Determination of Preservative Sodium Benzoate in Selected Samples of Fruit Juices and Squashes

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Abstract:

Preservatives are used to preserve and enhance the shelf life of food products. Sodium benzoate is more commonly used to preserve fruit juices and squashes.

Objective:

To determine, amount of preservative sodium benzoate in fruit juices and squashes, and whether they contain safe level of sodium benzoate as set by international standards of health by Food and Drug Administration (FDA).

Methods:

Quantitative experimental study was undertaken to determine the amount of preservative sodium benzoate in eight samples of fruit juices and squashes by titrimetric method, twice. Flavors of fruit juices selected were orange and mango, while brands included were Haleeb, Mitchell's, Nestle and Shezan. Fruit squash flavors included were orange and mango, whereas brands included were Kinza, Mitchell's, Shezan and Time. MS Excel was used for the interpretation and analysis of the data.

Results:

The results revealed that sodium benzoate was present in safe level of 0.1% as set by international standards of health FDA (USA) in all samples of fruit juices and squashes.

Conclusions:

It was concluded that the presence of sodium benzoate in fruit juices and squashes was found in approved FDA range in most of the samples available in local market.

Keywords:

Preservative, sodium benzoate, fruit juices, fruit squashes,

Introduction:

Fruit juices are consumed globally, not merely owing to their flavor, taste, and freshness, but also because of their valuable wellbeing properties while consumed on regular basis. Several people are becoming aware of the significance of consuming fruits in their every day diet as fruit juices are appropriate and suitable sources of carotenoids and polyphenolic compounds[1]; exerts antioxidative, immunomodulatory and antimicrobial effect. The gut microbiota is an important contributor to human health. Vegetable/fruit juices provide polyphenols, Fruit and vegetables are good sources of oligosaccharides, fiber and nitrate (beet juice), which may induce a prebiotic-like effect contribute to general health and decrease the risk of chronic diseases such as cardiovascular disease.[2]

The most preferred oldest chemical preservative used in cosmetic and food industries is sodium benzoate which is soluble in water[3], a white granular or crystalline powder in appearance[4]. Sodium benzoate is used as a common food preservative in salad dressings, carbonated drinks, jams, fruit juices and other condiments and is labeled by the code E211, classified" Generally Recognized As Safe" (GRAS) and regulates the concentration of sodium benzoate to 0.1% by weight in food products by The US Food and Drug Administration (FDA). Its content must be declared and must not exceed the established limits by legislation.[5]

In season, the fruit is preserved to make it available for further use in off season. During preparation of packed juices, more preservative is added, thus increasing its amount in the finished product.[6] Benzoates and sorbates are the most commonly used preservatives in foodstuffs and are analyzed by using anion exchange high-performance liquid chromatography (RP-HPLC)[7], capable of determining microgram quantities of two common food preservatives in citrus juices–8, other

foods as sodas, soy sauce, ketchup, peanut butter, cream cheese were also subjected for HPLC determination by UV diode array detection for identification and quantization of the two preservatives: 225 nm for sodium benzoate and 255 nm for potassium sorbate.

Mango is one of the main tropical fruit and is considered to be among one of the most consumed fresh fruits in the world. Mango is a unique fruit in terms of diverse products processed from it especially from its immature to fully ripe stages. Due to antimicrobial effect of potassium metabisulfite and sodium benzoate, mango pulp is effectively preserved using these chemicals at suitable concentration.[10] Mango nectar a ready to drink beverage is prepared by diluting single-strength mango pulp with the addition of sugar, water and preservatives to make product that has a certain percentage of mango pulp/ puree. Mango nectar can be made either from mangoes directly or from canned, aseptically packaged or frozen puree.[11] According to the Codex Alimentarius the percentage of pulp in the beverage must be noted on the label. For mango squash, a concentrated mango drink, juicy varieties of mangoes are preferred. Mango nectar and squash are similar in composition except for the presence of a preservative 0.1% sodium benzoate.[12]

To be labeled as a fruit juice, the US Food and Drug Administration (FDA) mandate that a product be 100% fruit juice. In general, juice drinks contain between 10% and 99% juice and added sweeteners, flavors, and sometimes fortifiers, such as vitamin C or calcium. According to FDA regulations, these ingredients must be listed on the label.[13] Some juices have naturally occurring high contents of potassium, vitamin A, and vitamin C. In addition, some juices and juice drinks are fortified with vitamin C, vitamin D and calcium.[14] Juice contains no fat or cholesterol, and unless the pulp is included, it contains no fiber.[15] In a study conducted at Brazil, Different brands of soft drink, fruit juice, margarine, yoghurt and cheese available on the Brazilian market, benzoic and sorbic acids were analyzed by high performance liquid chromatography (HPLC). Only one sample presented a preservative level above that permitted by the legislation in force in Brazil.[16]

This study was attempted to provide information about amount of preservative added to fruit juices and squashes. So that awareness could be created among consumers regarding safety of processed fruit juices and squashes, as far as the use of sodium benzoate is concerned.

Methods:

Quantitative research was undertaken to determine the amount of preservative sodium benzoate in selected samples of fruit juices and squashes. Various brands of fruit juices and squashes available in the market were taken for analysis. Fruit juice flavors included were orange and mango where as brands included were Haleeb, Mitchell's, Nestle and Shezan. Fruit squash flavors included were orange and mango while brands included were Kinza, Mitchell's, Shezan and Time. Thirty two samples were subjected to determination of sodium benzoate content as preservative in fruit juices and squashes. The samples were analyzed for sodium benzoate content twice. Sixteen samples of fruit juices and squashes were procured from the market in the month of March and the same number of fruit juices and squashes were purchased in the month of July for analysis of sodium benzoate content. Titrimetric method was used to determine amount of sodium benzoate as a preservative in samples of fruit juices and squashes as described in A.O.A.C (Association of Official Analytical Chemists) Manual 2005.[21] Sodium benzoate was calculated as: 1ml of 0.05 N NaOH = 0.0072 gm of anhydrous sodium benzoate. That is titrated value multiplied by 0.0072. Sodium Benzoate content is obtained in grams. To obtain sodium benzoate content in milligrams multiply it with 1000. The data collected was compiled and tabulated using computerized data base management programs. MS Excel was used for the interpretation and analysis of the data. Sodium benzoate values of the sample were compared with the standards i.e. 0.1% as set by International Standards of Health FDA, USA.

Results:

1. Determination of sodium benzoate in Mango Juice:

Sodium benzoate as a preservative was extracted in two samples of mango juice of Haleeb and Shezan brands. Sodium benzoate was not extracted in the mango juice of Mitchell's and Nestle brands. The analysis of mango juice samples of Haleeb and Shezan brands showed that

sodium benzoate extraction varied from one season to another due to seasonal availability of fruit. It is evident from the table that mango juice of Haleeb brand contained 0.102% sodium benzoate which slightly exceeded the standard value of 0.1% maximum during winter season due to non availability of fresh fruit in the market. It was further observed that pack of the mango juice was labeled as "Preservative" without specifying its proper name. In mango juice of shezan brand both values were found to be within limits i.e. 0.092% in winter season and 0.083% in summer season. The label of mango juice of Shezan brand provided no information about any preservative. Determination of sodium benzoate in samples showed that sodium benzoate was not extracted in the brands of Mitchells's and Nestle.on label of Mitchells's brand of mango juice the preservative " sodium benzoate E211" was mentioned but it certainly did not contain sodium benzoate, whereas on label of mango juice of Nestle brand word "permitted preservative" was mentioned but sodium benzoate in four samples of mango juice showed that Haleeb brand of mango juice exceeded the standard value in winter season that is 0.102%.

Sr. No	Brand name	Winter season value mg/100ml	Sodium benzoate percentage%	Summer season value mg/100 ml	Sodium benzoate percentage%	*Standard value, 0.1% i.e. 100mg/ 100ml
1	Haleeb	102.24	0.102	98.64	0.098	Beyond limit in winter season
2	Mitchell's	º N.D	º N.D	º N.D	º N.D	º N.D
3	Nestle	º N.D	º N.D	º N.D	º N.D	º N.D
4	Shezan	92.16	0.092	83.52	0.083	Within limit

Table 1: Determination of sodium benzoate in Mango Juice

º N.D stands for not detected

*Standard value of 0.1% was set by International standards of health by FDA, USA.

2. Determination of sodium benzoate in Orange Juice:

It is evident from the table (1 and 2) that sodium benzoate as a preservative was extracted to safe level in two samples of orange juice of Haleeb and Shezan brands. Sodium benzoate was not extracted in the orange juice of Mitchell's and Nestle brands. The analysis of orange juice samples of Haleeb and Shezan brands showed that sodium benzoate extraction varied from one season to another due to seasonal availability of fruit. It is evident from the table that sodium benzoate was extracted at higher amount in summer season (off season) and relatively at a lower amount in winter season (in season) due to non availability of fruit in the market. The values found from the analysis conducted during winter and summer season lied within the limit as set by International standards of Health FDA USA to 0.1% maximum. It was further observed that pack of the orange juice was labeled as "Preservative" without specifying its proper name. in orange juice of Shezan brand "All Pure No Preservative" was written but sample analyzed during winter and summer season indicate that sodium benzoate was extracted below 0.1% maximum. In both samples of orange juice of Mitchell's and Shezan brands no sodium benzoate was extracted. On label of Mitchell's brand of orange juice the preservative "sodium benzoate E211" was mentioned but certainly it did not contain sodium benzoate as preservative. On label of orange juice of Nestle brand "100% Pure No Preservative" was mentioned and it did not contain preservative.

Sr. No	Brand name	Winter season value mg/100ml	Sodium benzoate percentage%	Summer season value mg/100 ml	Sodium benzoate percentage%	*Standard value, 0.1% i.e. 100mg/ 100ml
1	Haleeb	92.88	0.092	95.04	0.095	Within limit
2	Mitchell's	º N.D	º N.D	º N.D	º N.D	º N.D
3	Nestle	º N.D	º N.D	º N.D	º N.D	º N.D
4	Shezan	75.6	0.075	82.08	0.082	Within limit

Table 2: Determination of sodium benzoate in Orange Juice

º N.D stands for not detected

*Standard value of 0.1% was set by International standards of health by FDA, USA.

3. Determination of sodium benzoate in Mango Squash:

It is evident (table 3) that sodium benzoate was used in all samples of mango squash and quantity was found to be safe within the limit, matching the standard value i.e. 0.1% maximum. Sodium benzoate extraction varied from one season to another due to seasonal availability of fruit. The word "permitted preservative" was mentioned on all the labels of mango squash of Kinza, Mitchell's, Shezan and Time brands without specifying proper name of preservative.

Sr. No	Brand name	Winter season value mg/100ml	Sodium benzoate percentage%	Summer season value mg/100 ml	Sodium benzoate percentage%	*Standard value, 0.1% i.e. 100mg/ 100ml
1	Kinza	100.00	0.1	96.44	0.096	Within limit
2	Mitchell's	79.92	0.079	76.32	0.076	Within limit
3	Shezan	89.28	0.089	84.96	0.084	Within limit
4	Time	92.16	0.092	88.56	0.088	Within limit

Table 3: Determination of sodium benzoate in Mango Squash

*Standard value of 0.1% was set by International standards of health by FDA, USA.

4. Determination of sodium benzoate in Orange Squash:

The results of sodium benzoate content in orange squash of selected brands revealed (table 4) that preservative was found within limits as set by International Standards of Health FDA to 0.1% maximum in all the samples of orange squashes. Sodium benzoate extraction varied from one season to another. It was further observed that as such no attention was paid on food labeling; orange squash of selected samples were labeled with word "Preservative" without specifying its proper name.

Sr. No	Brand name	Winter season value mg/100ml	Sodium benzoate percentage%	Summer season value mg/100 ml	Sodium benzoate percentage%	*Standard value, 0.1% i.e. 100mg/ 100ml
1	Kinza	91.44	0.091	92.88	0.092	Within limit
2	Mitchell's	83.52	0.083	87.12	0.087	Within limit
3	Shezan	92.16	0.092	95.04	0.095	Within limit
4	Time	97.92	0.097	82.08	0.082	Within limit

Table 4: Determination of sodium benzoate in Orange Squash
*Standard value of 0.1% was set by International standards of health by FDA, USA.

Discussion:

According to the results there is a seasonal variation in the amount of sodium benzoate. Mostly the levels of sodium benzoate in mango and orange juices and squashes of all brands during summers and winters were within the limits approved by FDA (i.e. 0.1%), except a slightly increased value of sodium benzoate in mango flavor of Haleeb during winters (0.102%). The presence of sodium benzoate in fruit juices and squashes available at local market in approved FDA range in most of the samples while two samples of fruit juices found to be deviated from FDA approved range of addition of sodium benzoate. Results of this study cannot be compared with previous studies, as different method of detection (HPLC) was used in them while in current study the method of detection used was titrimetric. The limitation of the study was that the researchers were bound to follow the titrimetric method of detection because of non-availability of high performance liquid chromatography at the place of research during the research period.

Conclusions:

Results of the current study showed the presence of sodium benzoate in fruit juices and squashes available at local market in approved FDA range i.e. 0.1% this study was attempted to provide information about amount of preservative added to fruit juices and squashes. So that awareness could be created among consumers regarding safety of processed fruit juices and squashes, as far as the use of sodium benzoate is concerned.

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