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Effect of pickling on β-carotene and Total Phenol content of selected fruits

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Abstract
Fruits and vegetables are immensely valued for their nutritional content and their potential health functionality against various degenerative diseases such as cancer, cardiovascular, cataract, diabetes and neurodegenerative diseases. The major groups of phytochemicals that have been suggested as a natural source of antioxidants may contribute to the total antioxidant activity of plant materials including polyphenols, carotenoid and traditional antioxidant vitamins such as vitamin C and E. In this study, an attempt was made to estimate the beta carotene and total phenol content in five selected fruits (fresh and pickled) - *Averrhoa bilimbi, Citrus limon, Carica papaya, Phyllanthus emblica* and *Mangifera indica*. Among the five fruits, it was determined that pickled *Mangifera indica* showed the highest value (328.97g/100g) for beta carotene and fresh *Citrus limon* had the lowest amount (228.63g/100g). Among the fresh fruits, the first candidate with highest value was found to be *Carica papaya*, then *Phyllanthus emblica*, *Mangifera indica*, *Averrhoa bilimbi* and the least one was *Citrus limon*. In picked fruits, the highest value was given by *Mangifera indica,* followed by *Carica papaya, Phyllanthus emblica, Averrhoa bilimbi* and finally *Citrus limon.* Among the five selected fruits, it was determined that fresh *Citrus limon* had the highest amount of phenol (61.73gg/100g) and pickled *Averrhoa bilimbi* (22.36g/100g) had the lowest amount. These priliminary observations indicates that the process of pickling can do considerable changes in both β-carotene and total phenolic contents in the selected fruits.

Keywords: β-carotene, Total Phenol, Fresh and Pickled fruits, *Averrhoa bilimbi, Citrus limon, Carica papaya, Phyllanthus emblica, Mangifera indica*

1. Introduction
Many fruits and vegetables grow only in specific conditions and time like particular type of soil, under certain temperature and humidity. So in order to use these fruits and vegetables throughout the year and in all the parts of the world, some processing methods can be adopted. This helps to stabilize and transport fruits and vegetables of remote regions of the world, to distant locations for consumption. Several methods of preservation like canning, freezing, dehydration, pickling, are carried out to get safe processed products that desirable quality attributes similar to those of fresh products. It is noticed that some of the fruits and vegetables and their juice may be too tough or bitter to consume as such, so some kind of treatment procedure like thermal treatment, is needed. However, all these processing methods will have the capacity to produce undesirable changes in the color, texture, flavor and nutritional quality of many fresh fruits and vegetables. In this study, an attempt was made to estimate the beta carotene and total phenol content in five selected fruits- *Averrhoa bilimbi, Citrus limon, Carica papaya, Phyllanthus emblica* and *Mangifera indica*.

2. Materials and methods
The following fruits were selected for the study- *Averrhoa bilimbi, Citrus limon, Carica papaya, Phyllanthus emblica* and *Mangifera indica*. Both fresh and pickled samples were used for the estimation of β-carotene and Total Phenol.

Estimation of β-carotene- Beta carotene was estimated using the method of Aebih (1984) [1]

Estimation of Total Phenol- Total phenol content was estimated using the method of Malick and Singh (1980) [6].

3. Results and discussion

The study aimed at comparing the β-carotene and Total Phenol contents in fresh and pickled fruits. The fruits selected for the study were *Averrhoa bilimbi*, *Citrus limon*, *Carica papaya*, *Phyllanthus emblica* and *Mangifera indica*.

Estimation of *β-carotene* in fresh and pickled fruits

β- carotene content of the fresh and pickled fruits is given as the table 1. Among the five fruits, it was determined that pickled *Mangifera indica* showed the highest value (328.97g/100g) for β-caroteneand fresh *Citrus limon* had the lowest amount (228.63g/100g). Among the fresh fruits, the first candidate was found to be *Carica papaya*, then *Phyllanthus emblica*, *Mangifera indica*, *Averrhoa bilimbi* and the least one was *Citrus limon*. In picked fruits, the highest value was given by *Mangifera indica,*followed by *Carica papaya, Phyllanthus emblica, Averrhoa bilimbi* and finally *Citrus limon.* The beta carotene content of fresh *Averrhoa bilimbi* was 240.15g/100g and that of pickled was 269.15g/100g. The beta carotene content in the fresh *Citrus limon* was 228.63g/100g and in pickled was 254.20g/100g which was the least amount experienced. Beta carotene was determined in fresh *Carica papaya* as 276.63g/100g and 298.04g/100g was found in pickled papaya. In fresh *Phyllanthus emblica* it was 256.63g/100g and in pickled, it was noted as 276.63g/100g. In *Mangifera indica*, it was determined as 261.68g/100g where as in pickled, it was 328.97g/100g which was the highest amount noted in this study. Beta-carotene content in fresh fruit and fruit concentrate of *A. bilimbi* was also determined by Peris.C *et al.,* (2013) [12]. Nurul, S. R *et al.,* (2012) [6] have determined beta carotene content in fresh and pickled papaya. The amounts of beta carotene of fruits can be influenced by a number of factors such as natural variation of fruits, geographical origin, post-harvest conditions such as time of picking to market and shelf time prior to purchase (Boudries *et al.*, 2007). [2] He also reported that the precaution steps that were taken into consideration during the analysis had minimized the lost of beta carotene which eventually contributed to high beta carotene content in the studied samples which included performing analysis under dim light. The evidence for the increase was not due to the synthesis of new b-carotene. However, it might have resulted from certain changes in the plant tissue during pickling, producing a higher release of beta-carotene during the extraction process. More b-carotene was therefore detected. Many researchers have also mentioned similar findings in cooked vegetables (Oser *et al*., 1943; Poster *et al*., 1947; Park 1987; Hart and Scott 1995; Sungpuag *et al*., 1999) [9, 13, 10, 4, 15]. Those studies indicated that the lower value of b-carotene found in the raw vegetables was apparently due to incomplete extraction of carotene from the stable lipoprotein complexes.

Consumption of beta –carotene is known to be beneficial in prevention of a number of cancers and cardiovascular diseases. Fruits containing beta-carotene, vitamin E and lycopene constitute natural sources of antioxidants. Fruits form a major part of the daily consumption in both healthy and diseased people and have a variety of pleasant and attractive flavours. Cooking and dehydration at high temperatures of 50°C -70°C may lead to greater destruction of carotenoids in *Averrhoa bilimbi* and the main reason is the oxidation (Peris C *et al.,* 2013) [12]. Hence, consumption of the fruit in its raw form or in beverage that has not been subjected to excess cooking is preferred.

Table 1: β-carotene content in fresh and pickled fruits (g/100g)

Sl No.	Fruits	Fresh	Pickled
1	*Averrhoa bilimbi*	240.15	269.15
2	*Citrus limon*	228.63	254.20
3	*Carica papaya*	276.63	298.04
4	*Phyllanthus emblica*	256.63	276.63
5	*Mangifera indica*	261.68	328.97

Estimation of Total Phenol in fresh and pickled fruits

Phenolic compounds exhibiting antioxidant properties. Therefore, they play an important role in protecting cells and organs from oxidative damage (Osawa, 1999) [8]. These phenolic compounds have one or more phenolic groups for hydrogen proton donors and neutralize free radicals (Osamuyimen *et al.,* 2011) [7]. The result of the estimation of Total Phenol is given as table 2. Among the five selected fruits, it was determined that fresh *Citrus limon* had the highest amount of phenol (61.73gg/100g) and pickled *Averrhoa bilimbi* (22.36g/100g) had the lowest amount of phenol. In case of fresh samples, the order of decresing amounts of total phenol can be indicated as: *Citrus limon, Carica papaya, Averrhoa bilimbi, Phyllanthus emblica* and finally *Mangifera indica*. Similarly the descending order incase of pickled fruits was *Carica papaya, Citrus limon, Mangifera indica, Phyllanthus emblica* and finally *Averrhoa bilimbi.* It was observed that the amount of phenol in *Averrhoa bilimbi* was estimated as 41.85g/100g where as pickled gave the value as 22.36g/100g which was the least value noted in this study. In case of *Citrus limo* the values were noted as 61.73g/100g and 35.69 g/100g for fresh and pickled respectively. *Carica papaya* gave the amount as 47.13g/100g and 39.68g/100g, *Phyllanthus emblica:* 38.69g/100g and 22.98g/100g and *Mangifera indica:* 35.28g/100g and 25.36g/100g.

The chilling and pickling condition causes a small decrease of phenolic content of the fruit. The various temperatures of chilling and various prickling durations gave significant effect on amount of total phenols in the preserved fruit (Penpan Wetwitayaklung *et al*., 2009) [11]. A study by Nurul, S. R. and Asmah, R (2012) [6] indicated that mean total phenolic content was higher in fresh papaya as compared to pickled papaya. One of the main reason for the loss of phenolic componunds may be the treatment used for the production of pickles. A study by Howard, L. R. and Hernandez-Brenes, C (1998) [5], showed large variability in the content of phenolics of fresh Jalapeno peppers; this can be explained in terms of differences in cultivar, soil and weather conditions, and maturity, as well as postharvest manipulation. Similar variability has been observed for Jalapeno peppers grown in different parts of the state of Chihuahua and in different years, using the same extraction conditions (Ruiz-Cruz, S *et al*., 2010) [14]. Fresh peppers presented higher values compared to pickled peppers. These results can be explained by considering that during the pickling and canning process there is a loss of phenolic compounds and vitamin C due to lixiviation (Chuah, A. M *et al*., 2008 and Yamaguchi, T *et al*., 2001) [3, 16].

Table 2: Total phenol in fresh and pickled fruits (g/100g)

Sl. No.	Fruits	Fresh	Pickled
1	*Averrhoa bilimbi*	41.85	22.36
2	*Citrus limon*	61.73	35.69
3	*Carica papaya*	47.13	39.68
4	*Phyllanthus emblica*	38.69	22.98
5	*Mangifera indica*	35.28	25.36

4. Conclusion

Fruits are so important that they have been such a major part of human diet. Studies had proven that regular consumption of fruits will help to reduce the risks of several diseases and functional declines associated with aging. The increasing number of diseases and growing cost of health care have promoted the people to revise the current guide lines concerning nutrition. This preliminary study selected β-carotene and Total Phenol analysis in five selected fruits (fresh and pickled). It was noted that both the factors changed as a result of pickling process. In case of the β-carotene content, it was noticed that the amount had been increased as a result of the pickling in all the selected fruits. However, it might have resulted from certain changes in the plant tissue during pickling, producing a higher release of beta-carotene during the extraction process. But in case of Total Phenol, the amount had been lowered as a result of processing. From this, it can be concluded that the food processing methods like pickling can make noticeable changes in nutritional and anti-nutritional factors.

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