage leading to economic losses was the main reason for decreasing the quality and safety by microbiological causes **[5]**. Therefore, various food preservation procedures, chilling, water activity reduction, freezing, nutrient restriction, acidification, packaging in modified atmospheres, physical non-thermal treatments, fermentation, or antimicrobial use, have been applied in microbial growth to traditionally control growth **[6]**.

The fresh fruits harvested for human consumption in the world is lost due to microbial spoilage. Fermented fruits can be contaminated with different microorganisms during processing, which can cause spoilage **[7]**. Spoilage is any change occurring in fruits, making them inedible for human.

Natural microflora coming from the soil, water, air, and other sources in fresh fruits **[8]**. The presence of air, high humidity, and high temperature as extrinsic factors during storage of fruits increases the chances of microbial growth and spoilage. The common fruit fly can contaminate plant foods with microorganisms such as *Rhizopus* spp **[9]**. Microbial spoilage in fruits represents significant economic loss throughout the fruit distribution chain. Refrigeration, vacuum packaging (VP), modified atmosphere packaging, washing, freezing, drying, heat treatment, and chemical preservatives are used to reduce microbial spoilage of fruits **[10]**.

One other source can be damaged fruit surfaces such that wounds, cuts, splits and perforations and pathogenic microorganisms enter in fruits during harvesting or growing. Pathogens expansion by juice so the diseases spreads **[11]**.

In fresh fruit juice samples total viable bacterial count is higher than the commercially packed fruit juice. Many researchers say that commercially packed juice is safe than the locally produce juice for consumption of humans. Commercially packed juice is safe because it uses a machine for mechanized and preservatives are added during process. Many preservatives harm human's health **[12]**.

Pathogenic bacteria produce their toxin and poisonous protein by causing food borne diseases. common food born pathogenic bacteria are *Bacillus cereus, Clostridium botulinum, Escherichia coli, Shigella spp., Salmonella spp., Staphylococcus aureus, Streptococcus pyogenes, Mycobacterium bovis, Listeria monocytogenes, Klebsiella spp., Enterobacter spp., Staphylococcus spp* **[13]**.

Food borne illness such as diarrhea, stomach pain, stomach cramps, vomiting, fever caused by pathogenic bacteria **[13]**.

NUTRITIONAL VALUE OF FRUITS

Nutritional value of fruits depends on their vitamins and minerals. Nutritional scientist consultation to eat minimum 115gms of fruit every day, they balanced diet and provide strengthens of life. Papaya, mango, guava, pineapple, jackfruit, lemon contain Vitamin A, B and C. and also contain calcium, magnesium, iron and potassium. Phosphorus and amino acid is present sufficient amount in wood apple, litchi, almond, karamcha etc **[14]**. Citrus fruits contain high amount of Vitamin C. Barbados cherry contain richest source of Vitamin C **[15]**.

For growth and development of children should be given adequate amount of nutrition

for which fruit should be given in the diet. Healthy diet help for high blood pressure problem, reduce risk of chronic diseases, prevent cholesterol. Unhealthy diet increases the chances of diseases **[16]**.

Fruits provide dietary fiber and fiber protect of cardiovascular diseases and obesity. They are also containing vitamins and minerals and source of phytochemicals that role as antioxidant, phytoestrogens, anti-inflammatory agents and other protective mechanisms **[17]**.

Apple

Apple contain high amount of fiber and phytochemical properties same as an antioxidant. Previous researches have shown that eating regular diet reduce wrinkle and fine lines. Apples are alkaline and they clean the liver **[18]**.

Strawberry

Strawberry contains high source Vitamin C, magnesium, folate and potassium. Strawberry help for health as an antioxidant, anti-inflammatory, antihyperlipidemic effects **[19]**.

Grapes

Grapes contain high source of phytochemicals such as a carotenoid, melatonin, phenolics and flavonoids. These phytochemicals act as an antimicrobial, antioxidant, anti-inflammatory, anticancer etc. They are beneficial for human health **[20]**.

Orange

Orange contain Vitamin C, thiamin, folate, and potassium. Vitamin C boost immunity to every day against viruses and bacterial infections and they also reduce risk of colon cancer. Prevent against cardinal diseases **[21]**.

Watermelon

Watermelon contains 90% of water, they hydrated and rejuvenates human skin. Lycopene present in watermelon and help to flush the toxins and combats free radicals. They have an antioxidant property – detox therapy **[22]**.

MICRORGANISMS FOUND IN DIFFERENT FRUITS

We humans are consuming fruits on daily basis due to high nutrition value. As nutrient content is high many organisms can attract to the fruits very easily and spoil the fruits. Common microorganisms which effect fruits are listed in **Table 1**.

Table 1: List of fruits with its contaminated microrganisms [23]

Fruits	Microorganisms
Apple	Escherichia coli
Strawberry	Vibrio cholera
Grapes	Salmonella spp
Orange	Staphylococcus aureus
Watermelon	Shigella spp

Escherichia coli

Escherichia coli produce enterotoxin, they responsible for bacterial infections. Symptoms of *Escherichia coli* infection diarrhea, vomiting, stomach cramps and fever. Some different species of *Escherichia coli* cause diarrhea, urine tract infection, respiratory infection, bloodstream infection **[24]**.

There is a belief that taking glucose linked sodium relieves dehydrating diarrhea, which is called oral rehydration therapy **[25]**.

Vibrio cholerae

Vibrio cholerae cause a cholera infection. Symptoms of cholera cause severe watery diarrhea. Above the 4.5 pH in fruit contamination by *Vibrio cholerae* and below 4.5 pH do not grow. Vaccine available for cholera **[26]**.

Salmonella spp

Salmonella is pathogenic bacteria they produce enterotoxin that causes food poisoning. Salmonella typhi cause typhoid. Antibiotic drug such as Azithromycin, Amoxicillin, Trimethoprim-Sulfamethoxazole (TMP-SMX) required for critical condition **[27]**.

Staphylococcus aureus

Staphylococcus aureus causes gastrointestinal illness. Symptoms is vomiting, fever, diarrhea, Nausea, stomach cramps. Drink plenty of fluids are taken **[28]**.

Shigella spp

Shigella spp causes food poisoning. Symptoms of fever, diarrhea, stomach cramps, rectal spasms. In this type of infection loperamide, paregoric antimotility drug used **[29]**.

FRUIT SPOILAGE

A microbial spoilage of fruits and their products is due to molds, yeasts, and aciduric bacteria such as lactic acid bacteria, Acetobacter, Gluconobacter due to their low pH (less than 4.0). There is a probability for spoilage of fresh fruits by different types of molds such as *Penicillium, Aspergillus, Alternaria, Botrytis, Rhizopus, Cladosporium, Tricothecium, Phytophthora, Aureobasidium, Colletotrichum*, and others. Yeast from the genera Saccharomyces, Candida, Torulopsis, and Hansenula is responsible for fermentation of fruits, while Bacterial spoilage is associated with the souring of fruits due to the growth of lactic and acetic acid bacteria **[30]**.

Fresh fruits get contaminated by pathogens such as *Salmonella, Shigella, Listeria monocytogenes, E. coli gastrointestinal viruses, Entamoeba histolytica,* and *Ascaris spp*. Basically these pathogens are incorporated by polluted irrigation water. Fruits are generally too acidic for growth of

the more common foodborne pathogens such as *Salmonella* and *Shigella* **[30]**.

On frozen fruits the contaminants originate from the equipment. In fruit processing equipment *Geotrichum candidum* may get accumulated which is termed "machinery mold". In the environment of fruit-processing lines some acid tolerant bacteria such as Acetobacter, *Gluconobacter*, and *Zymomonas* may also develop. At too low pH *Coliform* bacteria can be recovered to support growth of these organisms. Only osmophilic yeasts can grow in concentrated fruit drinks and preserves, due to low aw (0.90) but if oxygen is available then molds can also grow **[30]**.

CONCLUSION

The water used to prepare the juices was contaminated with various microbial species of the family Enterobacteriaceae. Additionally, the storage containers may also be unhygienic and increased the microbial load in the juice drastically. The fruit juices prepared in cafes and restaurants were highly contaminated by different organisms depending on type of fruits used for preparation of juices. The source of water used in the washing of the fruits and containers is assumed to be the primary source of increased fruit juice contamination. The bacterial contamination includes *Shigella, Salmonella, Staphylococcus aureus, and Escherichia coli*. These bacteria have been found to pose a significant threat to public health, for they cause various severe diseases such as shigellosis and enteric fever. The farmer should take care for spoilage and contamination, while growing and harvesting the fruit. This type of organisms may infect the fruits and if human consumed that contaminated fruits, the chances of getting diseases increased. The vendor should also take care that no contamination occurs while washing the fruits and the container should also be clean and hygienic.

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