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RESEARCH PAPER

Correlative Analysis of Various Parameters in Fresh Fruit Juices and Packaged Fruit Juices

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ABSTRACT:

This study compares the nutritional quality, sensory attributes and shelf-life of fresh fruit juices with the commercially packaged fruit juices. Fresh fruit juices, typically extracted directly from fruits, are rich in vitamins, minerals and antioxidants. In contrast, packaged fruit juices undergo processing techniques such as pasteurization and filtration, which can reduce nutrient levels and introduce additives like preservatives, artificial sweeteners, and flavor enhancers. Nutritional analysis showed that fresh juices, such as orange, apple, and mango, contained higher levels of vitamins (e.g., Vitamin C) and antioxidants compared to their commercially processed counterparts. Packaged juices, while convenient and having a longer shelf-life, often contained added sugars and preservatives that were absent in fresh juices. Sensory evaluation revealed that fresh juices were preferred for their natural taste and aroma, though they have a shorter shelf-life, typically lasting only a day when refrigerated. Consumer surveys highlighted that while fresh juices are perceived as healthier, they are less convenient and more expensive. Packaged juices, despite concerns over added sugars and preservatives, are favored for their practicality and longer shelf-life. This study emphasizes the trade-offs between freshness, nutrition, and convenience in fruit juice consumption.

HIGHLIGHTS

- Fresh fruit juices surpass the packaged juice in nutritional content, taste and health benefits.
- Studies have shown that fresh fruit juices have more nutrients and significantly less sugar and additives

Keywords: Fresh fruit juices, packaged fruit juices, Ascorbic acid, additives

In recent years, fruit juices have become increasingly popular as a convenient and flavorful means of obtaining essential nutrients, including vitamins, minerals, and antioxidants. As consumers seek healthier alternatives to sugary sodas, juices—especially those labeled "100% fruit juice"—are often considered a better option. However, the growing demand for ready-to-drink beverages has raised concerns about the nutritional quality of commercially produced juices, which undergo various industrial processes such as pasteurization and filtration to enhance shelf life and taste. These processes, while improving product stability, can result in nutrient loss, particularly of heat-sensitive vitamins.

Fresh fruit juices, made by directly extracting juice from fresh fruits, typically retain most of their natural nutrientsand flavor, offering health benefits such as vitamin C, antioxidants, and potassium (Reddy & Sharma *et al*. 2020). In contrast, processed juices, even those labeled "100% juice," often lose valuable nutrients during production. To compensate for flavor loss, many commercial juices are enhanced with added sugars, preservatives, and artificial flavorings (Zhou *et al*. 2019). While fresh juices offer

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a more authentic taste and vibrant aroma, processed juices may taste sweeter or more artificial due to these additives (Wang *et al*. 2022).

In India, fruit juice consumption is growing, particularly in urban areas, driven by rising health awareness and increasing disposable incomes (Singh *et al*. 2023). However, the market faces challenges, including inadequate infrastructure and competition from street vendors. Despite these obstacles, brands like Dabur's 'Real' and Pepsi Co's 'Tropicana' dominate the organized sector, which continues to expand (Goyal & Singh *et al.* 2021).

The present study discuss the variation in nutritional value of fresh fruit juices and packaged juices thus suggesting healthier options and inform consumers about smarter beverage choices.

MATERIALS AND METHODS

Fresh fruit juices is prepared by cutting 500 grams of the selected fruit into small pieces and grinding them in juicer (Sumeet Mixer juicer; Sumeet Appliances Pvt. Ltd, Mumbai, Maharashtra) Once the fresh juice is collected, top up the volume with distilled water until the flask reaches the 100 mL mark. The packaged juice includes Appy fizz, Maaza, Real juices.

Apparatus Required for Analysis

Density bottle with stopper, weighing balance accuracy 0.001, g constant temperature water bath (27°C), beaker of varying size, Thiele's tube, capillary tube, liquid paraffin oil, dropper, conical flask, burette, stand, burner, digital pH meter, conical flask, burette, pipette, volumetric flasks, 0.1 N NaOH, 1N H_2SO_4, 0.05N iodine

METHODS

Determination of Density of Sample

Density bottles are mainly used to determine the density of liquids of moderate viscosity.

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

Density (P) = Mass (M) / Volume (V)

Determination pf pH of Sample

To determine pH of the sample, calibrate the pH meter using pH capsules of pH 4 and 7.

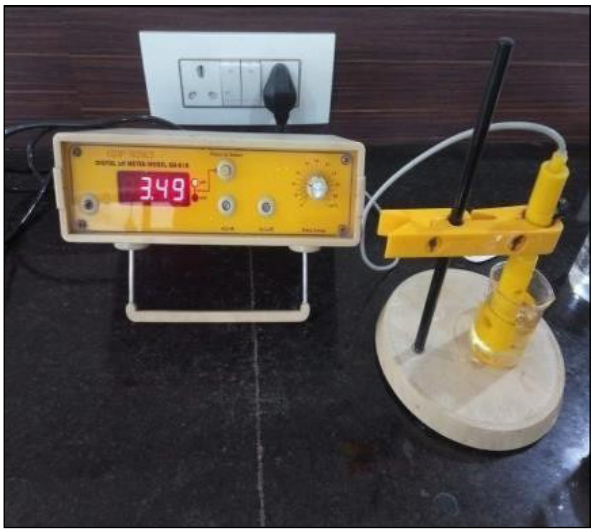

Fig. 1: Measure the pH of the sample.

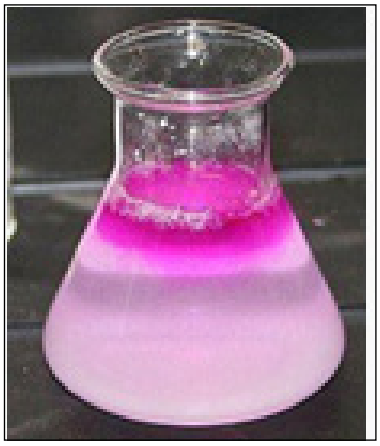

Fig. 2: Determination of Acid Value

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. Titrable acidity is determined by neutralizing the acid present in a known quantity (weight or volume) of food sample using a standard base. The end point for titration is usually either a target pH or the color change of a pH-sensitive dye, typically phenolphthalein.

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, using phenolphthalein as anindicator.

$$\% \text{ Acidity} = \frac{\text{Titre} \times \text{Factor (0.007 gm citric acid)} \times 100}{\text{Volume}}$$

The citric acid (monohydrate) content was calculated as %w/ v^{-1}

1 ml of 0.1N NaOH=0.007003 gm citric

Determination of Ascorbic Acid (Vitamin-C)

This method determines the vitamin C concentration in a solution by a redox titration using iodine. As the iodine is added during the titration, the ascorbic acid is oxidized to dehydroascorbic acid, while the iodine is reduced to iodide ions. Ascorbic acid + I_2 → 2 I^- + dehydro ascorbic 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 oxidized, the excess iodine is free to react with the starchindicator, forming the blue-black starch-iodine complex.

This is the end point of the titration.

Procedure

- Pipette 100 ml of the filtrate into a 250 ml separatory funnel.
- Neutralize to litmus paper using hydrochloric acid and add 5 ml excess. Extract carefully with 40, 30 and 20 ml portions of chloroform. Avoid formation of emulsion by shaking gently with rotatory motion.
- If emulsion forms, break it by stirring chloroform solution with a glass rod after each extraction, but donot drain any of the emulsion with chloroform layer.
- Transfer the combined chloroform extract in to a separatory funnel and wash it free from mineral acid byshaking gently and rinsing with water. Drain off the water phase.
- Dry the chloroform layer over anhydrous sodium sulphate and distil off the solvent.
- Dissolve residue in 30-50 ml of alcohol neutralized to phenolphthalein and titrate with 0.05 N sodiumhydroxide

Benzoic acid (ppm) =

$$\frac{122 \times \text{Titre} \times \text{Dilution} \times 1000 \times \text{ml of 0.05N NaOH}}{\text{Weight of sample} \times \text{aliquot taken (Filtrate)}}$$

RESULTS AND DISCUSSION

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

Density

Density was calculated with the help of density bottle method and it was concluded that fresh juice have less density as compared to packaged juice. This study is parallel to the research carried out by (Rathod *et al*. 2017; Suresh *et al*. 2017).

Maximum density in fresh juice was observed in orange juice (1.045 gms/ml) and minimum density was observed in strawberry (1.018 gms/ml). The higher density in orange juice in comparison to others depends is attributed to various factors like sugar content, pulp and fibre content, ripeness of fruit (Nijhuis 1995).

Table 1: Density of fresh fruit juice and packaged juice

Fruits	Density (gm/ml)	
	Fresh Juice	Packaged Juice
Mango	1.022	1.129
Apple	1.034	1.114
Orange	1.045	1.136
Strawberry	1.018	1.031

The results showed that fresh juices generally have lower density compared to packaged juices. Higher density in packaged juices may be due to various process it undergoes like concentration, pasteurization, addition of preservatives and flavour enhancers. A lower density often indicates a higher concentration of nutrients in the juice. This suggests that fresh juices are more nutrient-rich than their packaged counterparts.

pH

This is another parameter which helps us to understand whether the fresh juices are preferable or thepackaged juices.

Table 2: pH of fresh fruit juice and packaged juice

Fruits	pH	
	Fresh Juice	Packaged Juice
Mango	3.90	4.48
Apple	3.39	4.24
Orange	3.43	4.39
Strawberry	3.24	4.08

The fresh fruit juices are more acidic as compared to the packaged juices since it does not undergo different processing steps which neutralize acidity as is seen in packaged juices. Our results are congruent with the discovery made by (Kaur *et al*. 2018; Sharma *et al*. 2018). These findings suggest that fresh juices are healthier and preferable for consumption due to their lower acidity. It enhances nutrient absorption and is suitable for sensitive stomach.

Boiling Point: Study of boiling point helps manufacturers to optimize processing conditions and ensure quality.

Table 3: Boiling point of fresh fruit juice and packaged juice

Fruits	Boiling Point °C	
	Fresh Juice	Packaged Juice
Mango	102	101
Apple	101	100.2
Orange	100.5	99.8
Strawberry	101.5	100.6

Higher the boiling point of fruit juice lower will be the artificial content present in the juices. Fresh juices were having higher boiling point compared to packaged juices. Thus the boiling point of Fresh juices greater than the packaged juices. Our study's outcomes support the hypotheses proposed by (Rai *et al*. 2017; Sharma *et al*. 2017) in his pioneering work.

These results support the notion that fresh juices are healthier and contain fewer processed substances.

Acid Value

Acid-Base titration was performed and the result was observed.

As observed from the table 4 acid value of fresh fruit juice is greater compared to packaged juice and hence fresh juices are preferable for healthy diet. This investigation extends the research initiated by (Patel *et al*. 2018; Saini *et al*. 2018) offering new perspectives. This research complements the work conducted by (Singh *et al*. 2019; Agarwal *et al*. 2019) on similar issues, providing additional insights.

Table 4: Acid value of fresh fruit juice and packaged juice

Fruits	Acid Value (% acidity)	
	Fresh Juice	Packaged Juice
Mango	0.58	0.35
Apple	0.82	0.52
Orange	1.22	0.80
Strawberry	1.62	1.04

Ascorbic Acid Content

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

Table 5: Ascorbic acid content in fresh fruit juice and packaged juice

Fruits	Ascorbic Acid Concentration (mg/100 ml)	
	Fresh Juice	Packaged Juice
Mango	25.05	12.25
Apple	6.20	3.26
Orange	53.65	23.41
Strawberry	72.71	32.32

It was observed from the study that all the fresh juices have more concentration of vitamin C due to minimal processing and absence of heat treatment while packaged juice loses vitamin C during processing, pasteurization and storage due to oxidation, heat degradation and preservative interactions. This research is parallel with the work conducted by (Liu *et al*. 2019; Wang *et al*. 2019) on similar issues.

Benzoic Acid

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 packaged juices. As observed from table 6 strawberry juice have shown higher benzoic acid concentration in fresh juice as well as packaged juice. The harvesting of benzoic acid at riper stage leads to higher benzoic acid concentration and in packaged juice various manufacturing stages like pasteurization, concentration, preservation enhances

the benzoic acid concentration. Similar research was carried out by research group (Sharma *et al.* 2018; Jain *et al*. 2018).

Table 6: Benzoic acid concentration in fresh fruit juice and packaged juice

Fruits	Benzoic Acid concentration (mg/litre)	
	Fresh Juice	Packaged Juice
Mango	0.62	19.6
Apple	0.76	12.3
Orange	0.53	11.23
Strawberry	2.56	56.23

CONCLUSION

This study aimed to determine the best quality fruit juices and assess whether fresh or packaged juices are healthier. It compared the key properties of fresh fruit juices (from mango, orange, apple, and strawberry) with packaged juices, focusing on vitamin-C levels, pH, acid value,density, benzoic acid and ascorbic acid concentration. The results consistently showed that fresh juices outperformed packaged varieties in nutrientcontent, particularly vitamin-C.

From a health perspective, fresh juices are always preferred due to their higher nutrient levels and lack of preservatives. However, during off-seasons, packaged juices may offer a convenient alternative. The study also highlighted the health risks of processed juices, which often contain higher sugar levels and harmful preservatives.

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REFERENCES

Akinmoladun, A. and Oloyede. 2020. Acid Value and Its Significance in Oil Quality. *Int. J. Agric. Food Chem*, **68**(7): 1845-1853.

Chaudhary, A. and Rani, S. 2019. Effect of processing on the physical properties of fruit juices: A focus onboiling point. *Int. J. of Food Science and Technology*, **56**(3): 1472-1478.

Goyal, P. and Singh, M. 2021. Growth of the fruit juice market in India: Trends and challenges. *Indian J. of Marketing*, **51**(9): 35-46.

Kaur, A. and Sharma, P. 2018. Acidity and pH variations in fresh and processed fruit juices. *Int. J. Food Research,* **10**(3): 94-100.

Lee, S. Kim, Y. and Park, T. 2018. Evaluation of Acid Value as a Key Indicator for Oil Degradation. *Int. J. Food Chem.*, **245**(1): 1023-1031.

Liu, Y. and Wang, J. 2019. Comparative analysis of vitamin C content in fresh and commercially processed fruit juices. *Int. J. of Agricultural and Food Chemistry,* **67**(45): 12630-12637.

Nijhuis, H.H. 1995. Density and viscosity of fruit juices. *J. of Food Engineering*, **25**(2): 247-257.

Patel, R. and Saini, R. 2018. Acidity and nutritional comparison of fresh and packaged fruit juices. *Int. J. Food Science and Technology International*, **24**(6): 503-511.

Rai, S. and Sharma, M. 2017. Boiling point and its correlation with artificial additives in fruit juices. *Int. J. Food Chemistry*, (**229)**: 556-561.

Reddy, R. and Sharma, N. 2020. Nutritional benefits of fresh fruit juices versus processed juices. *Int. J. Food Science and Technology*, **37**(4): 542-550.

Rathod, N. and Suresh, K. 2017. Comparison of physical properties in fresh and processed fruit juices. *Int. J. of Food Science and Technology,* **54**(4): 1025-1031.

Sharma, A. and Jain, S. 2018. Vitamin C content in fruit juices: A comparative study of fresh and packagedvarieties. *Int. J. Food Research*, (**104)**: 34-39.

Sharma, P. and Gupta, S. 2019. Determination of Ascorbic Acid (Vitamin-C) in Various Fruit Juices. *Int. J. Food Chem.*, **274**(3): 812-818.

Singh, G. and Agarwal, A. 2019. Acid value analysis and its impact on health in fruit juices. *Int. J. of Food Chemistry,* (**257)**: 122-128.

Singh, M. and Gupta, S. 2020. Health implications of pH levels in fruit juices: A comparison of fresh andpackaged varieties. *Int. J. of Food Science and Nutrition*, **66**(7): 1211-1218.

Wang, S., Li, X. and Zhang, Y. 2022. Commercial fruit juice: Effects of industrial processing and quality changes. *Int. J. of Food Quality*, **45**(3): 123-134.