Sensorial acceptability, phytochemicals and health benefits of blended fruit juices

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Abstract

Fruit juice has all valuable component for human health such as sugar, minerals and vitamins and component of juice depend on the fruit species processing and storage condition. Fruits are regarded as "super food" or "functional food". Blending play good role to the production of the delightful and delicious beverages and improved their organoleptic quality and a high nutritive value. To resolve the high cost of some exotic fruit juices, scarcity or seasonal supply, balance of strong high acidity, taste, bitterness, and improvement of their TSS (total soluble solids), flavour, stabilizing colour, blending of fruit juices is practiced. Probiotics can be defined live yeast or bacteria which are good for human body especially in digestion. Probiotic is made up of two different word "pro" means 'for' and "bios" means 'life' so it means "for life". Probiotic drink is a drink which made up of after combination of probiotic strain.

Keywords- fruit juice, blending, super food, functional food, health benefits, probiotic

Introduction

All over the world it has been observed there is a sharp shift in the diet and nutritional behaviour. Costumers are looking for healthy alternatives to the soft drinks or carbonated beverages. An increase in the demand of health and functional foods has been observed throughout the world. The research on the development of natural health foods has been increased. To meet the consumer needs, food industries are developing new products with health characteristics (Endo et al., 2009).

Fruits are regarded as "super food" or "functional food". The fruit and fruit juices can play an important role in health promotion. Fruit juice is obtained by the extraction or pressing of the natural liquid contained in fruit. Essentially, fruit juices contain all the substances which are found in the original fruit expect dietary fibre. Food technologists are also trying to develop new techniques through which all the valuable component can be transferred in the fruit juices to make it nutritional. Juice is commonly consumed as a beverage or used as an ingredient or flavouring in foods or other beverages, like smoothies. Juices are low in compounds such as sodium and fat which are believed to have negative health effects when ingested in large amounts. Conversely, juices contain a variety of beneficial micronutrients, including minerals, such as potassium (Dillon, 1995), calcium and magnesium which contribute significantly to the recommended daily intake. The potassium is the major cation of the intracellular fluid. The movement of potassium out of cells, and sodium in, changes electrical potentials in nerves and muscles which is important for a regular function (Landon 2007). The highest fruit juice consumers are New Zealand and Colombia.

The nutritional component of the fruit juices can be enhanced by addition of two or more fruit juices. Additionally, it can also be increased by enriching with phytochemical content. For more health promoting factors medicinal components like herbs are also incorporated. Research during the last 20 years shown that the combination of food with medicinal herbs have many special health beneficial effects which are an excellent source for the development of multi-functional food. Medicinal plants are being used from the ancient times as the source of aromatic, medicine, and healing agents. Aromatic and medicinal herbs are a group of multifunctional plants. In traditional systems of medicine, the Indian medicinal plants have been used in successful management of some common diseases like headaches, common cold, heart disease, malaria, stomach disorders, inflammation, various forms of poisoning, as well as spiritual and flavouring purposes in food. Because of these advantages the medicinal plants have been widely used by the traditional medical practitioners in their day-to-day practice. According to a survey (1993) of World Health Organization (WHO), the practitioners of traditional system of medicine manage about 80% of patients in India, 85% in Burma and 90% in Bangladesh. A World Health Organization study estimates that about 80 percent of all worlds depends on natural products of plants for their health care instead of modern medicines. Primarily because of side effects, and high cost of modern medicine (Sharma, Shanker, Tyagi, Singh & Rao, 2008). The worldwide herbal market products are around $6.2 billion and estimated to reach $5 trillion by the year 2050 (WHO, Kumar & Janagam, 2011). Presently the demand for traditional Indian herbal-based beverage has increased tremendously in India and abroad. Natural antioxidants like phenolic compounds and flavonoids which act as secondary plant metabolites are present in food products of plant origin (Helle and Bertelsen, 1995; Yeh and Yen, 2003). It can trap the free radicals directly or scavenge them through a series of coupled reactions with antioxidant enzymes (Rao et al., 1996).

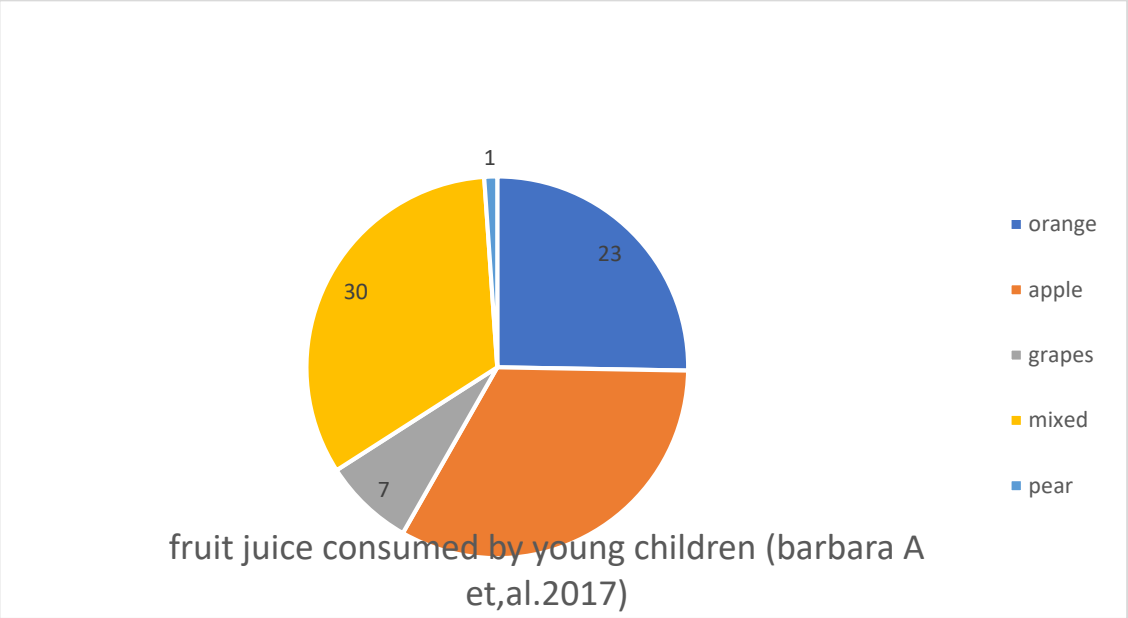
Functional food

The food or supplements which has some additional functions on prevention of disease or health promotion are known as functional food. The term functional food was first used by Japan in 1980s. Functional foods have around 176.7 billion global market in 2013 with 7.4% compound annual growth rate. Functional beverage sector has 10.8% compound annual growth rate alone (Robet, 2009).

Consumption of fruit juice

Consumption pattern of fruit juice has been changed. Fifty year ago, orange juice was the most popular fruit juice but now a day's apple juice is the most popular juice in human beings. During the first 5 to 7 months of life normal babies drunk only mother' breast milk but now a day's solid foods are available which required some additional water because solid food contain high renal osmosis load, protein and electrolyte element like egg yolk, strained meat and high meat dinner. But fruit or fruit juice contain low renal osmosis load so doctors recommended fruit juice for babies (American academy of paediatrics committee on nutrition). 40-50% of juice is consumed by 5-year-old children (juice manufacturing data). Orange juice is the world's largest consumed juice (Citrus Industry Magazine) with a consumption of 3236975.2 tons,

followed by apple juice (1728037 tons) and mango juice (1310.8 tons) is third largest consumed juice in world (Index box, 2010).



fruit juice consumed by young children (barbara A et,al.2017)

Fruit juice composition (per 8 flued ounce serving)

	Apple	Orange	Grape	Pear
Energy (kcl)	117	112	154	196
Fructose (g)	13.9	11.5	21.0	21.3
Glucose (g)	6.2	13.2	17.2	6.3
Sucrose(g)	4.2	1.7	0.0	6.0
Sorbitol(g)	0.6	0.0	0.0	4.5 to 5.5
Total fiber (g)	0.3	0.8	1.3	11.6
Soluble fiber (g)	0.1	0.3	0.5	4.3
Pectin (g)	0.1	0.5	0.5	1.8

all data taken from Minnesota nutrition data system

Health benefits of some fruit juices

Consumers find all nutritional components in fruit juice. So, drinking fruit juice is regarded as beneficial for health. Fruit juice act as an immunity booster which work as a health promoter and disease preventer. (……..)

Orange juice

Orange juice is one of the highest consumed fruit juices worldwide. Orange juice has many health benefits such as immunity booster, prevent cancer, detoxify the body, reduce inflammation, lower cholesterol levels, blood pressure, and reduce signs of ageing (Frumkin, 2003). Orange juice have low calory with high amount of minerals and vitamin C which act as an antioxidant. Compared to other fruit juices, orange juice contains high amount of bioflavonoids like hesperetin, and hesperidin. Hence prevent from diseases like diarrhoea, malaria, and pneumonia (Frumkin, 2003).

Apple juice

Apple is known as one of the high fibre's fruit. The fibres of apple protect human body from some severe diseases such as Asthma, Arthritis and effect of quercetin in Alzheimer's. Alkalinity of the apple juice act as a toxic cleaner in liver and helps to maintain the pH level in human body (Boyer et, al.2004). Apple juice contain acid like chlorogenic, catechin, phloridzin and quercetin which fight against breast cancer, lung cancer and cardiovascular diseases (Boyer et, al.2004).

Kiwi fruit juice

Kiwis are rich source of vitamin C also a good source of fibre and potassium. Serotonin as a hormone which is present in kiwi fruit or juice increases the energy level and other neurochemicals in human brain. Consequently, reduces the negative thought and emotion by 30 to 40%. Also contain vitamin E and lutein an antioxidant which protect the skin from UV rays (Femina, 2004).

Grapes juice

Generally, grape fruit or juice contain phyto nutrients like resveratrol in grape seed, grape flesh and grape skin which are helps to increase to gene expression and muscle tissue.

According to Sahaya, (2004) grape juice provides some heart benefits. Generally, resveratrol Phyto nutrient found in grape seed, grape flesh and grape skin which are helps to increase to gene expression and muscle tissue.

Pomegranate juice

Pomegranate juice has high amount of polyphenol and rich in antioxidant capacity which are helps to decrease the blockage problem in arteries also minimize the chances of high blood pressure problems and heart disease. The phytochemical which are found in pomegranate juice which decrease the growth of aromatase (enzyme which are responsible for breast cancer) (Basu et, al.2009). According to the various study in pomegranate juice researchers says that it has anti-inflammatory, anti-atherogenic, antioxidant and antihypertensive effects.

Some best juice combinations

- **Vitamin rich: - (**Orange+ grape juice) both juices are rich in vitamin C so after blending it will increase the vitamins content (Flora et, al1979).
- **Health booster: -** (kiwi +apple juice) kiwi and apple juice combination is the best combination juice in comparison of other juice combination as the purpose of health booster because of both are rich in fibre and other beneficial elements.
- **Anticancer: - (**Apple+ Onion) apple and onion intake was associated with a reduced risk of lung cancer in both males and females (Marchand et, al.2000).
- **Antioxidant delight: -** (Cranberry + pomegranate) both are rich in antioxidant so right combination of those juice can increase the amount of antioxidants which are necessary for human body.
- **Nutrition rich: -** Apple + watermelon

REVIEW OF LITERATURE

Many studies have been done to explore the beneficial effects of blended juice. Their physiochemical, phytochemical properties and their utilization in the products have been extensively studies by some researchers.

1. Bhardwaj et.al, (2010) optimised the blending of four different juices i.e., kinnow, aonla, ginger and pomegranate (Kinnow: Aonla: Ginger in 100: 0: 0, 95: 5: 0, 92: 5: 3 ratio and Kinnow: Pomegranate: Ginger in 90: 10: 0, 87: 10: 3 ratio) to prepare composite beverages with improved flavour, palatability, nutrition and medicinal value. They found that on the basis of sensory and physicochemical analysis, the kinnow juice blend with pomegranate and ginger juice at a ratio of 87:10:3 was the most powerful juice blend. Due to greater accuracy and taste, the sensory assessment score was also higher in the same study. The changes in TSS (12.00 to 14.13°Brix), ascorbic acid (18.38 to 12.90 mg/100 ml juice), acidity (0.720 to 0.510%), and limonin (0.103 to 0.250mg/ml juice) were minimal in comparison to control (100:00). The addition of ginger juice to blends has also shown to increase consistency and decrease microbial growth.
2. Sattar et. al, (2016) prepared 4 different juices (kinnow: Sugarcane) with combination of two different juices with different ratio (20:80, 40:60, 60:40 and 80:20). They were analysed for TSS, acidity, pH, reducing and non-reducing sugars, ascorbic acid contents, cloud stability and sensory evaluation with storage intervals of 0, 30, 60 and 90 days at ambient storage conditions. The results revealed that total soluble solids (11.43 to 14.63 Brix), Titratable acidity (0.23to 0.58%) ascorbic acid (6.40 to 23.05 mg/100ml) and Reducing sugars increased (0.92 to 1.20%) while pH (3.23 to 3.59%), and non-reducing sugars (11.28 to 9.12 %) decreased significantly during storage up 90 days. Sensory evaluation attributes (Colour, flavour and taste) of juice blends (60:40 & 80:20) with higher contents of kinnow juice remained within acceptable limits.
3. Prasad et. al, (2014) conducted a study on the Development of juice with combination of kinnow: aonla in different ratio like 100:00, 90:10, 80:20, 70:30, 60:40, 50:50 for increased their nutrition and

medicinal value. Ginger and Cardamom were used as herbal additives and were compared with control. All the herbal treatments were found better in respect of all physio chemical properties over Control. They analysed the (ginger powder @100 gram/ lit) 60:40 treatment is the best treatment with highest mean TSS (15.03 to 15.13 °Brix), pH (3.58 to 3.50) and ascorbic acid content (24.4 to 19.4 %) in comparison of control. In the same treatment, the sensory evaluation score was also higher due to improved consistency and flavour, and the overall results showed that the combination of different herbs gave better taste results than without herbal combinations.

4. Ullah et.al, 2015 conducted study on the effect of lemon and ginger extract on carrot and kinnow blended ready to serve (RTS) drinks during 3 months refrigeration temperature storage. In this treatment carrot, kinnow, CMC, Sugar, Water, Ginger extract and lemon juice were used in different proportion such as 0.5L: 0.5L: 1g/kg: 1kg: 5L: 0ml: 50ml, 0.5L: 0.5L: 1g/kg: 1kg: 5L: 10ml: 0ml, 0.5L: 0.5L: 1g/kg: 1kg: 5L: 10ml: 50ml, 0.5L: 0.5 L:1g/kg: 1kg: 5L:0ml: 80ml, 0.5L: 0.5L: 1g/kg:1 kg: 5L: 20ml:0ml, 0.5L: 0.5L: 1g/kg: 1kg: 5L : 20ml: 80ml and 0.5L: 0.5L: 1g/k: 1kg: 5L: 0ml: 0ml, for control. They were analysed for total solids, moisture, ash, pH, reducing sugar, ascorbic acid, non-reducing sugar, titratble acidy, total soluble solids, total microbial count and sensory attribute (taste, colour, flavor and overall acceptability). They found the treatment (0.5L: 0.5L: 1g/kg: 1kg: 5L: 20ml: 80ml) was the best treatment with minimum changes in total soluble solids (15.4 to 16.3 Brix), Titratable acidity (0.46 to 0.59%), Reducing sugars (14.78 to 14.91 %), pH (3.5 to 3.37%), and non-reducing sugars (6.97 to 6.85%) during storage up 90 days. All the sensory parameters decrease slightly but remains in acceptable range during storage period.
5. Mane RP et.al, (2017) carried out a study on the formation of fresh turmeric rhizome juice mixed orange RTS drink with orange juice formulations in various ratios to fresh turmeric rhizome juice such as 95:05, 90:10, and 85:15 respectively. They found that the ratio of 90:10 (addition of turmeric juice 10 per cent in beverage) was most effective juice blend on the basis of sensory and physio-chemical analysis. It has a mild acidity content that satisfies the taste and acceptability criteria for individuals serving the RTS drink with minimum refrigerated temperature changes (4 ° c). The changes in pH (3.4 to 3.39), TSS (12 °Brix to 13.1 °Brix), Acidity (0.28% to 0.22%), Total sugar (5.0% to 8.50%), Ascorbic acid (30.8 to 31.03 mg/100ml of juice) and Curcumin content (45.0mg/100ml of juice). According to their study, according to their report, ten members of the panel conducted a sensory assessment of this drink and numbers were given by evaluating color (7.5), texture (8.5), taste (8.0) and overall acceptability (8.1) relative to the control sample (100:00).
6. Frederick et, al. (2016) conducted a study on the blending of cabbage (Oxylus variety) with orange juice (Valencia late and blood varieties) for preparation of Ready-to-Serve (RTS) beverage. The experiment was composed of six different treatments such as 50:50, 60:40, 73:24, 95:5, 87:13, 80:20, 55:45, 67:33,100:00, 14ml ginger and 10gm sugar were added in each treatment. Ginger and sugar worked as additives for flavour and taste, aroma etc. They found 80% orange Valencia late and 20% cabbage was most suitable treatment for sensory and physiochemical characters and 74% of blood orange and 26% of cabbage was also best treatment.

7. Puranik et. al, (2011) prepared an herbal beverage with combination of sweet orange, giloy and basil in different ratio such as 89:05:06, 84:10:06, 79:15:06 and 74:20:06, 69:25:06 for improved the health and fulfils the nutritional requirements. They observed that the sweet orange blend with giloy and basil in ratio of 79:15;06 was most suitable blend on the basis sensory and physio chemical analysis. The changes in pH (4.02 to 3.41), TSS (15.24 to 15.02), acidity (0.4 to 0.49%), Vitamin C (134 to 62.6mg/100 g), microbial count (2.23 to 3.45(cfu/g). They also observed the antioxidant activity of optimized ready to serve beverages was found to be 24.56%, which decreased to 4.32% during 60 days of storage at ambient temperature (28 to 32°C). Sensory evaluation was also high (8.4) in same treatment. The data of organoleptic quality attributes measured on 9-point hedonic scale.
8. Afreen et.al, (2016) conducted a study during the period of July to August 2016 on the blending juice of Carrot with Sour orange juice for preparation of Ready-to-Serve (RTS) beverage. Beverage was prepared with the different combinations of Sour- Orange juices with sugar, water, Sodium metabisulphite and citric acid, the experiment was composed of four different treatments such as 100:0, 60:40, 50:50 and 40:60, for its overall acceptability, they examined different physio-chemical and sensory characteristics. According to their research 50:50 treatment was the most suitable treatment with high nutritional qualities and showed 3.03 pH, 7.3 mg/100g ascorbic acid, 16.9% total sugar, 0.32% titrable acidity, and 16.1˚ Brix total soluble solids TSS. In the sensory evaluation 50:50 treatment had higher score than other treatment. Therefore, the best treatment for commercial preparation, based on nutritional and sensory evaluations, was 50:50 (carrot juice and sour orange juice).
9. Harsha et. al, (2015) prepared an herbal juice with the combination citrus fruits and basil herbs, ginger and sugar syrup for increasing their medicinal value. They prepared juice with different combination of Lime juice, holy basil, ginger and sugar syrup were used in the ratios of 40:10:5:45; 35:15:5:45; 30:20:5:45; and 25:25:5:45 then pasteurized at 90°C for 25 second then cooled, stored at refrigerated temperature 5°C for 20 days. They observed that the treatment 30:20:5:45 in ratio was the most desirable blend on the bases of sensory and all physio chemical analysis. The changes in TSS (13.1 to 14.3 o brix), Titrable acidity (0.6 to 0.9%), Ascorbic acid (36 to 27mg/100gm), pH (5.2 to 2.1) was minimal in comparison to control. The antioxidant potential gradually decreased during the storage period from 50.5 in 10% to 56.1 in 25% juice blends. The average overall acceptability scores of more than 8 for juice blends samples up to 20% basil extract. Sensory evaluation also revealed that the juice blends are acceptable till 5^{th} to 10^{th} day of preparation, thereafter the quality deteriorated for consumption.
10. Sangeeta et.al, prepared 7 different types of juices with the combination of sugarcane and aonla in different ratio (100:00, 98:2, 95:5 90:10, 85:5, 80:20, 75:25) for improved the shelf life of sugarcane juice. These selected juice blends were thermally treated at different temperatures (60, 70 and 80°C) for different intervals of time (5, 10 and 15 minutes). They found that for minimum changes in TSS (18.07 to 19.3 Brix), acidity (0.132 to 0.130 percent), pH (4.67 to4.5), ascorbic acid (4.1 to7.70), sugarcane juice blend with aonla juice at a ratio of 95:5 was the most effective juice blend. Gradual

increase in the microbial count of juice samples (3.0 x 104 cfu's) after 20 days at room temperature and 50 days at refrigerator temperature in comparison of control (100:00). Due to greater accuracy and flavour, the sensory appraisal score was also higher 7/9 in the same treatment.

Physiochemical properties

Physicochemical characteristics as physical characteristics, solving characteristics related to interactions with different media, and properties or molecular characteristics that characterize chemical reactivity as intrinsic.

Total soluble solid (TSS)

Total Soluble Solids Value is a commonly used parameter to evaluate the quality beverage (Orak 2007; Ratnasooriya et. al, 2010). In the various studies it was observed that the effect of blending was depended on the volume of other juices added to the main juice so the blending was found to be in the range of 87% to 50%.

Titratable Acidity

Value of acidity in terms of pH and titratable acidity is one of the most important parameters to evaluate the control quality and shelf life of fruit juices (Juan Yu et.al,2011). In the various studies in kinnow blended juice it was observed that titratable acidity the titratable acidity of the blends kept on increasing. It was because pH and titratable acidity both are shown an inverse relation to each other.

pH

pH plays an important role in maintaining the shelf life of juice, pH may also affect the taste and processing requirements of the juice. Titratable acidity and pH both are inversely proportional to each other.

Effect of blending on physio chemical content of the juice

Sr. no.	Fruit Combination	TSS (^{0}brix)	Acidity (%)	pH	Reducing sugar (%)	Total sugar (%)	Reference
1	Kinnow, pomegranate and ginger (87:10:3)	11.50 to 12.00	0.755 to 0.720	*	*	7.50 to 8.11	Bhardwaj et.al, (2010)

2	Kinnow, Sugarcane (60:40)	14.63 to 12.60	0.23 to 0.50	3.59 to 3.34	11.98 to 9.85 2.16	*	Sattar et. al, (2016)
3	Aonla, kinnow, water and herbs (10:05:85:1.5 %)	15.03 to 15.03	0.50 to 0.40	3.46 to 3.56	*	*	Prasad et. al, (2014)
4	Carrot and Kinnow (50:50)	15.5 to 15.4	0.47 to 0.46	3.6 to 3.5	12.72 to 14.78	6.2 to 5.3	Ullah et.al, (2015)
5.	Turmeric rhizome juice with orange juice (90:10)	12 to 13.1	0.28 to 0.22	3.4 to 3.3	*	5.0 to 8.5	Mane RP et.al, (2017)
7.	Sweet orange, giloy and basil (93:06:02)	15.24 to 15.02	0.40 to 0.49	4.02 to 3.41	*	*	Puranik et. al, (2011)
8.	Carrot with Sour orange juice (50:50)	14.2 to 16.1	0.25 to 0.36	3.25-3.03	*	15-16.9	Afreen et.al,2016
9.	Lime juice, holy basil, ginger and sugar syrup (30:20:5:45)	12.1 to 13.1	0.44 to 0.59	5.18 to 5.31	*	*	Harsha et. al, (2015)
10.	Sugarcane and aonla (95:5)	18.07 to 19.3	0.132 to 0.130	4.67 to 4.5	*	*	Sangeeta et.al,
11.	Soya milk and mango pulp (50:50)	14.1-14.00	0.137 - 0.241	6.05 -5.22	*	9.23 - 2.427	Ranveer et. al, (2012)
12.	Whey, mango, sugar, ginger guar gum (82: 10 :8:0.5:0.05)	15 to 17.2	0.24 to 0.32	4.69 to 4.15	2.2 to 3.8	11.00 to 7.85	Alane et. al, (2017)

13.	Paneer whey, beet root and herbs (80:20:06)	13.00 to 12.86	0.37 to 0.35	4.34 to 4.36	*	12 to 12.09	Satpute et. al, (2018)
14.	Whey, banana juice, sugar and herb (80:10:08:02)	14.2 to 14.4	0.32 to 0.45	5.37 to 5.2	4.350 to 5.017	No change	Yadav et. al, (2010)
15.	Whey, pineapple, bottle gourd, sugar, mentha (70:10:10: 08:02)	13.97 to 14.33	0.37 to 0.46	5.01 to 4.81	*	No change	Baljeet et. al, (2012)
16.	Whey, guava and herbs (74:20:6)	28.7 to 22.7	0.43 to 0.44	5.3 to 5.4	6.93 to 6.65(0.28	11.04 to 12.10	Dubey et, al. (2016)
17.	Guava pulp with pineapple juice (50:50)	13.82 to 15.61	0.378 to 0.260	2.63 to 3.2	*	6.7 to 8.5	Sarkar et.al, (2017)
18.	Pineapple and aloe vera (90:20)	*	0.230 to 0.204	3.93 to 3.65	*	*	Biswas et. al, (2016)
19.	Pineapple juice, ginger, green chillies, pepper, cardamom and nutmeg (10:3: 00: 0.2 :00 :00)	15	0.250	3.95	4.20 to 4.23	13.58 to 13.61	Amaravathi et, al. (2014)
20.	Ginger and honey (5:15)	17.00 to 17.70	0.30 to 0.28	*	*	*	Singh et. al, (2014)
21.	Apple and Jamun (90:10)	11.5 to 11.72	0.40 to 0.41	*	7.77 to 7.82	*	Mishra et, al. (2016)

22.	Apple and apricot (75:25)	9.0 to 9.50	0.33 to 0.48	3.91 to 3.6	2.60 to 1.92	*	Hussain et.al, (2011)

Phytochemicals properties

Phytochemicals are compounds which are originated from plant sources which are found in vegetables, fruits, beans, grains and other plants source. It is suspected that some of these phytochemicals protect cells from damage that could lead to cancer. Some scientists think that you can reduce your cancer risk by eating more vegetables, fruits, and other plant foods that have certain phytochemicals in them.

Some of the most beneficial phytochemicals are:

- Beta carotene and other carotenoids which are found in fruits and vegetables
- Resveratrol which is found in red wine
- Polyphenols which are found in tea
- Isothiocyanates which is found in cruciferous vegetables (members of the cabbage family that include collards, broccoli, bok choy, brussels sprouts, kohlrabi, turnip, greens kale, mustard greens and cauliflower)

Flavonoids

Grains, vegetables, and fruits have maximum number of flavonoids. In soybeans, chickpeas, and licorice, the flavonoids can behave a bit like oestrogen, a hormone that may affect the risk of breast cancer that relies on oestrogen for its development. In these plants, estrogen-like compounds are called phytoestrogens. But most phytoestrogens do have very poor activity-like oestrogen. If your body's natural oestrogen role is substituted by a weak estrogen-like substance, then the weak substance will act as a relative anti-estrogen.

Antioxidants

It protects the cells of your body against unstable molecules and free radicals which formed during normal functions of the cell. Radiation, pollution, smoke, herbicides and tobacco can also generate free radicals in human body. Free radicals may harm the genetic sections of a cell. These modifications can lead to the development of cancer and other diseases. Broccoli, brussels sprouts, cabbage, cauliflower, tomatoes, maize, carrots, mangoes, sweet potatoes, soybeans, cantaloupe, spinach, almonds, lettuce, celery, liver, fish oil, seeds, cereals, kale, beets, red peppers, potatoes, blueberries, strawberries, and black and green tea contain more amount of antioxidants. Dark-colored fruits and berries typically contain more antioxidants than other vegetables and fruits.

Carotenoids

Carotenoids that give their orange colour to carrots, yams, cantaloupe, squash, and apricots which can help reduce cancer risk in human body.

Sulphides

The immune system can be improved by sulphides, generally which are found in garlic and onions.

Effect of blending on phytochemical content of the juice

Sr	Fruit Combination	Antioxidant	Ascorbic acid mg/100 ml juice	Reference
1	Kinnow, pomegranate and ginger (87:10:3)	*	21.15 to 18.38	Bhardwaj et.al, (2010)
2	Kinnow, Sugarcane (60:40)	*	6.40 to 15.65 -9.25	Sattar et. al, (2016)
3	Aonla, kinnow, water and herbs (10:05:85:1.5%)	*	24.0 to 24.4	Balaji et. al, (2014)
4	Carrot and Kinnow (50:50)	*	*	Ullah et.al, (2015)
5	Turmeric rhizome juice with orange juice (90:10)	*	30.8 to 31.03	Mane RP et.al, (2017)
7	Sweet orange, giloy and basil (93:06:02)	24.56%	*	Puranik et. al, (2011)
8	Carrot with Sour orange juice (50:50)	*	5 to 7.3	Afreen et.al, 2016
9	Lime juice, holy basil, ginger and sugar syrup (30:20:5:45)	59.7 to 64.6	46.7 to 36.44	Harsha et. al, (2015)

10	Sugarcane and aonla (95:5)	*	4.1 to 7.70	Sangeeta et.al, (2013)
11	Soya milk and mango pulp (50:50)	*	7.33 -9.77	Ranveer et. al, (2012)
12	Whey, mango, sugar, ginger guar gum (82: 10 :8:0.5:0.05)	*	42.85-*	Alane et. al, (2017)
13	Paneer whey, beet root and herbs (80:20:06)	*	*	Satpute et. al, (2018)
14	Whey, banana juice, sugar and herb (80:10:08:02)	*	**	Yadav et. al, (2010)
15	Whey, pineapple, bottle gourd, sugar, mentha (70:10:10: 08:02)	*	1.36-1.42	Baljeet et. al, (2012)
16	Whey, guava and herbs (74:20:6)	*	*	Dub ey et, al. (2016)
17	Guava pulp with pineapple juice (50:50)	*	65.75-33.63	Sarkar et.al, (2017)
18	Pineapple and aloe vera (90:20)	0.53-0.46	**	Biswas et. al, (2016)
19	Pineapple juice, ginger, green chillies, pepper, cardamom and nutmeg (10:3: 00: 0.2 :00 :00)	*	3.56-3.59	Amaravathi et, al. (2014)
20	Ginger and honey (5:15)	*	**	Singh et. al, (2014)
21	Apple and Jamun (90:10)	72.15-75.15	4.81-10.59	Mishra et, al. (2016)

22	Apple and apricot (75:25)	*	5.6-6.5	Hussain et.al, (2011)

Sr no		Storage (t °C)	Storage time												Reference
			0 days			15 day			30 days			45 days			
			TSS (°B)	pH	Acidity (%)	TSS (°B)	pH	Acidity (%)	TSS (°B)	pH	Acidity (%)	TSS (°B)	pH	Acidity (%)	
1	Kinnow, aonla, ginger and pomegranate (87:10:3)	5	12	3.87	0.72	13.29	3.6	0.62	13.75	3.56	0.56	14.13	3.65	0.51	Bhardwaj et.al, (2010)
2	Kinnow, Sugarcane (60:40)	7±1	12.2	3.44	0.45	12.23	3.40	0.46	12.3	3.38	0.48	*	*	*	Sattar et. al, (2016)
3	Aonla, kinnow water and herbs (10:05:85:1.5%)	4	15.03	3.56	0.42	15.14	3.49	0.45	15.25	3.4876	0.48	*	*	*	Balaji et. al, (2014)
4	Carrot, Kinnow (50:50)		15.4	3.5	0.46	*	*	*	15.7	3.46	0.5	*	*	*	Ullah et.al, (2015)
5	Orange juice with rhizome juice (90:10)	4-5	12	3.2	0.29	12.1	3.21	0.29	12.3	3.23	0.28	12.9	3.31	0.25	Mane RP et.al, (2017)

6	Sweet orange, giloy and basil (93:06:02)	28-32°	*	4.0	*	*	3.8	*	*	3.62	*	*	3.48	*	Puranik et. al, (2011)
8	Lime juice, holy basil, ginger and sugar syrup (30:20:5:45)	5	13	5.3	0.59	14.1	2.5	0.69	15.2	2.2	1.05	*	*	*	Harsha et. al, (2015)
9	Sugarcane and aonla (95:5)	4-5	19.1	4.49	0.25	18.5	4.44	0.26	18.2	4.38	0.26	18	4.43	0.30	Sangeeta et.al,
10	Soya milk and mango pulp (50:50)	*	*	*	*	*	*	*	*	*	*	*	*	*	Ranveer et. al, (2012)
11	Whey, mango, ginger, guar gum (82: 10 :8:0.5:0.05)	7±1	15	4.69	0.24	16.5	4.50	0.25	17.2	4.15	0.32	*	*	*	Alane et. al, (2017)
12	Paneer whey, beet root and herbs (80:20:06)	*	*	*	*	*	*	*	*	*	*	*	*	*	Satpute et. al, (2018)
13	Whey, banana juice, sugar and herb (80:10:08:02)	7±1	14.20	5.37	0.32	14.40	5.20	0.45	14.60	5.23	0.46	*	*	*	Yadav et. al, (2010)

14	Whey, pineapple, bottle gourd, sugar, mentha (70:10:10: 08:02)	4-5	13.97	5.01	0.37	14.33	4.81	0.46	14.26	4.75	0.57	*	*	*	Baljeet et. al, (2012)
15	Whey, guava and herbs (74:20:6)	*	*	*	*	*	*	*	*	*	*	*	*	*	Dubey et, al. (2016)
16	Guava pulp with pineapple juice (50:50)	4-5	15.06	3.08	0.368	15.31	3.16	0.340	15.33	3.25	0.329	15.70	3.33	0.309	Sarkar et.al, (2017)
17	Pineapple and aloe vera (90:20)	4-5	*	3.93	0.2	*	3.59	0.22	*	3.69	0.24	*	*	*	Biswas et. al, (2016)
19	Ginger and honey (5:15)	20	17	*	0.30	17.30	*	0.29	17.90	*	0.28	17.7	*	0.27	Singh et. al, (2014)
20	Apple and Jamun (90:10)	4-5	11.5	*	0.4	*	*	*	*	*	*	11.76	*	0.41	Mishra et, al. (2016)
21	Apple, apricot (75:25)	4	9.00	4.0	0.32	9.00	3.94	0.36	9.10	3.93	0.37	9.20	3.8	0.41	Hussain et.al, (2011)

Effect on storage life of blended juice

Organoleptic quality

Organoleptic evaluation is a great relevance for overall acceptability. Generally, organoleptic evaluation is the final parameter for checking the quality of the beverage from consumer's point of view. In the all papers, results indicated that taste, flavour, colour and overall acceptability of juice blends increased in maximum blended juices. RP et.al, (2017) reported decrease (8.8 to 8.6) in organoleptic score of orange juice- turmeric rhizome blended juice during storage. Same decreasing trend was found by Harsha et.al, (2015) and Sarkar et.al, (2017) in lime juice-holy basil-ginger-sugar syrup and guava pulp- pineapple juice respectively during storage. Amaravathi et.al, (2014) noted almost constant in organoleptic evaluation during storage.

Effect of blending on acceptability of the juice

Sr. no.	Fruits combination	Control	Sensory characters				Reference
			Colour	Flavour	Taste	Overall acceptance	
1.	Kinnow, ginger and pomegranate (87:10:3)	100% kinnow juice	8.30-7.27	7.92-7.43	7.81-7.71	8.01-7.40	Bhardwaj et.al, (2010)
2.	Kinnow, Sugarcane (60:40)	100% kinnow juice	5- 6.2	4.8-5.5	6-6.4	5.2-5.9	Sattar et. al, (2016)
3.	Kinnow and aonla (60:40)	100% kinnow juice	6.16-7.97	7.35-7.90	7-8.33	6.83-8.06	Balaji et. al, (2014)
4.	Carrot juice: Kinnow juice: CMC: Sugar Water: Ginger extract: Lemon juice (0.5 L 0.5 L 1 g/kg 1 kg 5 L 20 ml 80 ml)	0.5 L Carrot Juice+0.5 l Kinnow Juice+ 1g/kg CMC+1kg Sugar+5 L Water	8.3-8.6	8.2 -8.4	8.3-8.5	8.1-8.5	Ullah et.al, (2015)

5	Orange juice with Turmeric rhizome juice (90:10)	100% orange juice	8.7-8.5	8.5-8.5	9.0-9.0	8.8-8.6	Mane RP et.al, (2017)
6.	Cabbage, orange juice, ginger and sugar (15:60:15:10)	100% orange juice	6.0-7.0	6.0-7.0	*	6.0-7.0	Frederick et, al. (2016)
7.	Sweet orange: giloy and basil (93:06:02)	100% sweet orange juice	7.4- 8.1	7.8- 8.6	*	7.6 -8.35	Puranik et. al, (2011)
8.	Carrot with Sour orange juice (50:50)	100% carrot juice	6-6.66	*	5-5.40	5.55-6.03	Afreen et.al,2016
9.	Lime juice, holy basil, ginger and sugar syrup (30:20:5:45)	100% lime juice	7.2-4.1	8-4.2	8-3.2	7.9-3.8	Harsha et. al, (2015)
10.	Sugarcane and aonla (95:5)	100% sugarcane juice	1.62	1.62	1.62	1.62	Sangeeta et.al,
11.	Soya milk and mango pulp (50:50)	100% soya milk	5-7.86	4-6.50	4-7.30	4.3-7.22	Ranveer et. al, (2012)
12.	Whey, mango, sugar, ginger and guar gum (82: 10 :8:0.5:0.05)	100% paneer whey	5.8-7	5.28-6.7	5.71-6.2	5.59-6.63	Alane et. al, (2017)
13.	Paneer whey and beet root and herb (80:20:06)	100% paneer whey	*	*	*	*	Satpute et. al, (2018)
14.	Whey, banana juice, sugar and herb (80:10:08:02)	100% paneer whey	7.6-6.30	7.2-6.40	7.6-6.20	7.4-6.3	Yadav et. al, (2010)

15	Whey, pineapple, bottle gourd, sugar, mentha (70:10:10: 08:02)	100% paneer whey	8.0-7.70	7.50 - 6.80	8.0-6.60	7.8-7.03	Baljeet et. al, (2012)
16.	Whey: guava pulp: Basil, Mint, Ginger, Lemon grass and Alovera (74:20:06 one of the herbs)	100% milk whey	7-8.6	6.6-8.8	6.2-8.4	6.6-8.6	Dubey et, al. (2016
17.	Guava pulp with pineapple juice (50:50)	100% guava pulp	6.76 - 7.77	6.10 - 7.53	5.73-7.22	6.19-7.51	Sarkar et.al,
18.	Pineapple and aloe vera (90:20)	100% pine apple juice	9-8.5	9-8.9	8.5-8.9	8.83-8.7	Biswas et. al, (2016)
19.	Pineapple juice, ginger, green chillies, pepper, cardamom and nutmeg (10:3: 00: 0.2 :00 :00)	10% pine apple	9-9	9-9	9-9	9-9	Amaravathi et, al. (2014)
20.	Ginger and honey (5:15)	10% ginger extract	*	*	7.5 -6	7.5 -6	Singh et. al, (2014)
21.	Apple and Jamun (90:10)	100% apple juice	6.9-7.74	6.9-7.74	6.9-7.74	6.9-7.74	Mishra et, al. (2016)
22.	Apple: apricot (75:25)	100% apple juice	*	*	*	1-4.80	Hussain et.al, (2011)

Effect on microbial count (total plate count) of blended juice

In the various studies it was observed that the effect on microbial count (total plate count) of blended juice was depended on the storage time of the juices. The juice blend ratio of Sugarcane and aonla (95:5) had minimum population of total plate count 1.07log at the end of storage (30 days) (Sangeeta et.al201ss7),

Sr. no	Fruit combination with ratio	Effect			Reference
		0 days (log)	15 days (log)	30 days (log)	
1.	Kinnow, ginger and pomegranate (87:10:3)	3.88	*	3.25	Bhardwaj et al,2010
2.	Pineapple and aloe vera (90:20)	Nill	2.05	2.72	Biswas et.al, (2016)
3.	Sugarcane and aonla (95:5)	0.77	0.92	1.07	Sangeeta et.al, (2017)
4.	Apple: apricot (75:25)	1.04	1.23	1.84	Husain et. al,2011
5.	Whey, mango, sugar, ginger and guar gum (82: 10 :8:0.5:0.05)	1.30	*	2.44	Alane et. al, (2017)
6.	Apple and Jamun (90:10)	Nill	Nill	Nill	Mishra et, al. (2016)
7.	Carrot with Sour orange juice (50:50)	Nill	Nill	Nill	Afreen et.al,2016

Probiotics

Probiotics can be defined live yeast or bacteria which are good for human body especially in digestion. Probiotic is made up of two different word “pro” means ‘for’ and “bios” means ‘life’ so it means “for life”. Probiotic drink is a drink which made up of after combination of probiotic strain.

Some probiotic bacteria’s

- *Lactobacillus:* - Generally, found in yogurt and other fermented milk product which are helpful in diarrhea and lactose digestion (Islam et, al.2016).
- *Bifidobacterium:* - Generally, found in yogurt helpful in some diseases such as common cold improve abdominal pain and Irritable Bowel Syndrome symptoms (Islam et, al.2016)
- *Saccharomyces boulardii:* - it is a yeast which is found in kefir, kimchi and other product which help to protect from diarrhea and other digestion problems.

Suitability of blended juices for the development of probiotic drinks

Sr. no.	Major attributed fruits	Probiotic strains	Recommended value of strain Log CFU/ml,	Overall acceptability	Reference
1.	Carrot juice	*L. acidophillus, L. plantarium, L. casei, Bifidum longum*	2.95	2.9	Rafiq, 2016
2.	Guava	*L. plantarum*	3.13		Dipjyoti C et al., 2015
3.	Whey and Orange Juice	*Bifidobacterium bifidium, Lactobacillus acidophilus*	5	7.87	Shukla P, et al., 2014
4.	Peach juice	*(L. casei, L. delbrueckii and L. plantarum)*	5	7	Pakbin et al., 2015
5.	Guava Juice and honey	*Saccharomyces boulardii*	7	6.4	Saba et al., 2018
6.	Whey and Pineapple Juice	*L. acidophilus*	7.57	8.93	Shukla et al., 2013
7.	Beetroot	*Lactobacillus rhamnnosus, Lactobacillus plantarum and Lactobacillus delbruecki*	9.00	7	Panghal et al., 2017
8.	Apple, Banana and Orange	*Lactobaccilus acicdophilous*	10.14	7	Worku et al., 2019

9.	Pineapple Juice	*Bifidobacterium lactis, Lactobacillus plantarum, and Lactobacillus acidophilus*	7	8	Nguyen et al., 2019
10	Fig Juice	*Lb. acidophilus*	6	8	Khezri et al., 2016

Conclusion

Fruit beverages contains higher medicinal, nutritional, and calorific values compared to synthetic beverages. Drinking the perfect blend of fruits could lower your risk of cardiovascular disease. Fruit juice is very useful for human body because it contains all benefit minerals and vitamins.

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