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Changes in Nutrients During Storage and Processing of Canned Palmyrah Young Fruit Kernel

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Abstract:

Palmyrah young fruit kernel is a rich source of nutrients and anti-oxidants. Since Palmyrah products are seasonal, canning was adapted to deliver high quality, nutrient-dense foods on over the year. However there is a perception when a food is subjected to the canning techniques, they change some nutrients compared to the fresh form. Therefore a studywas conducted to assess whether canned Palmyrah young fruit kernel could deliver nutrient levels comparable to fresh one. Proximate, mineral and vitamin C, Total phenol and anti-oxidant activity analysis were conducted to assess how these nutrients were affected by the canning process and whether storage further changed these components. This study was found that canned Palmyrah young fruit kernel is significantly higher level in minerals and anti-oxidant activity than fresh. Vitamin C decrease immediately upon Canning and there were no statistically significant changes during storage while total phenolic content was significantly decreased with storage. Canned sample has significantly higher level of total sugar and ash while moisture and protein were found lower compare to fresh sample. This study shows that most of the nutrients content of canned Palmyrah young fruit kernel has been shown in this study to be comparable to that of fresh one.

Keywords **—Palmyrah, Young fruit kernel, Canning, nutrient**

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I. INTRODUCTION

There is consensus among nutritionists and medical professionals that increased consumption of fruits and vegetables will result in improved health for many individuals in the world (Durst & Weaver, 2013).Several reports have shown that adequate intake of fruits and vegetables form an important part of a healthy diet and low fruit and vegetable intake constitute a risk factor for chronic diseases such as cancer, coronary heart disease, stroke and cataract formation (Van Duyn&Pivonka, 2000).

Palmyrah (*Borassusflabalifer*) grows in dry zones of Sri Lanka, mostly in the Northern and Eastern parts of the island (Selvaratnam& Cyril, 1994).

Previous research studies conducted on Palmyrah young fruit kernel proved that they are potentially a good source of carbohydrate, protein, fiber and some essential mineral elements are found in high concentration (Tharmaratnam et al., 2017). In addition to nutritional importance, they are also being recognized as having total phenolic content and vitamin C which show anti-oxidant properties (Jeyaratnam 1986).

Therefore Increasing consumption of these Palmyrah products will help the people to maintain their dietary requirements and prevent the chronic diseases such as cancer, cardiovascular diseases and age- related pathologies and promote overall health (Arunachalam et al., 2011).

Even though Palmyrah products are seasonal, which limits their availability. These seasonable products are consumed in fresh form and the consumers who enjoy those products are expecting throughout the year. Therefore to make available throughout the year to consumers, canning was adapted to deliver high quality, nutrient-dense foods on a year-round basis, instead of the limited seasonal availability of fresh young fruit kernel. (Glanista et al., 2018).

However Many consumers have the perception that processed products have lower levels of vitamins, minerals and phytochemicals and are thus nutritionally inferior to fresh products. This misperception may limit consumers' food choices. (Durst & Weaver, 2013).

Therefore, an opportunity has been taken to assess whether canned products could deliver nutrient levels comparable to fresh with the purpose of supplying information that can promote commercial sales of Palmyrah young fruit kernel and its larger use by the local population as supplementary sources of essential nutrients.

II. MATERIALS AND METHODS

1. Sample Collection

Palmyrah young fruits were collected from selected palm in 'Kaithady'. All the samples were in same maturation stage, same size and same environmental condition.

2. Fresh Sample Preparation

The kernel wasremoved from freshly harvested Palmyrah young fruit at the same day of fruits plugging from the tree. Kernel was washed thoroughly with water. These were not allowed to soak since they may loseFlavour and nutritive value. These samples were avoided by exposing to air and processed as soon as possible and divided into three portions. One portion, on which moisture is to be determined, was blended into paste. While the other portion was frozen immediately in moisture proof container at -22 ºC for further analysis and another portionwas used for canning. (Glanista et al., 2018).

3. Canning of Palmyrah young fruit kernel

Canned sample was prepared by using isotonicconcentration of sugar solution containing 0.05% of sodium metabisulphite and pasteurized at 80 ºC for 20 minutes then stored at room temperature.(Glanista et al., 2018).

4. Proximate composition

Moisture, protein and total ash were determined by using Association of Official Analytical Chemists methods. (AOAC, 2012).DinitrosalicylicMethod was followed to determine the Sugar content. (Girish, et al, 2014)

5. Mineral composition

Phosphorous in the sample was determined using Association of Official Analytical Chemists method. (AOAC, 2012). Potassium and sodium content was estimated using aflame photometer andCalcium and iron were carried out according to Vogel method (Vogel, 1989)

6. Vitamin C content

Determine the vitamin C concentration in the sample by a redox titration method using iodine.(Suntornsuk, et al, 2002)

7. Total phenolic content

The total phenolic content was determined by Folin-Ciocalteu method (VL Singleton,et al,1999)

8. Antioxidant activity using DPPH method

Samples were analyzed for antioxidant activity by usingAscorbic acid as the reference standard, to quantify the free radical scavenging capacity, which wasexpressed as ascorbic acid equivalent . (DP Subramanianet al, 2011).

9. Statistical analysis

All data obtained were subjected to statistical analysis (ANOVA), using Minitab 13 software at 95% confidence interval and pairwise compared by using LSD (Least Significant Difference) test. For all the analyses, the alpha error was set at 0.05%.

III. RESULTS AND DISCUSSION

In this chapter fresh and canned Palmyrah young fruit kernel were analyzed for their nutrient contents to assess whether both could deliver nutrient levels comparable to each other.

A fresh sample of Palmyrah young fruit kernel is designated as F and canned sample of four month storage designated as in the order 1st, 2nd, 3rd and 4th.

Table 1. Changes in proximate Composition in the Palmyrah young fruit kernel during canning and storage period (g/100g)

N=3	Moisture	Total ash	Protein	Total sugar
F	84.35 ± 0.05^{a}	0.48 ± 0.02^{b}	0.837 ± 0.05^{a}	8.38 ± 0.07^{b}
1st	80.34 ± 0.04^{b}	0.53 ± 0.09^{a}	0.745 ± 0.09^{b}	10.44 ± 0.10^{a}
2nd	80.32 ± 0.03^{b}	0.54 ± 0.10^{a}	0.658 ± 0.03^{c}	10.58 ± 0.09^{a}
3rd	80.50 ± 0.05^{b}	0.57 ± 0.06^{a}	0.655 ± 0.05^{c}	10.50 ± 0.10^{a}
4th	80.59 ± 0.04^{b}	0.58 ± 0.04^{a}	0.649 ± 0.07^{c}	10.45 ± 0.05^{a}

Each value in the table is represented as mean ± SD (n = 3) Values in the same column followed by a different letter (a-e) are significantly different ($p< 0.05$).

From the table 1 the moisture content observed in the fresh sample(84.35±0.05) was significantly higher than canned samples(80.32±0.03-80.59±0.04) .while there were no significant difference between canned samples during the storage($p>0.05$). The moisture content was slightly lower due to the incorporation of sugar solution .This pattern of moisture content was observed for canned pineapple (Adnan*et al*, 2017).

The ash content of food sample gives an idea of the mineral elements present in the sample. With regard to ash content of canned samples showed significantly higher (0.53±0.09 - 0.58±0.04) than fresh sample (0.48±0.02).While there were no significant difference among the canned samples during 4 months of storage (p>0.05).

In the table 1 it can be observed that fresh sample (0.837±0.05) has significantly higher protein content than canned samples (p<0.05).while observed the canned samples, there was slightly decrease in the protein content in the 2nd month of storage (0.658±0.03) than 1st month storage (0.745±0.09) and there were no significant difference between 2nd -4th month of storage (0.649±0.07-0.658±0.03) (p>0.05). Zhou et al supported to my findings, he states that heat treatment significantly inhibited synthesis of soluble protein and reduced its contentand the effectiveness of heat treatment remained until the end of storage. (Zhou et al, 2015)

With regards to total sugar content it was found fresh sample is slightly lower (8.38±0.07) than canned samples (10.44±0.10 - 10.58±0.09). While there were no significant difference in the canned sample during the storage (p>0.05). This effect due to the removal of water content from canned palmyrah young fruit kernel might cause to increase the sugar content in the canned Palmyrah young fruit kernel.

Table 2. Changes in Minerals Composition in the Palmyrah young fruit kernel during canning and storage period (mg/100g)

N=3	Phosphorous (P)	Sodium (Na)	Potassium (K)	Calcium (Ca)	Iron (Fe)
F	24.26 ±0.08^{b}	102.18±0.05^{c}	110.45±0.08^{c}	70±0.25^{c}	0.08±0.12^{d}
1st	25.32±0.12^{a}	135.23±0.08^{b}	126.36±0.07^{b}	80±0.18^{b}	0.24±0.09^{c}
2nd	25.48±0.10^{a}	138.14±0.05^{b}	129.12±0.04^{b}	82±0.14^{a}	0.26±0.14^{c}
3rd	25.50±0.09^{a}	142.27±0.10^{a}	130.08±0.10^{a}	83±0.20^{a}	0.65±0.08^{b}
4th	25.57 ±0.10^{a}	147.65±0.08^{a}	135.15±0.07^{a}	83±0.25^{a}	1.31±0.16^{a}

Each value in the table is represented as mean ± SD (n = 3). Values in the same column followed by a different letter (a-e) are significantly different (p< 0.05)

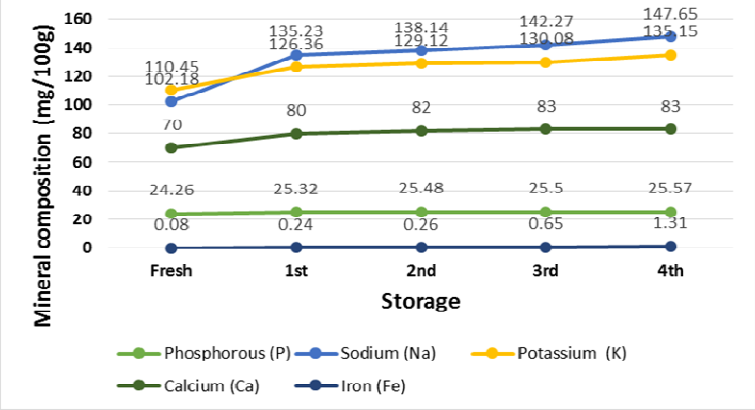

Figure 1: Changes in mineral composition during canning and storage period (g/100g)

A number of studies have reported that mineral content is highly dependent on commercial processing techniques and local water content. On the mineral composition, content of phosphorous (P) in fresh sample has slightly lower (24.26 ±0.08) than canned sample ($p<0.05$).While no significant difference was observed in the canned sample during the storage. The results of the range was between (25.32±0.12-25.57 ±0.10) ($p>0.05$).

Sodium content (Na) of 1st month of canned sample was found to be highest than fresh followed by 2nd, 3rd and 4th respectively. This could be as a result of addition of sodium metabisulphite during the canning to improve preservation.

The concentration of potassium (K) in canned samples are closely similar to each other ($p>0.05$) and highest than fresh sample. ($p<0.05$). Likewise, Calcium, of canned samples also were found to have almost similar concentrations (80±0.18-83±0.25) ($p>0.05$).While has a higher concentration than the fresh sample (70±0.25) ($p<0.05$).This is supported by Dandago, M. A that Minerals are heat stable under normal processing Conditions. Canned fruits and vegetables also may have higher levels of calcium and other minerals, due to uptake from hard water used in canning and are thus not expected to change significantly during storage. (Dandago,M.A).

With regard to Iron concentration, the fresh sample was found to be lowest amount in iron content while the concentration of iron gradually increased with storage of canned samples. ($p<0.05$).Such a difference might arise due to possible deposition of iron from the iron lids used for canning the Palmyrah young fruit kernels. Similar results was reported byAbdullahi et al, on the study of Proximate, Mineral and Vitamin Analysis of Fresh and Canned Tomato. (Abdullahi et al, 2016). In addition Elkins also supported to my findings that Mineral content may increase in canned foods due to uptake from hard water or the addition of brines. Minerals are generally unaffected during storage, except for iron and copper in canned foods. (Rickman et al, 2007).

Figure 2. Changes in Vitamin C content in the Palmyrah young fruit kernel during canning and storage period (g/100g)

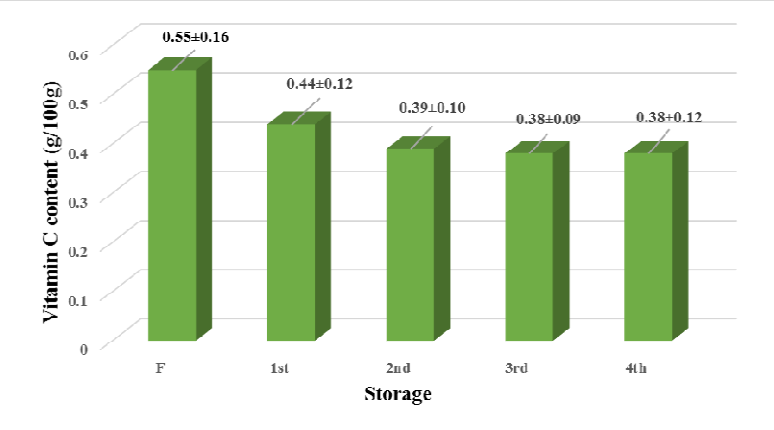

Figure 2 revealed that Fresh sample has significantly higher vitamin C content than canned samples while concentration of vitamin C remained relatively constant with storage period.A number of studies have reported thatVitamin C is essential to a healthy diet as well as being a highly effective antioxidant.Researchers further note that a significant loss of nutrients, especially heat-labile vitamins, may occur during the canning process (Abdullahi, 2016).Rickman et al suggest that canning

actually preserve nutrient value of the product while vitamin C is lost during the canning process and the level of vitamin C remains stable during the one to two years shelf life of the product(.(Rickman et al, 2007).

Figure 3. Changes in total phenolic content in the Palmyrah young fruit kernel during canning and storage period (mg/100g)

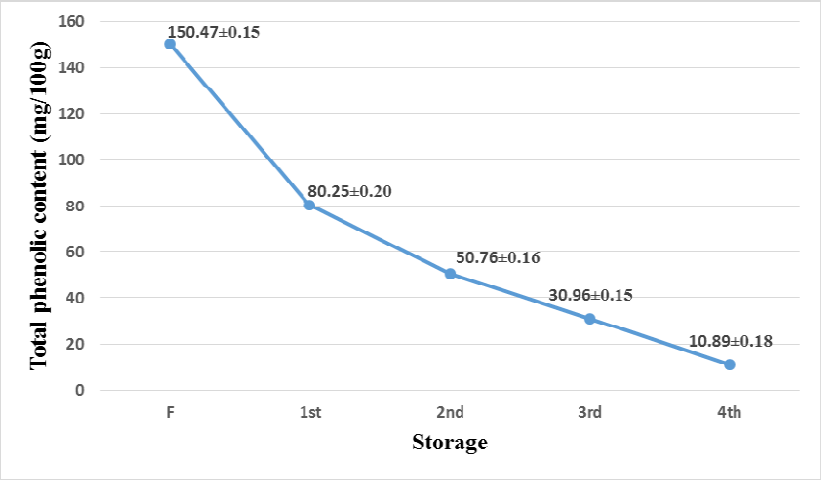

Figure 3 indicate that Fresh sample has significantly higher phenolic content than canned samples while concentration of phenolic content gradually decrease with storage period ($p<0.05$). Similar findings have been suggested by Vivar, He states in hisresearchon the Influence of canning process on colour, weight and grade of mushrooms, he has noted thatlargest loss of total phenols due to canning was found in mushrooms which underwent several washing and immersion steps in addition to thermal processing. (Vivar-Quintana AM, 1999)

Figure 4. Changes in Antioxidant activity in the Palmyrah young fruit kernel during canning and storage period (IC 50)

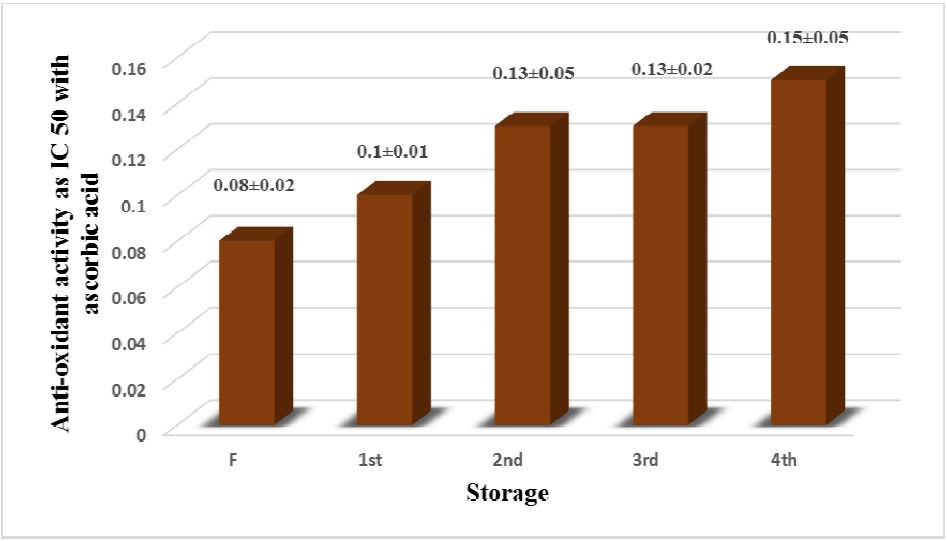

Figure 4 shows the canned samples all had higher apparent levels of antioxidants than the fresh samples ($p<0.05$). Similar results was found by Dewanto et al.(2002) that antioxidant activity increases the longer

the thermal processing time fruits and vegetables are subjected to when canning .This is most likely due to increased inactivation of degradative enzymes during the canning process. (Durst et al, 2002).

IV. CONCLUSION

Many consumers have the perception that canned products have lower levels of nutrients than fresh food. The nutritional content of canned Palmyrah young fruit kernel was comparable to that of fresh one. It can be seen that the proximate contents of the canned Palmyrah young fruit kernel were significantly higher than the fresh one with the exception of moisture and protein content. Vitamins C along with total phenolic content decrease immediately upon canning process and appear to stabilize after the processing step, showing minimal additional changes upon storage for 4 months. This may be due to the combined effects of processing conditionsand equilibration with the canning syrup. The minerals compositionsuch as sodium, potassium, calcium, phosphorous and iron as well as anti-oxidant activity were found to be higher in canned product than fresh. This study reveals that the canned Palmyrah young fruit kernel is rich in essential nutrients. Increasingconsumption ofcanned Palmyrah young fruit kernel help the people to maintain their dietary requirements.

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