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# Comparative study of fresh fruit juices And marketed fruit juices

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***Abstract :*** The present study experimentally investigated which kind of fruit juice is healthiest for consumption Freshly extracted juices obtained from organically produced farms. Detected the amount of benzoic acid, ascorbic acid, sugar content, acid value, viscosity, density present in the different fruit juices. Bacterial count characterized on the basis of some biochemical tests. The fruit juices that were tested included apple, orange, mango, strawberry. As well as Determination of the degree of maturity of fruits and best quality fruit juice. Our results clearly proven that Natural fruit juices are more healthy than marketed juices which contains more sugar and preservatives

**Keyword**: -Sugar Content Analysis fresh fruit juices, market fruit juice, health juice

## INTRODUCTION

India is a market of diversity diverse with regards to income, price points of products, cultureand preferences and a marketer has to get use of these diverse characteristics of the market. Drinking juice is not a part of our culture. We drink water with our meal but in the West onestarts the day with breakfast and a glass of juice. Juice is to a great extent considered as a luxury not a necessity in our society, surely but slowly things are changing mainly in the urban and semi urban area, where the population is getting more and more health conscious and are realizing the important nutrient values of fruit and are making them a part of their daily diet. The companies in this Rs. 100 crore industry will have to organize various promotional activities from time to time mainly to increase sampling and to educate the consumers about packaged fruit juice that it is as pure and nutritious as fresh juice which is perceived as fresh as it is extracted in their presence i.e. actual or assumed. There are two main brands in this segment of non- carbonated drink markets; they are 'Real' from Dabur and 'Tropicana' from PepsiCo. These two players command around 80% market share in the organized sector. We can observe this industry is growing and new ones entering the market. In recent times we have seen the entries of some international brands. Fruit juice market has not been fully tapped because of poor infrastructure, poor storage facility, and highly organized market, chiefly constituted by road side vendors. Consumer still prefers to buy juices from road side vendorseven if juices are unhygienic. The major growth drivers in fruit juice market are, increase in health consciousness among consumers, increase in disposable incomes, and more sophisticated cocktail culture. Leading Manufacturers of Fruit Beverages in India:

| Company | Brand | Flavours |
|---|---|---|
| Parle Agro | Frooti | Mango, Guava, Pineapple, Strawberry and Orange |
| | Appy | Apple |
| PepsiCo Ltd. | Tropicana | Orange, Apple, Grape,Pineapple, |
| | Slice | Mango, Litchi, Orange |
| Dabur | Real | Orange, Mango, Pineapple,Litchi |
| Coca Cola | Maaza | Mango |
| Godrej Foods | Jumpin | Orange, Apple. |

Fruits contain many beneficial qualities to one's health; they provide an abundance of vitamins, minerals, anti-oxidants and fibers, which are all essential for the human diet. Manypeople consume fruit juices on a daily basis. Fruit juices are a convenient way for people to receive the benefits of various fruits. India is the second largest producer of fruits in the world which accounts for 30 million tones.Fruit juices are popular worldwide with children of all ages as they are sweet and perceived to be healthful. Fruit juices are marketed aggressively and are promoted as a "health drink".

Parents are aware of the deleterious effect of the various carbonated beverages on the teeth, so they prefer more natural and healthful products such as fresh fruit juices which are easy toprepare at home and provide a good source of vitamin C. these elements are essential nutrients which are required for humans in very small amounts. They have a vital function toavoid deficiency diseases. The study was carried out to measure ph.

Fruit juice: - Juice is the liquid that is naturally contained in fruit or vegetable tissue. Juice is prepared by mechanically squeezing or macerating fresh fruits or vegetables flesh without the application of het or solvents. For example, orange juice is the liquid extract of the fruit of the orange tree. Juice may be prepared in the home from fresh fruits and vegetables using a variety of hand or electric juicers. Many commercial juices are filtered to remove fiber or pulp, but highpulp fresh orange juice is a popular beverage. Juice may be marketed in concentrate from sometimes

frozen, requiring the user to add water to reconstitute the liquid back to its 'original state'. However, concentrates generally have a noticeably different taste from that oftheir 'fresh squeezed' counterparts. Other juices are reconstituted before packaging for retail sale. Common methods for preservation and processing of fruit juices include canning, pasteurization, freezing, evaporation and spray drying.

Juice is commonly consumed as a beverage or used as an ingredient or flavoring in foods or other beverages, as for smoothies. Juice emerged as a popular beverage choice after the development of pasteurization methods enabled its preservation without using fermentation. The largest fruit juice consumers are New Zealand and Colombia.

**Orange juice** is the most consumed fruit juice in Europe and around the world [1] [2]. It is obtained from the endocarp of the orange (Citrus sinensis) fruit. Orange juice contains substantial amounts of several micronutrients such as vitamin C, folate and polyphenols (e.g.,hesperidin which is a flavanone) [3], and may therefore contribute significantly to their daily intakes. Orange juice is positively linked to achieving RECOMMENDED INTAKES OF VITAMIN C. Vitamin C contributes to normal collagen formation for the normal function ofbones, cartilage and blood vessels.

Orange juice is a source of potassium which contributes to normal muscle function and to themaintenance of NORMAL BLOOD PRESSURE. Orange juice contains FOLATE which contributes to MATERNAL TISSUE GROWTH during pregnancy, the normal function of the immune system, and the REDUCTION OF TIREDNESS AND FATIGUE. Throughout the world, a large percentage of the population – both of developmental age and adults – doesnot consume the amount of fruit and vegetables recommended by guidelines and scientific societies. Fruit juice consumption, which is higher in children, becomes gradually lower in adolescence; with the lowest consumption levels seen in adulthood.

**Apple juice** is a fruit juice made by the maceration and pressing of an apple (Malus pumila). The resulting expelled juice may be further treated by enzymatic and centrifugal clarification to remove the starch and pectin, which holds fine particulate in suspension, andthen pasteurized in industries to prepare marketed apple juice.

Apple juice is 88% water and 11% carbohydrate (including 9% sugars), with negligible content of protein and fat. A 100 ml reference is amount of unsweetened apple juice supplies46 calories and no significant content of any micronutrient. Apple juice can be useful for re hydrating when you are sick. Ita disease fighting compound may also protect your heart andbrain as you age.

Health benefits of apple juice:

- Heart health
- Asthma
- Detox
- Vitamins
- Cholesterol
- Cancer

**Mango juice** is made from endocarp of mango fruit (Mangifera indica).Thicker juice is oftencalled "mango nectar".A non-carbonated beverage flavored by the pulp from mangos. A mango is a tropical fruit that has a flavor which tastes like a blend of pineapple, apricot, and peach. The mango nectar has a delicate flavor that is both sweet and sour, much like the mango fruit. It is yellowish orange in color and has a smell that resembles a fresh mango.

Mango nectar is sometimes used as an ingredient to flavor mixed cocktails.

**Packed With Nutrients**

Calories: 99.
Protein: 1.4 grams.
Carbs: 24.7 grams.
Fat: 0.6 grams.
Dietary fiber: 2.6 grams.
Vitamin C: 67% of the Reference Daily Intake (RDI)
Copper: 20% of the RDI.
Folate: 18% of the RDI.

To process mango into juice drinks can prolong their shelf life, promote added value, increasefarmers' income, and enrich the fruit juice market. The mango juice production process covers sorting, peeling and destoning, softening, pulping, homogenization, degassing, sterilization, filling and packing, cooling.

**Benefits of mango juice:**

- Helps in digestion. Mangoes could help facilitate healthy digestion.
- Promotes Healthy Gut.
- Boosts Immunity.
- Promotes eye health.
- Lowers Cholesterol.
- Clears the Skin.
- Aids Weight Loss.

**Strawberry juice** is made from maceration of strawberry fruit (fragaria ananassa)

A strawberry juice drink is described along with a method of producing the drink. An enzyme is added to the pureed juice stock to reduce fiber length. Water is added to form amixture of between 25% and 45% water and between 55% and 75% pureed juice stock byvolume.

| | Value per glass | % Daily Values |
|---|---|---|
| Energy | 50 Cal | 2 % |
| Protein | 0.5 g | 1% |
| Carbohydrates | 11.6 g | 4% |
| Fibre | 1.8g | 7% |

The juicy fruit is also rich in vital minerals, such as potassium and phytonutrients—these sweet, yet tangy berries are wonderful when added to smoothies. A glass of strawberry juicewill provide your body with immune-boosting power and properties of polyphenols and antioxidants

**Difference between marketed fruit juice and fresh fruit juice:**

- Anything which is packed or processed means that it has a lot of sugar andpreservatives added in the product to enhance the life of the product.
- Thus for any fitness goal fitness regime or for a healthy lifestyle packed juices are nothealthy or suitable for anyone to consume since it contains a large amount of preservative and artificial flavours, independent it is a juice or a soda drink or anything, packed means added preservatives
- Fresh juices are the best natural drink anyone can consume since they do not containsany added sugar or artificial flavours in them for enhancement of their taste, also it isfree from added preservatives in them
- The only sugar they contains is sucrose which is a fruit sugar natural, which is goodfor health also fruit juices or orange juices provides a good amount of fibre and roughage to the body.

**Comparison of sugar content in marketed fruit juice and fresh fruit juice**:

- Fruits contain many beneficial qualities to one's health; they provide an abundance of vitamins, minerals, anti- oxidants and fibers, which are all essential for the human diet[4].
- Many people consume fruit juices on a daily basis. Fruit juices are a convenient way for people to receive the benefits of various fruits. However, they may also have highsugar content. Although the sugar is natural, it may not be healthy in high quantities. It was suggested that too much sugar could pose harmful health effects, as people could develop diabetes, obesity, heart disease, and other complications from excess consumption [5].
- Recently, companies have been marketing fruit juices with the "no sugar added" feature, in part, to ad- dress the concern of exceeding the daily-recommended intake for sugar. The comparison of the sugar content in freshly-extracted fruit juice with thesugar content in bottled 100% fruit juice claiming to have "no sugar added" is of interest for a number of reasons. It is important to know if the juices with the "no sugar added" claim truly represent the sugar content of juice extracted from the corresponding fresh fruit. If the sugar content in bottled fruit juice with the "no additional sugar" label is higher than that of freshly-extracted fruit juice, people may want to recon- sider the amount of commercially-bottled fruit juice they consume. Fructose is one of the most abundant sugars in fruit juice. Some people believe fructose is healthier than sucrose because it is found naturally in fruit, however it can be equally harmful [6]. Fructose, also known as fruit sugar, is a simple monosaccharide absorbed directly into the bloodstream during digestion.
- Fruits, vegetables, and honey are all natural sources of fructose. Three common formsof fructose are crystalline fructose, high-fructose corn syrup, and sucrose. Crystalline fructose is derived from corn, and has the highest concentration of fructose. High-fructose corn syrup is a combination of fructose and glucose. Sucrose is acompound of one molecule of glucose and one molecule of fructose[7] and is commonly referred to as table sugar[8].
- Excessive amounts of fructose consumption has been tied to negative health effects.

- The study reported in reached a number of conclusions as follows. Fructose is likelya primary cause of symptoms in certain patients with functional bowel disturbances. The ever-increasing occurrence of obesity, diabetes mellitus, and non-alcoholic fattyliver disease could be the result of excessive fructose intake as well. Finally, fructose may promote the formation of toxic advanced glycation end products, which maycontribute to diabetes, the aging process, and the thickening of artery walls.
- Excessive sugar consumption is an ongoing concern. It is therefore important to validate the claim of "no sugar added" appearing on 100% fruit juice bottles. Accordingly, an experiment was proposed to determine and to compare the level ofsugar content in freshly-extracted fruit juices to purchased 100% fruit juices with a"no sugar added" label as available to consumers in the USA.

**Composition of soft drinks and fruit juices in relation to spoilage:**

There is a bewildering variety of soft drink and fruit juices for sale, and many methods for their manufacture. Soft drinks can be non-carbonated, carbonated, with or without added fruitjuice, often with the addition of organic acid preservatives. They can be filled on standard or clean fill lines. Fruit juices, fruit juice concentrates and fruit nectars may be fresh, unpasteurized and clean filled, or pasteurized, then hot, aseptic, or clean filled (Stratford et al., 2000; Stratford and James, 2003). Recent technology using ultra-high pressure has been used to produce 'cold pasteurised fruit juices. These have the advantage of a fresh juice mouthfeel, but with destruction of pathogens and the majority of spoilage agents, enhancing the shelf life of an essentially fresh product (Mermelstein, 1999; Zook et al., 1999). Simple soft drinks such as orangeade and lemonade are too acidic for the growth of most organisms, so that spoilage is generally by carbonation-resistant species such as Dekkera anomala (Stratford and James, 2003). Yeasts usually require a carbon source such as a hexose sugar, anitrogen source such as amino acids or ammonium salts, simple salts (phosphate, sulphate, potassium and mag- nesium ions), trace minerals and vitamins. Some yeasts have particular sugar requirements; for example, Z.bailii and Z.rouxii cannot utilise sucrose (Pitt & Hocking,1997; Stratford et al., 2000). Sugars have a protective effect on the heat resistance of yeasts and bacteria; this is an important consideration at higher concentrations of sugar. Soft drinks are often nitrogen poor and thus the addition of fruit juice greatly enhances the potential for spoilage. Some yeasts, for example Dekkera bruxellensis, can use nitrate. Phosphate levels are often low, trace minerals satisfactory, particularly in hard water areas. The low pH value of soft drinks and fruit juices, pH 2.5–3.8 (Table 11.1), inhibits most bacteria, but leaves yeasts unaffected. In soft drinks and fruit juices, oxygen levels are usually low, and CO2 levels either low or very high (in carbonated soft drinks). Spoilage is therefore due to facultative anaerobes,

organisms that can grow with or without oxygen. In carbonated drinks,mould and bacterial growth is very unlikely as they are very sensitive to CO2.

**Examples of fruit juice pH and risk organisms**

| FRUITS | Approximate pH ranges | Risk organism |
|---|---|---|
| Apples | 2.9-3.91 | Yeasts |
| Oranges | 3.20-4.51 | Yeasts |
| Strawberries | 3.21 | Yeasts |
| Mango | 3.95-4.50 | Yeasts and bacteria |

Fruit juices are very lightly processed foods that are governed by a specific regulation within the European Un- ion: Council Directive 2001/112/EC, which has been transposed into French law by Decree 2003-838 and amended by Directive 2012/12/EU. This regulation defines three main types of products, depending on the fruit content and process: "fruit juice","fruit juice from concentrate" and "fruit nectar". Fruit juice is obtained by mechanical extraction (squeezing) of fruits harvested at maturity, followed by pasteurization. Fruit juice from concentrate is obtained in the same way except that the juice is concentrated through evaporation of natural water content. The juice is then restored by adding the same amount ofwater as was extracted from that juice during the concentration process. The concentration step is used to facilitate storage and transportation, and improve the environmental impact of the product. Fruit nectar is made by adding water to fruit juice or fruit purée, with or without sugar or artificial sweeteners. The minimal fruit content in fruit nectar should be 25% - 50%, depending on the type of fruit.

**ADULTERATION:**

The action of making something poorer in quality by the addition of another substance.

The adulteration of fruit juices and juice-based beverages is a serious economic problem[9].Juice adulteration has progressed from simple dilution with water and the substitution of cheap ingredients to highly sophisticated manipulations designed to mask the adulteration process. To improve the quality and self-life of the juices many additives are added into the juice during the process of manufacturing. Ascorbic acid is the natural component obtained in the fruit juice and Benzoic acid is added in the juice as preservatives to increase the life of the juice but using Benzoic acid with high ascorbic acid content is not recommended by the researchers.As a result of interaction of benzoic acid with ascorbic acid in fruit juice, under certain conditions a detectable level of benzene could be formed.Because benzene has shownto be carcinogenic, its potential formation in fruit juices during processing and storage shouldbe of some concern[10].

Over the years, several methods for adulterating juice have been used.Adulteration ranges in sophistication from simply diluting juice with water to adding beet sugar, the adulterant that is most difficult to detect.Introducing these ingredients is not illegal; however, knowingly selling the resulting product as pure juice constitutes fraud. Processors can increase their margin of profit or undercut competitors' prices to increase sales by adulterating juice and selling it as 100-percent-pure juice.Although these types of adulteration provide an economicadvantage (and are therefore referred to as economic adulteration), they pose little threat to the public's health and safety. The nutritional benefits of adulterated juices are generally

similar to those of their pure counterparts, and the adulterated products are usually consideredharmless except for customers who are allergic to a substituted ingredient.

The most common forms of adulteration that occur within the fruit juice industry usually take the form of juice dilution with water,addition of sugars, pulp wash or other additives andjuice-to-juice adulteration, defined as the undeclared addition of a juice of lesser value to a product, the addition of high fructose corn syrup (HFCS),[11]or the addition of other fruit juice[12].

**FOOD ADULTERATION:**

- Food Adulteration refers to the process by which the quality or the nature of a givenfood is reduced through addition of adulterants or removal of vital substance.
- Food adulterants refer to the foreign and usually inferior chemical substance presentin food that cause harm or is unwanted in the food.
- Basically, during food adulteration, small quantity of non-nutritious substances is added intentionally to improve the appearance, texture or storage properties of the food.
- Food adulteration is quite common in the developing countries.

**FOOD IS ADULTERATED:**

- The food sold does not meet the nature of the substance or quality as per the demandof consumer.
- The food contains inferior or cheaper substance.
- The food has been prepared, packed or kept under unclean conditions leading tocontamination.
- Food contains substances that depreciates or injuriously affects the health.
- If the food's original nature is substituted wholly or partially by abstracting a portionof vital substance from food.
- If it is an imitation of some other food substance.

**CAUSES OF FOOD ADULTERATION:**

- Profit motive of traders: Done as a part of the business strategy.
- Food insecurity: To increase quantity of food production and sales.
- Increased Urbanization: To make maximum profit from food items by fewer investments.
- High population demands: Increased food demand of the population and its changingtrends.
- Illiteracy of general public: Lack of consciousness of proper food consumption.
- Lack of effective food laws.
- Lack of government in initiative.

**METHODS OF FOOD ADULTERATION:**

- Mixing: Mixing of clay, stones, pebbles, sand, marble chips, etc.
- Substitution: Cheaper and inferior substances being replaced wholly or partially withgood ones.
- Concealing quality: Trying to hide the food standard. E.G. adding captions ofqualitative food to low quality for selling.
- Decomposed food: Mainly in fruits and vegetables. The decomposed ones are mixedwith good ones
- Misbranding/ False labels: Includes duplicate food stuffs, changing of manufactureand expiry dates.
- Addition of toxicants: adding non-edible substances like argemone in mustard oil, lowquality preservatives, colouring agents, etc.

**OBJECTIVES:**

1. To study what kind of fruit juice is healthiest for consumption (marketed or freshjuice).
2. To study the difference in various parameters of fresh fruit juice and marketed fruitjuice.
3. To identify the difference between the amount of benzoic acid and ascorbic acidpresent in the different fruit juices.
4. Determination of the degree of maturity of fruits.
5. Determination of best quality fruit juice.

**PLAN OF WORK:**

- **PREPARATION OF FRESH FRUIT JUICE**:

1. Cut a 100 g sample into small pieces and grind in a mortar and pestle.
2. Add 10 mL portions of distilled water several times while grinding the sample, eachtime decanting off the liquid extract into a 100 mL volumetric flask.
3. Finally, strain the ground fruit pulp through cheesecloth, rinsing the pulp with a few10 mL portions of water and collecting all filtrate and washings in the volumetric flask.
4. Make the extracted solution up to 100 mL with distilled water.

OR

1. Alternatively, the 100 g sample of fruit may be blended in a food processor togetherwith about 50 mL of distilled water.
2. After blending, strain the pulp through cheesecloth, washing it with a few 10mLportions of distilled water, and make the extracted solution up to 100 mL in a volumetric flask.

- **APPARATUS REQUIRED:**

Density bottle with stopper, weighing balance accuracy 0.001, g constant temperaturewater bath ($27^0$C) , beaker of varying size , Thiele's tube , capillary tube , liquid paraffin oil , dropper , conical flask , burette , stand , burner.

**INSTRUMENT:**

1. pH meter (DIGITAL pH METER MODEL EQ-610).
2. Brookfield Viscometer (AMETEK).
3. Abbe's refractometer (LABLINE)
4.

**PREPARATION OF SOLUTIONS:**

1) 0.1 M NaOH:
   - Weigh accurately 4gm NaOH and add in 1L distilled water and mix well.
2) 1M $H_2SO_4$:
   - Pour 3.7 mL concentrated sulfuric acid into 500 mL distilled water.
   - Dilute the solution to 1.0 litre.
3) 0.05N iodine:
   - Dissolved 10g of KI in about 350 mL of distilled water.
   - Add 6.35g of iodine($I_2$) and mix until all the iodine crystals have dissolved.
   - Transfer the solution into a 1000 mL volumetric flask and fill to the mark withdistilled water.
4) 0.05N NaOH
   - Place 2gm of NaOH in 1L volumetric flask and dilute upto the mark withdistilled water.

**METHODOLOGY.**

## 1- DENSITY OF SAMPLE.

(By density bottle method).

Density bottles are mainly used to determine the density of liquids of moderate viscosity. They are notvolumetric instruments, however, they are calibrated 'to contain' as in the case of volumetric flask[13].

Density bottle with stopper

**Procedure:**

1. Determine the weight of the dry and empty density bottle.
2. Fill the density bottle with one of the sample fruit juice, avoiding bubbles. The groundneck should be covered to about 1/3.
3. In a thermostatic bath, adjust the temperature of the bottle and contents to 20 °C.
4. Align the stopper respectively, the thermometer of the density bottle according to themarking, and insert carefully. The capillary tube fills up and the displaced liquid comes out.
5. Carefully dry the outer surfaces of the stopper (respectively, the side capillary) andthe density bottle with tissue.

   ATTENTION: Be careful not to remove any liquid from the capillary. The sampleliquid must be exactly level with the upper end of the capillary.

6. Determine the weight of the filled density bottle.

Calculate the density from the mass (weight) and the volume of the liquid at the referencetemperature of 20 °C. The volume is engraved on the bottle. Use the following equation:

DENSITY (P) = MASS (M)/VOLUME (V)

7. Note down the density obtained in the table below. Repeat the procedure again withremaining juice sample.

| DENSITY (gm/ml) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 1.132 | 1.229 |
| APPLE | 1.144 | 1.214 |
| ORANGE | 1.145 | 1.236 |
| STRAWBERRY | 1.131 | 1.23 |

Note: Calibrated density bottles have a unique identification number on all component parts. Only useparts with the same number together.

**2- $P^H$ OF SAMPLE.**

(Using pH meter).

How does a pH meter works?

An acidic solution has far more positively charged hydrogen ions in it than an alkaline one, so it has greater potential to produce an electric current in a certain situation,in other words, it's a bit like a battery that can produce a greater voltage. A pH meter takes advantage of thisand works like a voltmeter it measures the voltage (electrical potential) produced by the solution whose acidity we're interested in, compares it with the voltage of a known solution,and uses the difference in voltage (the "potential difference") between them to deduce the difference in pH.

The potassium chloride inside the glass electrode (shown here colored orange) is a neutral solution with a pH of 7, so it contains a certain amount of hydrogen ions ($H^+$). Suppose the unknown solution you're testing (blue) is much more acidic, so it contains a lot more hydrogen ions. What the glass electrode does is to measure the difference in pH between theorange solution and the blue solution by measuring the difference in the voltages their hydrogen ions produce. Since we know the pH of the orange solution (7), we can figure out the pH of the blue solution.

How does it all work? When you dip the two electrodes into the blue test solution,some of the hydrogen ions move toward the outer surface of the glass electrode and replace some of the metal ions inside it, while some of the metal ions move from the glass electrode into the blue solution. This ion-swapping process is called **ion exchange**, and it's the key to how glasselectrode works. Ion-swapping also takes place on the inside surface of the glass electrode from the orange solution. The two solutions on either side of the glass have different acidity, so a different amount of ion-swapping takes place on the two sides of the glass. This creates a different degree of hydrogen-ion activity on the two surfaces of the glass, which means a different amount of electrical charge builds up on them. This charge difference means a tiny voltage (sometimes called a potential difference, typically a few tens or hundreds of millivolts) appears between the two sides of the glass, which produces a difference in voltagebetween the silver electrode (5) and the reference electrode (8) that shows up as a measurement on the meter

Although the meter is measuring voltage, what the pointer on the scale (or digital display) actually shows us is a pH measurement. The bigger the difference in voltage between the orange (inside) and blue (outside) solutions, the bigger the difference in hydrogen ion activity between. If there is more hydrogen ion activity in the blue solution, it's more acidic than the orange solution and the meter shows this as a lower pH; in the same way, if there's less hydrogen ion activity in the blue solution, the meter shows this as a higher pH (more alkaline).


**PROCEDURE:**

1. The pH meter is calibrated with solutions of known pH, typically before each use.
2. To measure the pH of the juice sample,fill the sample in the beaker and dip the electrode in the beaker and held there sufficiently long for the hydrogen ions in thetest solution to equilibrate with the ions on the surface of the bulb on the glass electrode.
3. This equilibration provides a stable pH measurement.
4. Note the pH observed in the table below and using same method identify the pH of allthe sample juices.

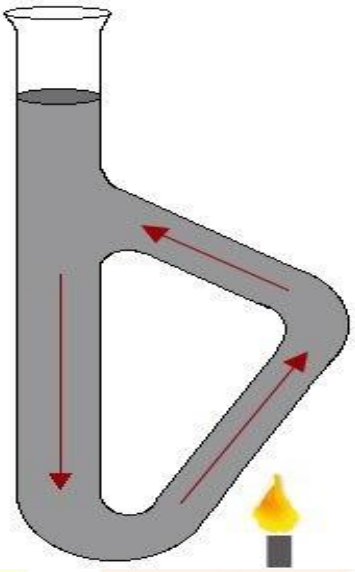
| pH READING. | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 4.68 | 3.30 |
| APPLE | 4.54 | 3.49 |
| ORANGE | 4.49 | 3.63 |
| STRAWBERRY | 4.08 | 3.84 |

**3- BOILING POINT.**

(Using Thiele's tube)

***Boiling point*** of the liquid is the temperature at which liquid starts boiling.

The ***Thiele's tube*** is a laboratory glassware designed to contain and heat an oilbath. Such a setup is commonly used in the determination of the melting point or boiling point of a substance.The apparatus itself resembles a glass test tube with an attached handle.



Principle:

Oil is poured into the tube, and then the "handle" is heated, either by a small flame or some otherof convection currents in the oil when it is heated. These currents maintain a fairly uniform temperature distribution throughout the oil in the tube. The side arm of the tube is designed to generate these convection currents and thus transfer the heat from the flame evenly and rapidly throughout the heating oil. The sample, packed in a capillary tube, is attached to the thermometer, and held by means of a rubber band or a small slice of rubber tubing. The Thiele tube is usually heated using a microburner with a small flame.

**Procedure:**

1. The juice sample is filled in a fusion tube and it is attached to a thermometer with arubber band and immersed in the tube.
2. A sealed capillary, open end pointing down, is placed in the fusion tube.
3. The Thiele tube is heated, dissolved gases evolve from the sample first.
4. Once the sample starts to boil, heating is stopped, and the temperature starts to fall.
5. The temperature at which the liquid sample is sucked into the sealed capillary is theboiling point of the sample.
6. Report the boiling point of all the sample in the table below.

| BOILING POINT (°C) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 120 | 106 |
| APPLE | 116 | 111 |
| ORANGE | 117 | 109 |
| STRAWBERRY | 112 | 105 |

**4-VISCOSITY.**

(By using Brookfield Viscometer).


Viscosity is measure of fluid's resistance toflow[14][15].
It is to drive a spindle ( which is immersed in thetest fluid ) through a calibrated spring. The viscous drag of the fluid against the spindle is measured by the spring deflection. Spring deflection is measured with a rotary transducer.

**Principle:**
Brookfield viscometers employ the well-known principle of rotational viscometry; they measure viscosity by sensing the torque required to rotate aspindle at constant speed while immersed in the sample fluid. The torque is proportional to the viscous drag on the immersed spindle, and thus tothe viscosity of the fluid.The continuous rotation of the spindle allows uninterrupted measurements to be made over long periods of time-dependent fluid properties.The rate of shear the sample fluid is subjected to is constant, so the instrument is suitable for measuring Newtonian and non-Newtonian fluids.

To be able to measure the sample's viscosity in the Brookfield viscometer, the material needsto be stationary inside a container while the spindle moves while immersed in the fluid.
Another possible option is to move the container with a stationary spindle. Whatever option is being used, the material must be able to produce laminar flow over the spindle while moving. This is only possible with a low Reynolds Number.

**PROCEDURE:**

1. Switch on the system and Viscometer and callibrate the instrument (autozero).
2. Connect the selected spindle to the viscometer by screwing them to the lower shaft.The lower shaft should be hold in one hand and lifted up and the spindle should be screwed to the left.
3. Then select the speed for the spindle by first pressing either the UP or DOWN arrow keys, which will cause the area to the right of RPM (on the bottom line) to display thecurrently selected speed.
4. Press the UP or DOWN arrow key until the desired speed in displayed and thenrelease it.
5. Then press the AUTO RANGE key, which display the maximum calculated viscosity(full scale reading) which can be measured with the current spindle / speed setting.
6. If the viscosity of the test fluid is greater than the AUTO RANGE displayed, then "cP EEEE" and '%EEEE' will be displayed when operated with this test fluid.
7. Change either the spindle or speed to achieve a maximum accuracy with the autorange.
8. Pressing and holding the AUTO RANGE key during power on will enable theviscosity display read cPs or m.pas. 1 cPs = 1milli pascal.
9. Insert and center spindle in the test material until the fluid level is at the immersiongroove in the spindle shaft. Press the MOTOR ON / OFF key once to turn the motorON.
10. Allow time for the indicated reading to stabilize. For maximum accuracy, readingsbelow 10% torque must not be taken.
11. Press the MOTOR ON / OFF key once again to turn the motor OFF when changing aspindle / speed or changing samples.
12. Remove the spindle before cleaning and clean it after use.
13. Write down the values obtained of all the sample juice in the table below.

| VISCOSITY (poise) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 0.06 | 0.0037 |
| APPLE | 0.03 | 0.0021 |
| ORANGE | 0.0109 | 0.00345 |
| STRAWBERRY | 0.0174 | 0.00168 |

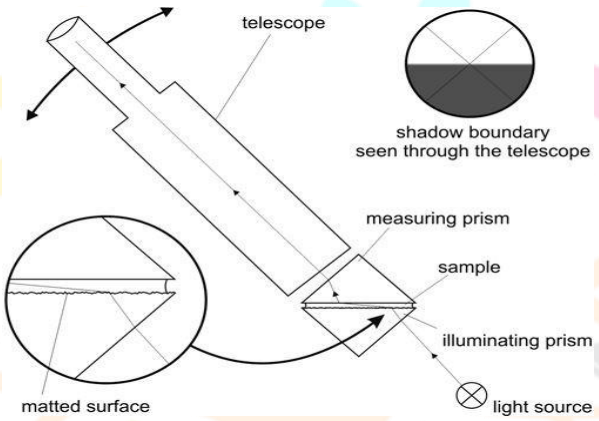
## 5- SUGAR CONTENT.

(Using Abbe's refractometer).

The concentration of sugar present in the juice sample was determined with the help ofAbbe's refractometer.

The refractometer [16], which optically measures the refractive index of juice, is the standard method used to measure SSC(solid sugar content) or TSS(total solid sugar) of fruit and vegetables. TSS or Brix represents the percentage by mass of total soluble solids of a pure aqueous sucrose solution. Several types of refractometers are available in the market, some ofwhich are based on either refraction or critical reflection of light. Of these, critical angle based refractive index refractometer is more suitable and accurate because it is not affected by suspended solids and color of sample. Because of this advantage, refractive index refractometer is used as a convenient method for measuring Brix of turbid colloidal fluids, such as fruit juices.

Abbe refractometer [17] working principle is based on critical angle.Sample is put betweentwo prisms - measuring and illuminating. Light enters sample from the illuminating prism,gets refracted at critical angle at the bottom surface of measuring prism, and then the telescope is used to measure position of the border between bright and light areas.




**PROCEDURE:**

1. Clean the prism using acetone or ethanol with help of cotton.
2. Pour the drop of sample juice on the prism using dropper and close the prism.
3. Rotate the scale slowly until half-light and half dark area is seen.
4. Report the reading obtained from the built-in scale by looking into the refractometer.

| SUGAR CONTENT (BRIX) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 1.390 | 1.351 |
| APPLE | 1.376 | 1.359 |
| ORANGE | 1.391 | 1.354 |
| STRAWBERRY | 1.372 | 1.353 |

## 6- ACID VALUE.

**(Acid-base titration).**

An acid–base titration is a method of quantitative analysis for determining the concentration of an acid or base by exactly neutralizing it with a standard solution of base or acid having known concentration[18].Titratable acidity is determined by neutralizing the acid present in a known quantity (weightor volume) of food sample using a standard base[19].The endpoint for titration is usually either a target pH or the color change of a pH-sensitivedye, typically phenolphthalein.

An acid-base titration using phenolphthalein as the indicator. The conical flask contained solution that justreached the endpoint.

**Procedure:**

1. 20ml of juice sample was allowed to rest for 24 hours to allow it's gases to evaporate.
2. 10ml of fruit juice was added in conical flask and titrated with 0.1M NaOH,usingphenolphthalein as an indicator.

$$\text{Calculation: X\% acidity} = \frac{\text{Titre x factor (0.007 gm citric acid) x 100}}{\text{Volume}}$$

The citric acid (monohydrate) content was calculated as % w/v$^{-1}$.1 ml of 0.1M

NaOH=0.007003gm citric acid (monohydrate).

| ACID VALUE (%acidity) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| **MANGO** | **0.287** | **0.357** |
| **APPLE** | **0.224** | **0.329** |
| **ORANGE** | **0.259** | **0.308** |
| **STRAWBERRY** | **0.203** | **0.315** |

## 7-DETERMINATION OF ASCORBIC ACID (VITAMIN-C).

(Using assay of ascorbic acid).

**Principle:**

This method determines the vitamin C concentration in a solution by a redox titration using iodine. Vitamin C, more properly called ascorbic acid, is an essential antioxidant needed bythe human body (see additional notes). As the iodine is added during the titration, the ascorbic acid is oxidised to dehydroascorbic acid, while the iodine is reduced to iodide ions.

ascorbic acid + I2 → 2 I− + dehydroascorbic acid

Due to this reaction, the iodine formed is immediately reduced to iodide as long as there is any ascorbic acid present. Once all the ascorbic acid has been oxidised, the excess iodine isfree to react with the starch indicator, forming the blue-black starch-iodine complex.

This is the endpoint of the titration[21].

**PROCEDURE:**

1. Dissolve 0.1gm of ascorbic acid (0.1ml of juice sample) in a mixture of 100ml freshlyboiled and cooled water and 25 ml of 1M $H_2SO_4$.
2. Immediately titrate with 0.05N iodine using starch solution as an indicator until permanent blue violet colour is obtained.
   1ml of 0.05M Iodine=0.008806gm of ascorbic acid.

| ASCORBIC ACID CONC. (mg/100ml) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 0.008 | 0.004 |
| APPLE | 0.006 | 0.003 |
| ORANGE | 0.011 | 0.004 |
| STRAWBERRY | 0.005 | 0.001 |

## 8- DETERMINATION OF BENZOIC ACID.

(Using assay of benzoic acid).

**Benzoic acid**, a white, crystalline organic compound belonging to the family of carboxylicacids, widely used as a food preservatives.

Principle:

Benzoic acid is separated from a known quantity of the sample by saturating with sodium chloride and then acidifying with dilute hydrochloric acid and extracting with chloroform. The chloroform layer is made mineral acid free and the solvent is removed by evaporation. The residue is dissolved in neutral alcohol and the amount of benzoic acid isdetermined by titration against standard alkali[[22].

**PROCEDURE:**

1. Pipette 100 ml of the filtrate into a 250 ml separatory funnel.
2. Neutralize to litmus paper using hydrochloric acid and add 5 ml excess. Extract
3. carefully with 40-, 30-, 30- and 20-ml portions of chloroform. Avoid formation ofemulsion by shaking gently with rotatory motion.
4. If emulsion forms, break it by stirring chloroform solution with a glass rod after eachextraction, but do not drain any of the emulsion with chloroform layer.
5. Transfer the combined chloroform extract in to a separatory funnel and wash it freefrom mineral acid by shaking gently and rinsing with water. Drain off the water phase.
6. Dry the chloroform layer over anhydrous sodium sulphate and distil off the solvent.
7. Dissolve residue in 30-50 ml of alcohol neutralised to phenolphthalein and titrate with 0.05 N sodium hydroxide.

Calculate the benzoic acid contents as follows:

$$\text{Benzoic acid (ppm)} = \frac{122\times \text{Titre}\times \text{Dilution}\times 1000 \times \text{ml of 0.05N sodium hydroxide}}{\text{Weight of sample} \times \text{aliquot taken (100 or 200ml of filtrate)}}$$

| BENZOIC ACID CONC.(gm/100ml) | FRESH JUICE | MARKETED JUICE |
|---|---|---|
| MANGO | 0.072 | 0.18 |
| APPLE | 0.084 | 0.156 |
| ORANGE | 0.108 | 0.06 |
| STRAWBERRY | 0.048 | 0.09 |

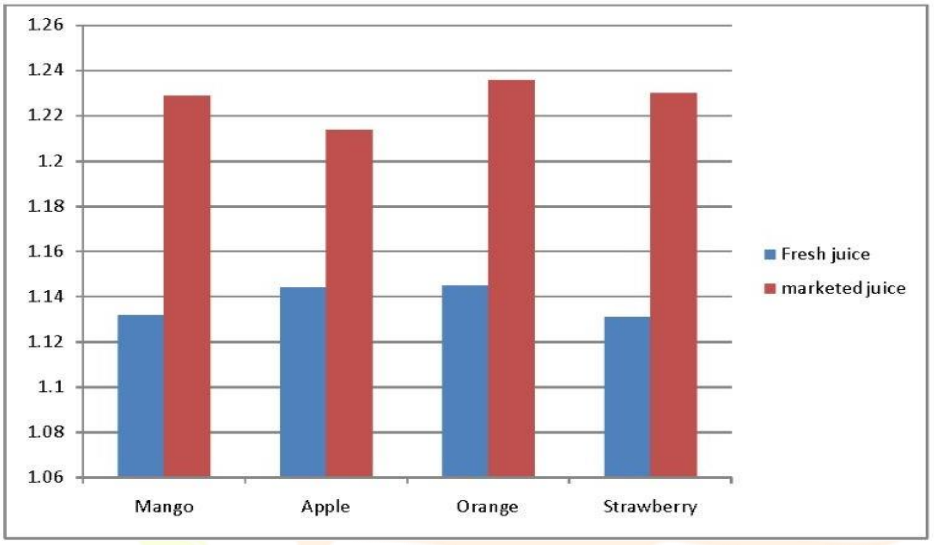
**RESULTS & DISCUSSION.**

To determine the healthiest juice for consumption various parameterswere considered and results were recorded as follows:

## 1) According to Density:-

Density was calculated with the help of density bottle method and itwas concluded that fresh juice have less density as compared to marketed juice.

Lower the density higher will be its nutrients content in the juices ofparticular font.

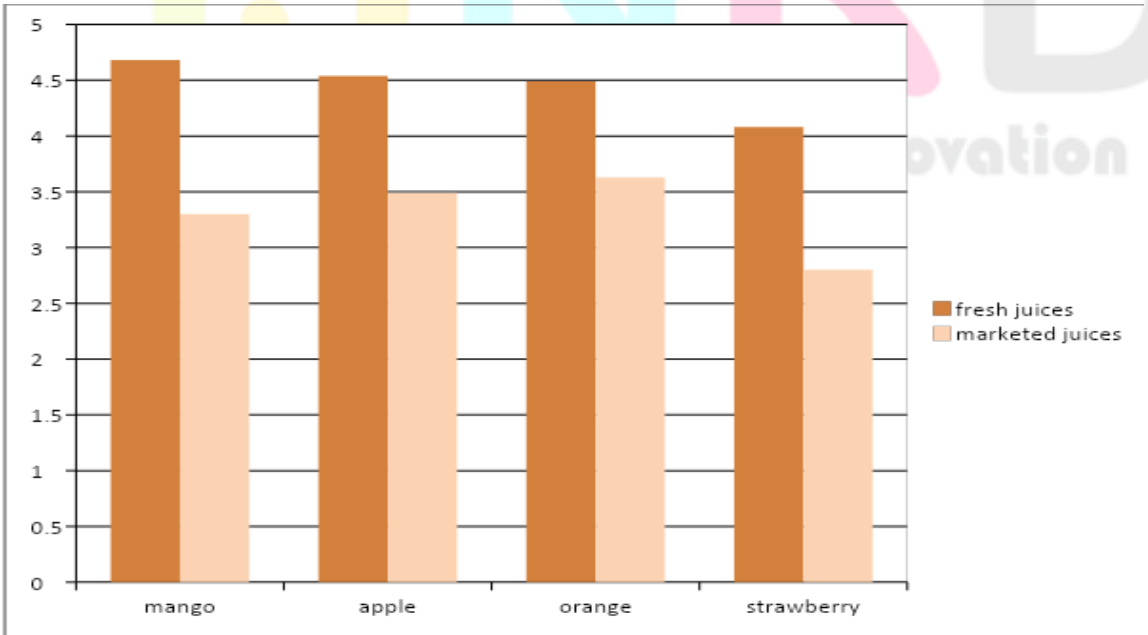



## 2) According To pH:-

This is another parameter which helps us to understand weather the fresh juices are preferableor the marketed juices. According to this various values were recorded .

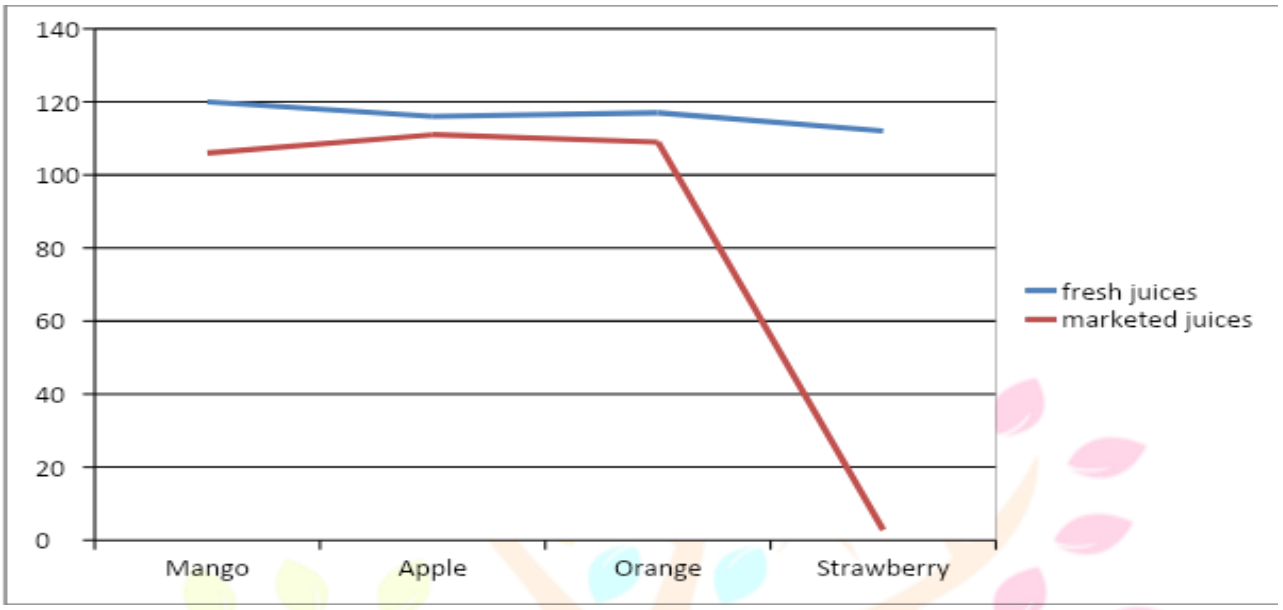
The hydrogen ion activity was more and hence the marketed juices were more acidiccompared to fresh juices and the graph came as follows.

Thus fresh juices are considered healthy for the consumption.



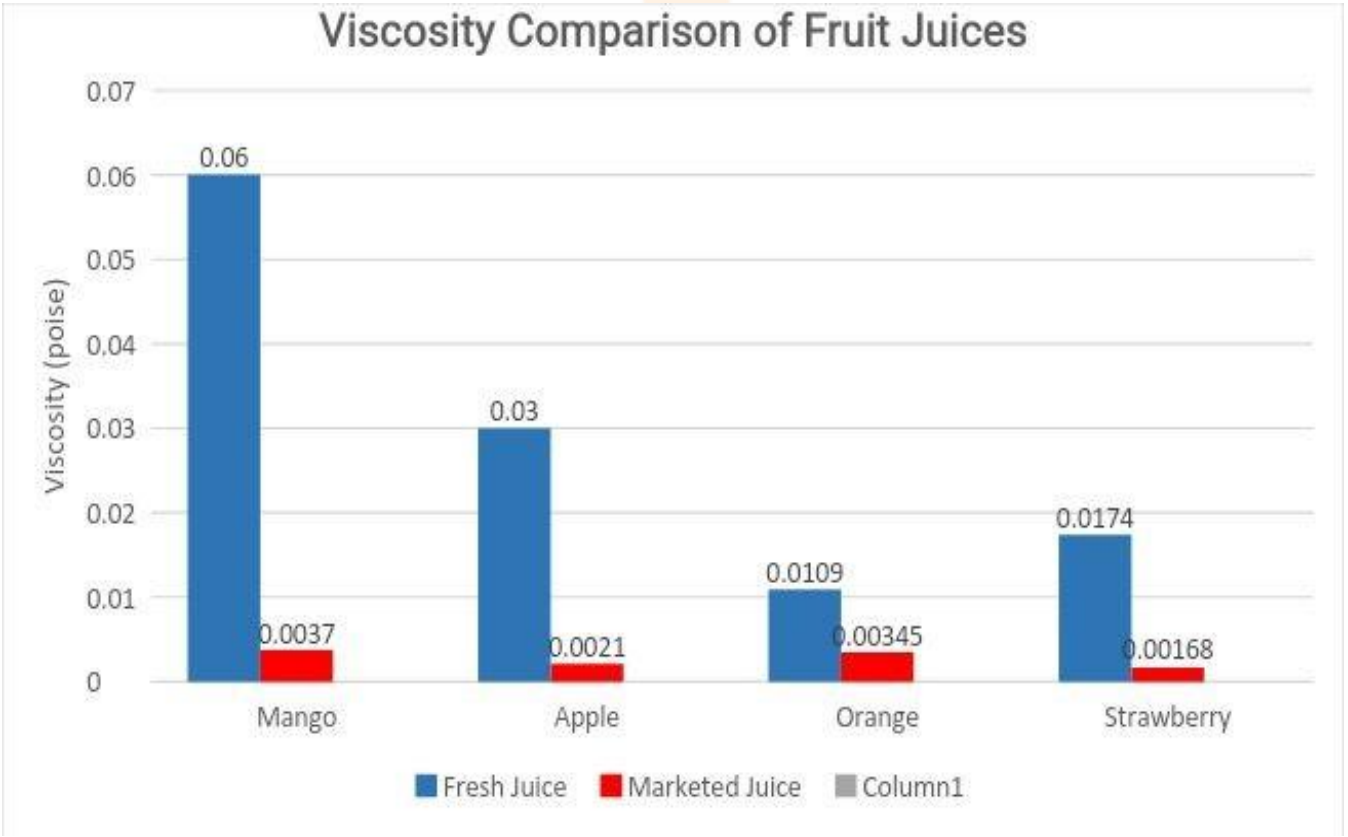
## 3) According To Boiling Point:-

Higher the boiling point of juice lower will be the artificial content present in the juices. Fresh juices were having higher boiling point compared to marketed juices. The graph forboiling point was as above. Thus the boiling point of Fresh juices > marketed juices




## 4) Viscosity: -

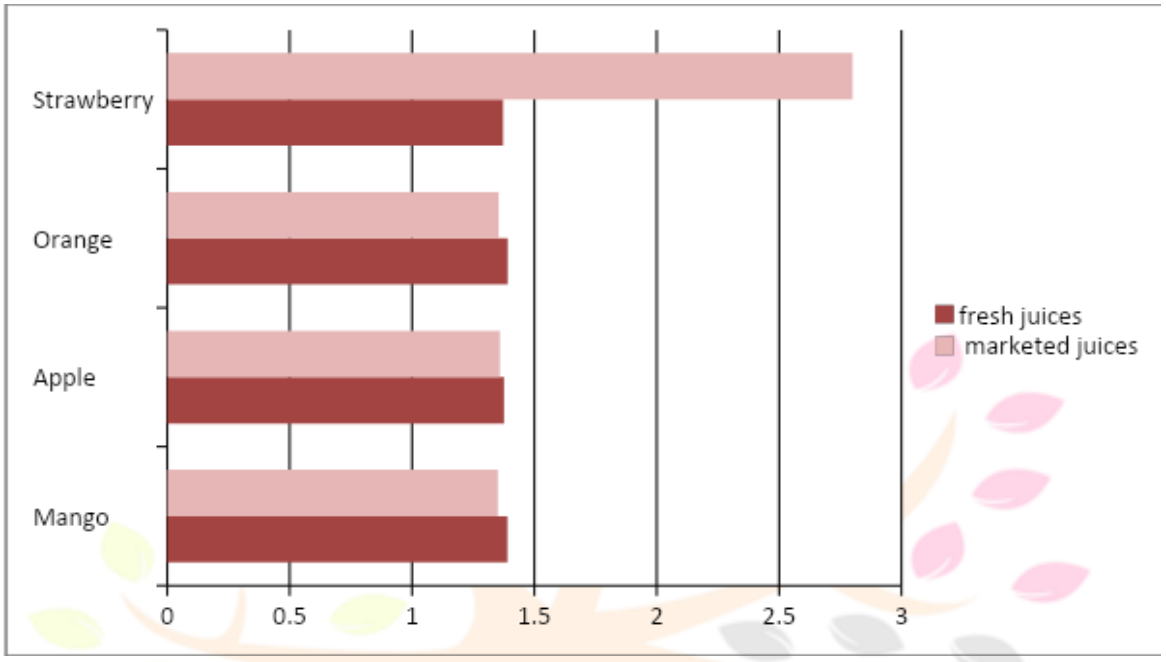
Viscosity is the rheological property of the liquid and it was determined using Brookfield Viscometer. The value obtained clearly tells that the viscosity of processed juice sample was less than that ofthe fresh fruit juice which indicates the addition of other additives inthe juice which decreases the viscosity.



## 5) Sugar Content:-

Sugar content in the juices was determined with the help of Abbe's refractometer. The graphcame as follows: Fresh strawberry juices have more sugar content compared to all other fruits. Fresh juices aremore sweeten in taste compared to marketed ones as they have these natural properties.

Hence marketed juices contain artificial flavors.

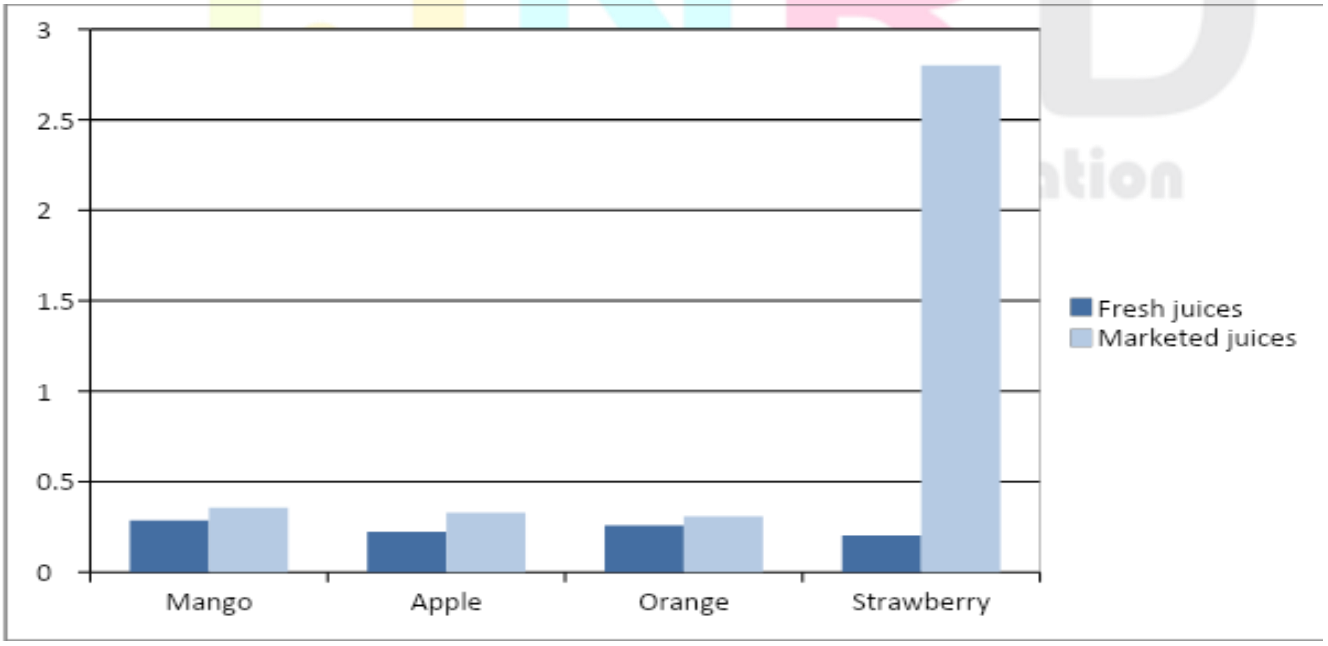



## 6) ACID VALUE:-

Acid base titration was performed and the result was observed as :

Acidity of marketed mango juice is greater compared to fresh mango juice.Same was observed in the other fruit juices. Hence this concludes that the acid value of marketed juicesare greater and hence fresh juices are preferable for healthy diet.

Hence fresh juices are more beneficial for the body compared to marketedjuices.

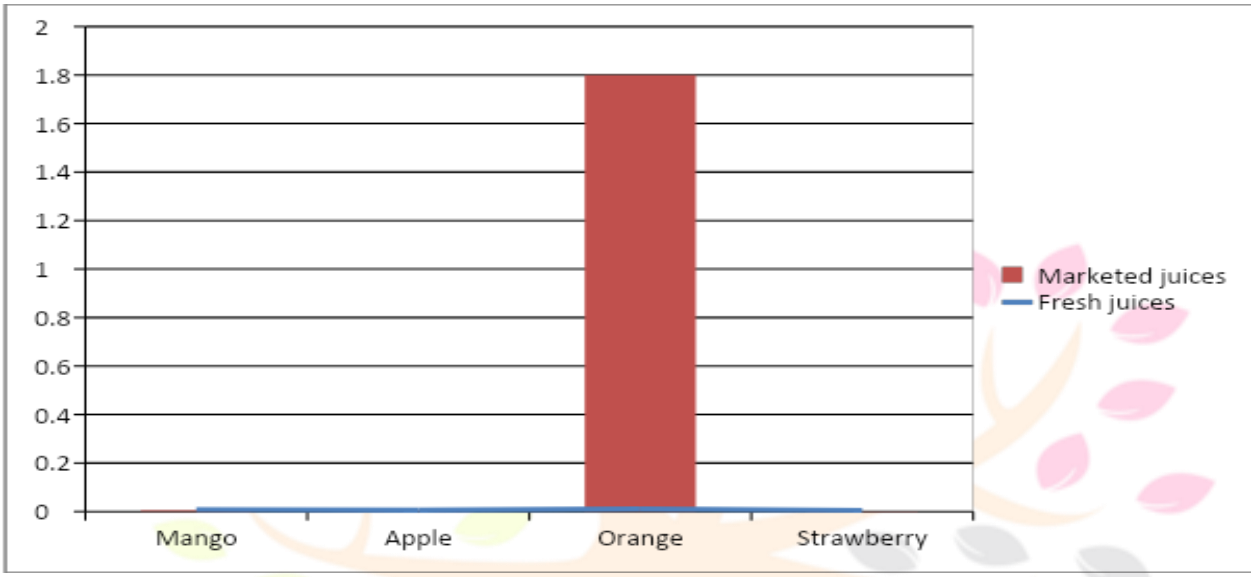


## 7) Determing The Ascorbic Acid Content: -

With help of Ascorbic Acid Assay the concentration of vitamin C was determinted.

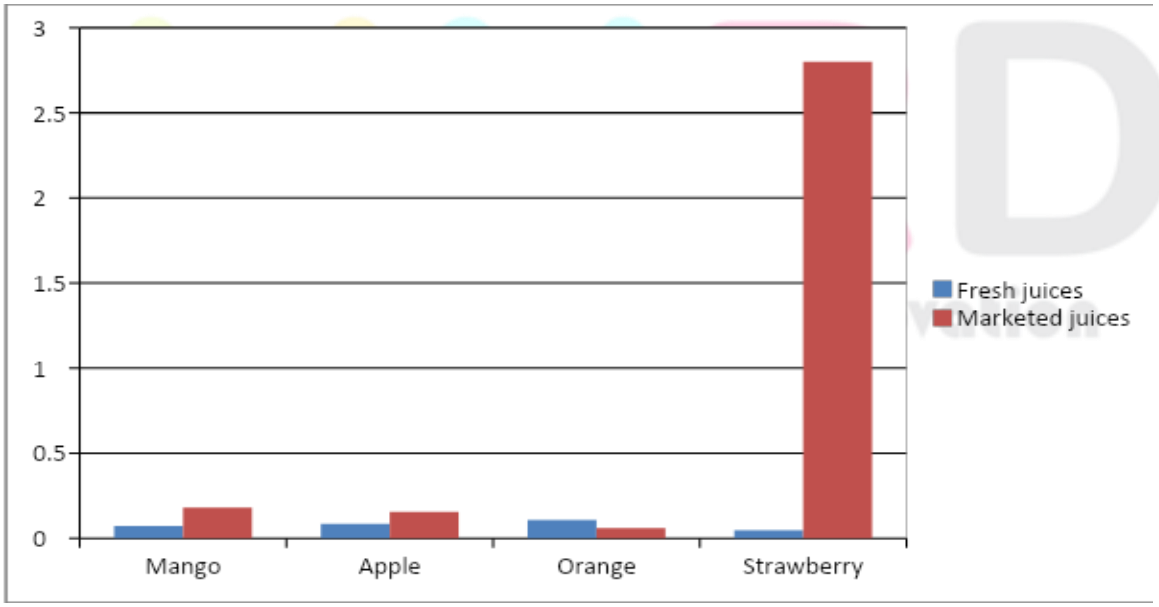
Here it was observed that the all fresh juices have less concentration of vitamin C except forthe orange. Orange has naturally more content vitamin C.As observed in the graph marketedjuices have more vitamin C content compared to fresh juices except for orange

Hence the graph came as below:




## 8) Benzoic Acid determination:-

With the help of assay of benzoic acid the content of benzoic acid was determined by the calculated method.Experimentally fresh juices have less benzoic acid compared to marketedjuices. Whereas only the orange fresh juice contain more benzoic acid content naturally. Butby the graph it was observed as below




Hence we can observe that with the help of above parameters values were doneboth experimentally and graphically. Thus fresh juices are more preferable compared to marketed juices.

**CONCLUSION:**

The objective of the study is to determine the best quality of fruit juices and what kind of fruitjuices is healthiest for the consumption (fresh or marketed) and the study satisfies the objective of the study.

As per the nutritional facts we have tested fresh juices of mango, orange, apple and strawberryfor nutrients like vitamin C and all other properties like viscosity, density, benzoic acid concentration, ascorbic acid and we found that fresh juices were much higher than for packaged juices. From a health perspective fresh juice is always preferable but it is limited availability during off season may make the packaged variant a convenient choice for consumers. Key nutrients of freshly squeezed juices and of marketed juice, there is no doubt that fresh juices is superior. Hence it is always advisable to consume freshly squeezed juice preferably at home as it is hygienically and microbiologically safe.

Consumption of adulterated fruit juices is severely harmful for public health. The higher sugar in processed juices and the way the pasteurization process occurs not only kill harmfulbacteria but also reduce the quantity of nutrients and enzymes inherently available in the fresh juices.

Now without using any preservative agents fruit juices can create enough protection against the growth of microorganisms. The higher acidic character (ph 3-4) of fruit juice is another prevention factor against microorganisms. Using benzoic acid in fruit juices with high ascorbic acid content was also not recommended by the researchers. As a result of interactionof benzoic acid with ascorbic acid in fruit juice under certain conditions a detectable level of benzene could be formed. moreover the presence of ferrous and copper, sodium benzoate with ascorbic acid produced low levels of benzene. Because benzene is shown to be carcinogenic its potential formation in fruits juices during processing and storage should be of some concern. The comparison study showed that addition of benzoic acid into fruit juiceshas been decreased from 100% to 4.34% .

The comparison of sugar concentration in extracted juice of fresh fruit to that of commercially bottled 100% fruit juice with no sugar added attribute. The goal of the study was to determine if the sugar content of bottled 100% fruit juices with no added sugar contentmay contain higher sugar content then extracted juices of fresh fruits.

After performing the project of comparative study of fresh juices and marketed juices , It wasconcluded that juices purchased from the retail market posed a health risk whereas the fresh fruits were considered as risk free .

Thus we can conclude that fresh juices are more healthy compared to marketed juices.

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