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Physico-Chemical Andmicrobial Quality And Charecteristics Of Street Vended Fruit Juices A Review

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Abstract

Street vended fruit juices are on high demand because of their nutritive value and mineral and vitamin content but the concern on food safety is very high. There is little evidence for the association between fruit juice, especially 100% fruit juice, and mortality risk. In addition, whether 100% fruit juice can be a healthy alternative to whole fruit remains uncertain. This study is aimed to detect different food borne micro-organisms along with Physico-chemical characteristics of freshly prepared street vended fruit juices (orange, pineapple, grape, mixed fruit juices). A total of 100 juice samples from five different places stalls of Pulivendla were collected and examined for their physic -chemical properties and for their microbiological quality. Physico-chemical properties of fruit juices include pH, Titrable acidity and TSS,ash, total soluble solid, total sugar, reducing sugar and titrable acidity, vitamins and microorganisms.

Key words: Street vended fruit juices, micro-organisms, physic-chemical characters.

Introduction

India produces about 9 million tons of fruits every year. The total market potential for fruit juices includes both packed and freshly made fruit juices. Fruit juice is considered the most popular nonalcoholic beverage among all age groups due to its fresh flavor and nutritive value.These juices provide a lot of growth factors—vitamins and minerals to the body, which has increased their consumption in the recent times.Juices are fat-free and contain naturally occurring phytonutrients contributing to better health, e. g., vitamin C in orange juice acts as an antioxidant photochemical and improves the blood lipid profiles in hypercholesteromic patients and play important role in detoxification[1]. The major ingredients of juice are water, sugar, and fruit pulp.water, and ice. The final product is unfermented and unpasteurized for consumption.

Juice can be contaminated at any step of preparation. There are several factors that act as source of contamination like use of unhygienic water, flies, airborne dust, contaminated raw materials and equipment, improper handling, and unhygienic working environment. Such juices are the potential sources of microbes like *Escherichia* .Such juices are the potential sources of microbes like *Escherichia coli* O157:H7, *Salmonella* species, *Shigella* sp, *Staphylococcus aureus*, yeast. And their to survive in acidified vegetable products and fruits is of concern because of previously documented outbreaks associated with fruit juices

Materials and Methods

Sample collection total100 locally made and 10 branded fruit juice samples were collected from various places of Pulivendla city. Catering to different age groups and communities were various places. These are area 1.Bus stand,2.Vegetable market,3.Main market,4.Civil hospital.5.College areas.Samples were fresh fruit juices were picked up from at least 6 fruit juices apple, grapes,fine apple, watermelon,pine apple, sapota.All samples were collected sterile containers and examine physic-chemical characters and microbial examination.

1.Sapota juice

Sapota juice, also known as chiku or sapodilla juice, has unique physico-chemical properties that contribute to its nutritional and sensory characteristics. Here's an overview of some of its key physico-chemicalNutritional ProfileMicrobial charecters and physical properties.

1.1.Physico-chemical Characteristics

Sapota juice typically has a brownish to yellow-brown color. This is due to the presence of phenolic compounds and carotenoids. It has a sweet, malty flavor with hints of pear and brown sugar. The juice has a pleasant, fruity aroma. Sapota juice generally has a pH between 4.5 and 5.5, making it slightly acidic. The acidity level can affect its taste and preservation. The juice is naturally high in sugars, primarily fructose and sucrose. This contributes to its sweetness. The juice has a high Brix value (usually between 15 and 25), which indicates a high soluble solids content. The acidity is relatively low compared to other fruit juices, which complements its sweetness. Rich in vitamins like Vitamin C, Vitamin A, and several B-vitamins. Contains essential minerals such as potassium, calcium, and magnesium. Sapota juice has a relatively thick, creamy texture due to its high pectin content and soluble solids. Total Soluble Solidsis high in sputa juice due to its sugar content. It is often measured using a refract meter. Fresh sapota juice may have a shorter shelf life due to its high sugar content and lower acidity, which can affect microbial stability. Pasteurization or refrigeration can help extend its shelf life. High in calories due to its sugar content. Contains dietary fiber, which can aid in digestion. These properties contribute to the distinct sensory experience and nutritional profile of sapota juice, making it a popular choice for its natural sweetness and health benefits.

1.2. Nutritional Profile

Sapota nutritive values are Calories: 150–180 kcalCarbohydrates: 35–45 sugar: 30–35 g (natural fruit sugars)Dietary Fiber: 4–6 g (if pulp is retained)Protein: 1–2 fat: 1–2 saturated Fat: 0.5 g (very low)Monounsaturated Fat: ~0.2 polyunsaturated Fat: ~0.1 vitamin C: 25–30 mg (around 30-40% of the daily

value)Vitamin A: 60–80 IU (1-2% of the daily value)Potassium: 300–350 mg (about 8-10% of the daily value)Magnesium: 10–15 mg Calcium: 20–25 mg Iron: 0.5–1 mg and High in fiber: Helps with digestion and promotes gut health. Rich in antioxidants: Contains vitamins C and A, which help in boosting the immune system and reducing oxidative stress. Good source of potassium: Helps in maintaining electrolyte balance and promoting heart health. Energy-boosting: The natural sugars in sapota juice provide quick energy.Sapota juice is naturally sweet, so it may not require additional sweeteners. However, because of its relatively high sugar content, it should be consumed in moderation, especially by those monitoring their sugar intake.

1.3. Microbial characters

Sapota (chiku) can be a medium for microbial growth if not handled or processed properly. Here's a breakdown of the microbial characteristics and considerations associated with sapota: Fresh sapota can harbor a variety of microorganisms on its surface, including bacteria, yeasts, and molds. Common bacterial genera include *Pseudomonas, Enterobacter,* and *Bacillus*. Yeasts and molds such as *Aspergilla's* and *Penicillium* can also be present. Pathogenic bacteria such as *Salmonella, E. coli,* and *Listeria* can sometimes be found, though they are not commonly associated with sapota. These can cause spoilage and off-flavors. *Candida* and *Rhodotorula* are examples of yeast that might be found on sapota. Molds like *Aspergilla's* and *Penicillium* can grow on decaying or overripe fruits. The slightly acidic pH of sapota juice (4.5 to 5.5) is somewhat inhibitory to many pathogenic bacteria but can support the growth of certain yeasts and molds.High sugar content can inhibit the growth of some microorganisms but can also provide a suitable environment for osmotolerant yeasts and molds.During processing and packaging, sapota juice can become contaminated from equipment, handling practices, or storage conditions. Proper pasteurization, refrigeration, and hygienic handling are crucial to control microbial contamination and extend shelf life.Regular microbial testing is essential in commercial production to ensure safety and quality. This includes testing for total microbial counts, yeast and mold counts, and the presence of pathogenic bacteria. Good sanitation practices in handling, processing, and packaging are critical to minimize microbial contamination.Signs of microbial spoilage in sapota juice include off-flavors, off-smells, and changes in color. The presence of gas bubbles or cloudiness might also indicate microbial activity. Without proper preservation, sapota juice can spoil relatively quickly due to microbial growth. Pasteurization and refrigeration help prolong its shelf life by controlling microbial populations [2].

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1.4. Physical Stability

Oranges have a relatively long shelf life when stored properly, typically several weeks to a couple of months. The shelf life can be extended through refrigerate. Oranges do not continue to ripen significantly after harvest, so the timing of harvest is crucial. They are best stored in a cool, dry place or refrigerated to maintain freshness

2.Pomegranate juice

Pomegranate (Punica granatum) is known for its unique flavor, color, and nutritional profile. Here's a detailed look at the physico-chemical characteristics of pomegranates, nutritional profile,microbial charecters and physical propertiesincluding both the fruit and its juice:

2.1.Physico-chemical Characteristics

Ranges from reddish to deep purple, depending on the variety and ripeness. Typically red to pinkish-red; the color can vary slightly based on the variety and mat generally round with a hard outer skin. Size varies, but it is usuallybetween 7 to 12 cm in diameter. Juicy, gem-like structures inside the fruit. Tough and leathery.Juicy and slightly crunchy with a firm texture. Pomegranate juice typically has a pH between 2.8 and 3.5, making it acidic. Pomegranate juice usually has a high TSS value, ranging from 15% to 20%, indicating a high concentration of sugars and other soluble compounds. Primarily consists of fructose and glucose, contributing to its sweet flavor. The sugar content is generally high, with total sugars ranging from 13% to 20% in the juice. The juice has a relatively high acidity due to organic acids, primarily citric acid, and to a lesser extent, malic acid. Rich in Vitamin C, Vitamin K, and several B-vitamins. Contains potassium, calcium, magnesium, and phosphorus. High in antioxidants such as allergic acid, tannins, and anthocyanin's, which contribute to its health benefits and color. Pomegranate juice is rich in polyphenols, which are associated with various health benefits.

2.2. Nutritional Profile

Pomegranate juice is relatively high in calories due to its sugar content, with approximately 80-100 calories per 100 ml.The fruit contains dietary fiber, although the juice is relatively low in fiber compared to the whole fruit. Pomegranate juice has a tart and sweet flavor profile with a distinct fruity taste.It has a pleasant, fruity aroma with hints of berry-like notes.[1]

2.3. Microbial Characteristics

Due to its high acidity, pomegranate juice has some inherent antimicrobial properties, but it can still be susceptible to microbial contamination if not processed or stored properly. Pasteurization and refrigeration are commonly used to extend shelf life and ensure microbial safety

2.4. Physical Stability

Pomegranate juice can ferment or spoil if not stored correctly. The shelf life is influenced by factors such as pasteurization, packaging, and storage conditions. The juice has a relatively low viscosity, although this can be affected by the concentration of dissolved solids and the presence of pulp.

3. Apple juice

Apples (Malus domestica) are one of the most widely consumed fruits globally, and they have a range of physico-chemical and microbial characteristics that affect their quality, safety, and storage. Here's an overview of these characteristics:

3.1. Physico-chemical Characteristics

Varies from green to yellow to red, depending on the variety and ripeness. Some apples may have a combination of these colors. Typically white to cream-colored. Generally round or slightly oblate, with size varying from small (about 5 cm in diameter) to large (about 10 cm in diameter).Smooth to slightly Crisp and juicy when fresh, though it can become mealy or soft over time. Apples generally have a pH between 3.0 and 4.0, making them acidic. Total SolubleSolids is commonly measured using a refract meter and is typically between 10% and 16%, indicating the concentration of sugars and other soluble compounds. Mainly consists of fructose, glucose, and sucrose. Sugar content can range from about 8% to 15% depending on the variety and ripeness Apples contain organic acids, predominantly malic acid, contributing to their tartness. Titratable acidity typically ranges from 0.5% to 1.5%.Rich in Vitamin C and contains small amounts of Vitamin A and several B-vitamins. Includes potassium, calcium, and magnesium.Apples contain various antioxidants, including quercetin, catechins, and chlorogenic acids, which contribute to their health benefits.

3.2. Nutritional Profile

Apples are relatively low in calories, with about 50-60 calories per 100 grams. High in dietary fiber, particularly in the skin, with around 2-4 grams per 100 grams of fruit. This includes both soluble (pectin) and insoluble fibers. Apples have a range of flavors from sweet to tart, depending on the variety. Common flavor notes include fruity, floral, and sometimes spicy or woody.Apples have a fresh, fruity aroma that varies among varieties, with some having more pronounced floral or spicy notes.

3.3. Microbial Characteristics

Apples can harbor natural microbes on their surface, including bacteria, yeasts, and molds. Common bacteria include *Pseudomonas* and *Xanthomonas*. Yeasts and molds such as *Penicillium* and *Aspergillus* can also be found. While less common, pathogens such as *Salmonella*, *E. coli*, and *Listeria* can occasionally be found on apples, particularly if there is contamination during harvesting or handlin[3].Apples can become contaminated from soil, water, or during handling. Proper washing and sanitation are essential to reduce microbial contamination.Apple juice, due to its low pH and sugar content, can be a good medium for microbial growth if not processed properly. Pasteurization is commonly used to ensure safety and extend shelf life[4].

3.4. Physical Stability

Apples have a relatively long shelf life compared to some fruits. The shelf life can be affected by storage conditions (temperature, humidity) and the apple variety. Refrigeration extends shelf lifeby slowing down ripening and microbial growth. Apples continue to ripen after harvest, leading to changes in texture and flavor. Ethylene gas plays a key role in this process.

4.Orange juice

Oranges (Citrus sinensis) are renowned for their refreshing taste and high vitamin C content. Their physico-chemical and microbial characteristics significantly influence their quality, safety, and shelf life. Here's an overview of some of its key physico-chemicalNutritional Profile Microbial charecters and physical properties.

4.1. Physical Characteristics

Typically orange, but can also be greenish or yellowish depending on ripeness and variety. Usually orange, although some varieties may have a yellowish or pinkish hue. Generally round, ranging in size from small (about 6 cm in diameter) to large (about 10 cm in diameter).Thick and leathery, with a porous texture due to oil glands. Juicy and segmented, with a firm, fibrous texture. Oranges typically have a pH between 3.0 and 4.0, making them acidic.Total soluble solids is measured using a refract meter and usually ranges from 8% to 12%, indicating the concentration of sugars and other soluble compounds. The juice is rich in fructose, glucose, and sucrose. Sugar content generally ranges from 8% to 12% in orange juice. Oranges have a relatively high acidity primarily due to citric acid. Titratable acidity typically ranges from 1.0% to 2.0%..Extremely high in Vitamin C (ascorbic acid), with a content ranging from 40 to 60 mg per 100 grams of fruit. Also contains Vitamin A, Vitamin B1 (thiamine), Vitamin B2 (riboflavin), and Vitamin B9 (folate).Contains potassium, calcium, magnesium, and phosphorus. Rich in antioxidants such as flavonoids (e.g., hesperidin, naringenin) and carotenoids (e.g., beta-carotene).

4.2.Nutritional Profile

Oranges are relatively low in calories, providing about 40-50 calories per 100 grams. Provides dietary fiber, particularly in the form of pectin, which aids in digestion. A medium-sized orange typically contains about 2.4 grams of fiber. Oranges have a sweet and tangy flavor, which can vary slightly depending on the variety. The flavor profile includes fruity and citrusy notes. The aroma is fresh, fruity, and citrusy, often described as vibrant and invigorating[5]

4.3. Microbial Characteristics

Oranges can harbor various microorganisms on their surface, including bacteria, yeasts, and molds. Common bacteria include *Pseudomonas*, *Bacillus*, and *Enterobacter*. Yeasts and molds such as *Penicillium* and *Aspergillus* can also be present. While less common, pathogens like *Salmonella*, *E. coli*, and *Listeria* can occasionally be found on oranges, particularly if there is contamination during harvesting or handling.

Contamination can occur from soil, water, or during handling. Proper washing and sanitation are essential to reduce microbial contamination. Orange juice is acidic, which provides some resistance to microbial growth. However, it can still be susceptible to spoilage if not processed properly. Pasteurization is commonly used to kill harmful microorganisms and extend shelf life[6].

4.4.Physical Stability

Oranges have a relatively long shelf life when stored properly, typically several weeks to a couple of months. The shelf life can be extended through refrigerate. Oranges do not continue to ripen significantly after harvest, so the timing of harvest is crucial. They are best stored in a cool, dry place or refrigerated to maintain freshness.

5.Grapes juice

Grapes (Vitis vinifera) are a popular fruit known for their sweetness and versatility in products like wine, juice, and raisins. Here's a detailed overview of their physico-chemical and microbial characteristics:

5.1.Physico-chemical Characteristic

Can range from green to red to purple or black, depending on the variety and ripeness.Usually greenish or translucent, although it can be darker in certain varieties.Typically round or oval, with sizes varying between small (about 1-2 cm in diameter) and large (up to 3 cm in diameter). Grapes grow in clusters.Smooth and often covered with a natural waxy bloom.Juicy and tender, with a slightly crisp texture. Grapes generally have a pH between 3.0 and 4.0, making them acidic.Total Soluble Solidsis typically measured using a refractometer and ranges from 15% to 25%, indicating a high concentration of sugars and other soluble compounds.Grapes contain mainly fructose, glucose, and some sucrose. Sugar content varies with ripeness and variety, typically ranging from 15% to 25%. Grapes contain organic acids, primarily tartaric acid, malic acid, and citric acid. Titratable acidity usually ranges from 0.5% to 1.0%. Contains Vitamin C and small amounts of Vitamin K, Vitamin B6, and riboflavin. Includes potassium, calcium, magnesium, and phosphorus.Rich in antioxidants such as flavonoids (e.g., quercetin) and resveratrol. The skin, in particular, contains high levels of polyphenols.Present in red and black grape varieties, contributing to their astringency.[7]

5.2.Nutritional Profile

Grapes are relatively low in calories, with about 60-70 calories per 100 grams. Grapes contain dietary fiber, mainly in the skin, with about 0.9 grams per 100 grams of fruit. Grapes have a sweet and sometimes tart flavor, which can vary depending on the variety. Flavor notes include fruity, floral, and sometimes musky or earthy.The aroma is generally fresh and fruity, with a pleasant, grape-like scent[8].

5.3.Microbial Characteristics

Grapes can harbor a range of microorganisms on their surface, including bacteria, yeasts, and molds. Common bacteria include *Pseudomonas* and *Bacillus*. Yeasts and molds such as *Aspergillus* and *Penicillium* are also present.Pathogens such as *Salmonella*, *E. coli*, and *Listeria* can occasionally be found, especially if contamination occurs during harvest or handling.Grapes can become contaminated from soil, water, or during handling. Proper washing and sanitation are essential to minimize microbial contamination. Grapes and their derivatives like juice and wine can be susceptible to spoilage if not handled correctly. Wine, in particular, is susceptible to microbial contamination if not properly fermented or aged. Pasteurization for grape juice and proper fermentation techniques for wine are critical to ensuring microbial safety and extending shelf life.

5.4.Physical Stability

Grapes have a relatively short shelf life and can deteriorate quickly if not stored properly. They typically last about 1-2 weeks when refrigerated. Grapes do not continue to ripen significantly after harvest, so they should be picked at the right maturity level. Proper storage in a cool, dry place or refrigerated helps maintain freshness[9].

6. Watermelon juice

Watermelon (Citrulluslanatus) is a popular fruit known for its refreshing taste and high water content. Here's a comprehensive overview of its physico-chemical,nutritional,microbialand physical stability characteristics:

6.1.Physico-chemical Characteristics

Typically green with dark green or light green stripes. The skin can be smooth or slightly rough.Usually bright red or pink, though there are varieties with yellow or orange flesh.Generally large and round or oblong, with sizes varying from small (about 1-2 kg) to large (up to 10 kg or more).Thick and tough, with a waxy surface.Juicy and crisp, with a high water content that makes it refreshing. The texture is typically firm but tender.Watermelon has a pH between 5.2 and 5.8, making it slightly acidic to neutral.Total Soluble Solids is measured using a refractometer and generally ranges from 8% to 12%, reflecting the concentration of sugars and other soluble compounds.Primarily consists of fructose, glucose, and sucrose. Sugar content typically ranges from 6% to 10%, contributing to its sweet flavor.Watermelon has relatively low acidity compared to many fruits, with titratable acidity usually ranging from 0.1% to 0.2%.Contains Vitamin C and small amounts of Vitamin A, Vitamin B6, and folate.Includes potassium, magnesium, and small amounts of calcium and phosphorus.Watermelon is rich in lycopene, an antioxidant responsible for its red color and associated with various health benefits.Containscitrulline, an amino acid that may have beneficial effects on blood flow and exercise performance[9].

6.2.Nutritional Profile

Watermelon is low in calories, with about 30 calories per 100 grams of fruit.Contains a small amount of dietary fiber, primarily in the form of insoluble fiber, with about 0.4 grams per 100 grams of fruit.Watermelon has a sweet, mildly tangy flavor, with a refreshing and hydrating taste.The aroma is subtle, fruity, and fresh, with a hint of melon-like scent[10].

6.3.Microbial Characteristics

Watermelons can harbor various microorganisms on their surface, including bacteria, yeasts, and molds. Common bacteria include *Pseudomonas*, *Bacillus*, and *Enterobacter*. Yeasts and molds like *Aspergillus* and *Penicillium* can also be present.Pathogens such as *Salmonella*, *E. coli*, and *Listeria* can occasionally be found, especially if there is contamination during harvesting or handling.Contamination can occur from soil, water, or during handling. Proper washing and sanitation are essential to reduce microbial contamination.Watermelon juice can be susceptible to microbial contamination if not processed properly. It requires pasteurization or proper storage conditions to ensure safety and extend shelf life[11].

6.4.Physical Stability

Watermelon has a relatively short shelf life, typically around 1-2 weeks when stored at room temperature and up to 3-4 weeks if refrigerated. The shelf life can be affected by storage conditions and handling practices.Watermelons do not continue to ripen significantly after harvest[12]. They should be harvested at full maturity for optimal flavor and sweetness. Proper storage in a cool, dry place or refrigerated helps maintain freshness and prevent spoilage.

Conclusion

Sapota, like many fruits, requires careful handling and processing to ensure it is free from harmful microorganisms. Effective measures such as proper sanitation, pasteurization, and appropriate storage conditions are essential to maintaining the safety and quality of sapota juice. Pomegranate is a fruit with distinctive physico-chemical characteristics that contribute to its flavor, color, and health benefits. Its acidic pH, high sugar content, and rich antioxidant profile make it a unique and valuable fruit in both culinary and nutritional contexts. Apples are valued for their diverse range of physico-chemical properties, including their acidity, sweetness, and rich antioxidant content. Their microbial characteristics require attention to ensure food safety, particularly in processing and handling to avoid contamination. Proper storage and handling can help maintain their quality and extend their shelf life.Oranges are characterized by their acidic pH, high sugar content, and rich vitamin C and antioxidant profiles. Their microbial characteristics require careful handling to prevent contamination, especially in processing and storage. Proper sanitation and processing practices, such as pasteurization for orange juice, are essential for ensuring safety and extending shelf Grapes are characterized by their acidic pH, high sugar content, and rich antioxidant profile. Their microbial characteristics require careful handling to prevent contamination, particularly in processing and storage.

Proper washing, sanitation, and processing techniques are essential for ensuring the safety and quality of grapes and their derivatives like grape juice and wine. Watermelon is characterized by its high water content, mildly acidic pH, and sweet flavor. Its microbial characteristics require careful handling to avoid contamination, especially in processing and storage. Proper sanitation and storage practices are crucial for maintaining the fruit's quality and safety.

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