Executive Summary of Minor Research Project on

Analysis of Vitamin C in Commercial and Natural Fruit Juices

Fruits are not only delicious but healthful too. Botanically, fruits are the part of the plant that carries the seeds for future generations of plants. They are often attractively 'packaged' by nature to encourage animals and birds to eat them and scatter the seeds. Rich in vitamins A and C, plus folate and other essential nutrients, they may help prevent heart disease and stroke, control blood pressure and cholesterol, prevent some types of cancer and guard against vision loss. Fresh fruits were Nature's greatest gifts. They were a unique group of foods because they have a wide variety of types, flavors, colors, and textures. Relatively recent preservation techniques and modern transport facilities have increased the variety of fruit available.

. Vitamin C is one of the most important vitamins for human nutrition that is supplied by fruits and vegetables. Citrus fruits (especially oranges, lemons, and grape fruits), gooseberries, strawberries, and raspberries provide a good source. Vitamin C or ascorbic acid is an essential, water soluble organic compound important **i**n animal metabolism. L-Ascorbic acid (AA) is the main biologically active form of vitamin C. Ascorbic acid is reversibly oxidized to form L-Dehydroascorbic acid (DHA), which also exhibits biological activity. Since DHA can be easily converted into AA in the human body it is important to measure both AA and DHA in fruits and vegetables to know vitamin C activity (Lee and Kader, 2000).Among the vitamins, vitamin C (ascorbic acid) is an essential micronutrient required for normal metabolic function of the body (Jaffe, 1984). Vitamin C is easily oxidized, and the majority of its functions invivo rely on this property. Most animals produce it in their bodies, but humans, other

primates, guinea pigs lack an enzyme called Gulonolactone oxidase, that convert glucose to Vitamin C. So they lack the ability to synthesis Vitamin C in their body and need to take it through their diet. A vitamin C deficiency in humans results in the disease called scurvey, whose symptoms include hemorrhaging, joint pain and exhaustion (Brody, 1994 and Pauling, 1976).A very small daily intake of vitamin C (10-15 mg/day for an adult) is required to avoid deficiency and stave off scurvey (Kallner,1986).

Vitamin C is the major water-soluble antioxidant within the body (Sies, et al., 1995; Levine, 1986; Levine, 1995). It lowers blood pressure and cholesterol levels (Rath, 1993). Numerious analysis have shown that an adequate intake of vitamin C is effective in lowering the risk of developing cancers of the breast, cervix, colon, rectum, lung, mouth, prostate and stomach (Levine, 1996; Block, 1992; Block, 1991). Vitamin C is generally non-toxic. For maintaining a good and sound health and for prevention from common cold, human body should be kept saturated with vitamin C. Vitamin C toxicity is very rare, because the body cannot store the vitamin however ,amounts greater than 2000 mg/day are not recommended because such high doses can lead to stomach upset and diarrhea. Keeping in view its importance, the estimation of Vitamin C containing fruits assumes significance.

Citrus species (Rutaceae), the most popular fruits, originated in South-East Asia and then gradually spread to different parts of the world. These fruits contain a variety of sugars, citric acid, ascorbic acid, carotenoids, minerals, essential oils, etc and play an important role in human nutrition as excellent source of antioxidants (ascorbic acid, carotenoids and phenolic compounds). These constituents are considered to be essential components of functional foods. Many of these substances prevent damage to cell membrane and other structures by neutralizing free radicals. Ascorbic acid is the most important antioxidant in citrus fruit juices and it protects the organism from oxidative stress. Vitamin C cannot synthesize through body cells, nor does it store it. It is therefore important to include plenty of vitamin C containing foods in daily diet.

One of the objective of the present study was to relate the content of ascorbic acid of six Citrus fruits namely Citrus sinensis (Orange), Citrus limon (Lemon),Citrus paradisi (Grape), Citrus maxima (Babloos naranga), Citrus limetta (Mosambi) and Punica granatum (Pomegranate) with the view of making recommendations for their intake. A redox titration, involving an Iodometric method, has been used to do the analysis.

Various reports have shown fruits to be excellent sources of vitamin C. But it is lost from foods during preparation, cooking or storage. To find out the effect of temperature on stability of Vitamin C a temperature dependence study of vitamin C was carried out under three temperature regimes representing the ranges the fruits may be exposed to during processing and storage. The pH values of selected fruit juice samples were also determined.

The pH of citrus fruit juices selected ranged from 2.60 to 4.10 and was found to be lesser in case of lemon fruits when compared to others.P^H values of fruit juices are different due to the variation in amount of acidic contents. All samples were found to be acidic whose intake generates acidic environment in the stomach.

The result of the average value of vitamin C in each fruit juice samples under the specified condition are tabulated in Table below. It showed the highest concentration of vitamin C found in Babloos juice, hitting (31.97) mg /100g, the lowest level was found in Grape juice, when it reached (2.34)mg /100 g of juice. The amount of Vitamin C in juices of six different citrus fruits (Orange, Mosambi, Pomegranate, Babloos, Grape and Lemon) is as follows.

Bambloos > Orange >Mosambi>Lemon>Pomegranate>Grape

No	Fruit Juice Samples	Condition	Temperature	Total Vitamin C (mg/100g)
1	Orange	Fresh	32^0C	31.24
2	Lemon	Fresh	32^0C	16.56
3	Grape	Fresh	32^0C	2.3409
4	Babloos	Fresh	32^0C	31.97
5	Mosambi	Fresh	32^0C	30.506
6	Pomegranate	Fresh	32^0C	12.77

Table 2: *Total Vitamin C Content in Natural Fruit Juice Samples*

The effect of temperature on the amount of Vitamin C in citrus fruits was also calculated by titrating the juices using iodine solution. It can be seen from analytical results in table 3 that the lower the temperature the better the concentration of Vitamin C in fruit juice.

No	Fruit sample	Concentration		
		At room temperature (mg/g)	At 60^0C (mg/g)	At 90^0C (mg/g)
1	Orange	31.24	29.507	22.59
2	Lemon	16.56	14.0348	3.1958
3	Grape	2.3409	2.1608	1.639
4	Babloos	31.97	28.071	23.096

5	Mosambi	30.506	28.229	24.35
6	Pomegranate	12.77	12.77	9.295

Table 3: Total Vitamin C Content in Natural Fruit Juice Samples at different temperature

Higher temperature does not favour Vitamin C. it is better to maintain or store Vitamin C in a place below the room temperature. This is consistent with reports that, climate, especially temperature affect vitamin C level. Areas with cool nights produce citrus fruits with higher vitamin C levels. Hot tropical areas produce fruit with lower levels of vitamin C. Vitamin C loss during storage depends on the type of storage method employed, for example, handling and storage; oxygen is the most destructive ingredient in juice, causing degradation of vitamin C. Juice should be discouraged from being display in the hot weather above room temperature in order to maintain production concentration.

Our temperature dependence study on citrus fruits were found to follow a similar pattern of loss. This is because the vitamin C is more sensitive to temperature. Degradation was observed high in our selected samples as the temperature was raised to 90^{o}C

Conclusion

Determination of ascorbic acid content by iodometric titration is an easy, safe, and fast method. The redox reaction is preferable to an acid-base titration because a number of other species in juice can act as acids. This would help in quickly determining an estimate of ascorbic acid content of fruits for the purpose of recommending them for consumption to curb deficiency problems. Adequate consumption of fruits with high level of vitamin C can help in health improvement and thus reduce diseases such as diabetes, glaucoma, atherosclerosis, stroke, heart diseases and cancer The ascorbic acid content of the juices of six

Citrus fruits – Orange, Mosambi, Pomegranate, Babloos, Grape and Lemon were determined iodometrically in order to know which fruit would best supply the ascorbic acid need for the body. Results showed that Bambloos had the highest value of ascorbic acid, 31.97mg/100g followed by Orange, 31.24mg/100g and then Mosambi, 30.50mg/100g. Grape had the least value, 2.34mg/100g. It therefore follows that Bambloos would supply more ascorbic acid per 100gram for body need compared to the other fruits.

Bambloos > Orange >Mosambi>Lemon>Pomegranate>Grape

Temparature effects on Vitamin C content in citrus fruits were also determined using iodometric titration method under three temperature regimes (room temperature, 60^{o}C and 80^{o}C), representing the range of temperatures the fruits may be exposed to during processing and storage. It was observed that Vitamin C content was decreased as it was exposed to higher temperature. The decrease was observed high when the temperature of the juice was raised and kept at 60^{o}C. This is as a result of increase in oxidation of ascorbic acid with increase in temperature, as higher temperature favours redox reaction. This work helped to demonstrate the effects of processing and storage on the ascorbic acid contents of these fruits. Also lower pH value was preferred to prolong the shelf life.

Vitamin C exist in the form of drugs as swallow tablets, chewing tablets, swallow capsules, solvents and injection. We can had access to the handling of the recommended amount of vitamin C easily through alternative medicine but the damage will be limited in the short term if they are to stop dealing dose, therefore preferred experts dealt vitamins by natural eating and drinking, and not to rely on synthetic substitutes. Our project here makes some suggestions for the preferential intake of fruit juices.

6. References

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