CHARACTERIZATION OF MICROBES IN CONTAMINATED FRUITS AND VEGETABLES

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ABSTRACT

Fruits and vegetables are dietary source of nutrients, micronutrients and vitamins which help the consumers from vitamin deficiencies, malnutrition and to get rid of a variety of ailments. However, these may be contaminated with different bacterias that may cause food- borne illness. Therefore, it is important to detect and identify the microbial flora i.e. *Escherichia coli, Pseudomonas aeruginosa, Micrococcus luteus, Staphylococcus aureus, Klebsiella pneumoniae* etc. associated with fresh fruits and vegetables. Primary characterisation of bacteria can be done by visual colony characters, microscopic characterisation (simple staining and gram staining) and other tests like motility test, oxygen tolerance test, catalase test and secondary identification of the isolates may be done on the basis of biochemical analysis (IMViC tests) and carbohydrate utilization test. The inner part of fruits and vegetables are free of microorganisms, however, the surfaces of raw vegetables and fruits are contaminated with a variety of microorganisms and this depends on microbial population of the environment from which the food was taken, the condition of the raw product, the method of handling, the time and storage conditions. Proper fruits and vegetables handling, hygiene transportation and proper storage is necessary to avoid microbial food spoilage and related health risks.

Keywords: Biochemical analysis, fruits, microbial flora, microscopic characterization, vegetables.

INTRODUCTION

Vegetables and fruits are an important part of a healthy diet. No single fruit or vegetable provides all the nutrients we need to be healthy. The higher the average daily intake of fruits and vegetables, the lower the chances of developing cardiovascular diseases. Almost all the fruits and vegetables contain flavonoids and these possess significant antioxidant potential and used to treat a variety of ailments[1].

Fruits and vegetables get contaminated at each step from cultivation to consumers. Many studies have been carried out on various aspects of fruits and vegetables contamination at different sources [2-3]. Vishwanath and Kaur (2000) reported bacterial contamination from these fresh produce[4]. So, it is very important to detect and identified the pathogenic micro flora from fresh fruits and vegetables. Variety of microbial strains present in fruits and vegetables are mentioned in table 1. Pharmacological importance of fruits and vegetables are mentioned in table 2.

Table 1: Microbial strains present in fruits and vegetables

S. No.	Sample	Microbial strains
1.	Apple	*K. pneumoniae, B. cereus, E. coli* [5]
2.	Mango	*K. pneumoniae, E. coli* [5]
3.	Orange	*B. cereus, K. pneumoniae, E. coli* [5]
4.	Pomegranate	*E. coli, K. pneumoniae* [5]
5.	Papaya	*B. cereus, S. aureus, M. luteus, P. aeruginosa* [5]
6.	Litchi	*E. coli, K. pneumoniae, B. cereus* [5]
7.	Lady finger	*E. coli, K. pneumoniae* [5]
8.	Pumpkin	*E. coli, K. pneumoniae, B. cereus* [5]
9.	Capsicum	*E. coli, K. pneumoniae, B. cereus* [5]
10.	Karella	*E. coli, K. pneumoniae, B. cereus* [5]
11.	Tomato	*E. coli, K. pneumoniae, S. aureus, M. luteus, P. aeruginosa, B. cereus* [5]
12.	Melons	*S. enterica, E. coli, L. monocytogenes* [5]
13.	Spinach	*K. pneumoniae, P. aeruginosa, M. luteus* [5]

Methods of identification of microorganisms

a) **Morphological identification**: The isolated bacteria can be identified on the basis of negative staining and gram staining[6].

b) **Selective-cum-differential agar media based identification**: The pure colonies can be grown on media like *Bacillus cereus* agar, Bile esculin agar, MacConkey agar, mannitol salt agar and also identified on the basis of characteristic growth appearance.

c) **Biochemical identification**: The isolated bacterial colonies can be confirmed by biochemical tests.

Table 2: Pharmacological uses of some common fruits and vegetables

S. No.	Sample	Marker compound (Category)	Pharmacological uses
1.	Tomato	Lycopene (Carotenoid)	Cancer, diabetes, atherogenesis, eye disease[7].
2.	Pomegranate	Gallic acid (Phenolic acid)	Cancer, inflammation, menorrhagia[8].
3.	Apple	Quercetin (Flavonoid)	Microbial, viral infections, cancer, heart disease, diabetes, inflammation[9].
4.	Orange	Hesperidin (Flavonoid)	Inflammation, analgesia, hypertension, cancer[10].
5.	Capsicum	Capsaicin (Capsaicinoid)	Obesity, various cancers, cardiovascular and gastrointestinal conditions[11].
6.	Spinach	Quercetin (Flavonoid)	Microbial, viral infections, cancer, heart disease, diabetes, inflammation[9].
7.	Peppermint	Hesperidin (Flavonoid)	Inflammation, analgesia, hypertension, cancer[10].
8.	Red chilli	Capsaicin (Capsaicinoid)	Obesity, various cancers, cardiovascular and gastrointestinal conditions[11].
9.	Cucumber	Oleic acid (Fatty acid)	Cancer, autoimmune, inflammatory disease[12].
10.	Papaya	Lycopene (Carotenoid)	Cancer, diabetes, atherogenesis, eye disease[7].

Advantages and disadvantages of microbes present in fruits and vegetables

E.coli
Advantages of *E.coli*
>It improves immune system.
>It prevents many intestinal complications.
>It has ability to boost digestion[13].

Disadvantage of *E.coli*
E.coli causes severe stomach cramps, diarrhea, vomiting, slight Fever[14].

P. aeruginosa
Advantage of *P. aeruginosa*
It is used as biocontrol agents and bioremediation agents[15].
Disadvantage of *P. aeruginosa*
It may cause urinary tract infections, burns, wounds and other blood infections[16].

B. cereus:
Advantages of *B. Cereus*
>It reduces antibiotic-induced microbiota disturbance
>It stabilizes immune modulation.
>It enhances gut function and stability.
>It improves digestion and nutrient absorption[17].

Disadvantage of *B. cereus*
It may cause diarrhea, bloating, cramps, rashes and acne[18].

K. pneumonia
Disadvantages of *K. pneumonia*
>*Klebsiella pneumoniae* can cause bronchial pneumonia.
>It can also cause UTI[19].

S. aureus
Disadvantages of *S. aureus*
>It may cause minor skin infections such as pimples and boils.
>It may toxic shock syndrome (TSS), pneumonia and meningitis[20].

Influence of storage conditions on food products

There have been several researches and reports that states that influence of storage conditions mainly temperature and humidity on food products (vegetables and fruits). By increasing temperature, bioactive constituents of vegetables and fruits get destroyed and even they become poisonous. Therefore, these products should be studied for their proper storage temperature conditions so as to protect their useful ingredients/ constituents.

DISCUSSION

The increasing consciousness in people regarding the nutrition has resulted in the consumption of raw fresh unprocessed vegetables and fruits. A number of diseases out breaks due to consumption of these produce have been reported[21, 22]. Physical hazards that contaminated fruits and vegetables during production or handlings are likely to be removed by proper washing and rinsing by suitable antimicrobial agents to reduce contamination before consuming. Hydrogen peroxide (2.5% and 5%), ethanol, benzoate citrate and calcium chloride reduce surface micro flora up to 80%. Therefore, use of hydrogen peroxide as rinsing agent for fresh fruits and vegetables can play an important role in food safety[23].

CONCLUSION

The presence of pathogenic micro flora on the surface of fresh fruits and vegetables indicates the necessity for observing hygienic conditions during production because such type of contamination can occur from water, soil, waste and humans. Bacterial contamination may be present due to improper handling, unhygienic transportation condition and improper storage. Other source may be the result of post harvesting and unhygienic distribution. Therefore, all control measures must be taken to avoid food spoilage or food borne infections.

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