Advances in Life Science and Technology
ISSN 2224-7181 (Paper) ISSN 2225-062X (Online)
Vol.24, 2014

Assessment of Some Commercial Fruit Juices Commonly Consumed in Federal University of Agriculture Makurdi, Benue State Nigeria, for Lipid Peroxidation Intermediates and Antioxidant Vitamin

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Abstract
Fruit juice are commercially produced and consumed as supplements to normal diet especially in the Northern Nigeria. They could be contaminated due to poor quality control and environmental factors, thereby increasing the risk of food borne diseases in the community. Lipid peroxidation studies were carried out on some commercial fruit juice products consumed within the Federal University of Agriculture Makurdi, Benue State, Nigeria to determine their safety levels. A total of eighteen samples were used in the study. Lipid peroxidation was determined in the samples using standard biochemical methods.The results show that there was significant differences ($p<0.05$) on the malondialdehyde concentration in samples D and F compared to the other samples. The malonaldehyde content was not significantly different ($p>0.05$). The results show that the ascorbic acid contents of samples A and B were significantly higher compared to sample F. The study shows that some of the fruit juice samples marketed in Makurdi have appreciable degree of peroxidation in them as indicated on their malondialdehyde levels and corresponding low levels of ascorbic acids. The public health importance of these results was highlighted.
Keywords: Fruit juice, lipid peroxidation, antioxidant vitamins.

INTRODUCTION.

Fruit juices are liquid that is naturally contained in fruits and vegetables. They are prepared by mechanically squeezing or macerating the fruit or vegetable flesh without the application of heat.

Juices are often consumed for their perceived health benefits (Adebesin et al., 2001). Orange juice, for instance, is known to be a good source of vitamin C, folic acid and potassium and could serve as an excellent source of bioavailable antioxidant phytochemicals (Franke et al., 2005Amusa and Asheye, 2009)and significantly improves blood lipid profiles in people affected with hypercholesterolemia(Amusa et al., 2005; Kurowska et al., 2000). Prune and cranberry juices are associated with a digestive health benefit and help to prevent or even treat bladder infections respectively (Kwan et al.,2004; Chan etal., 2005).

Fruit juices are known for their ability to raise serum antioxidant potential and even offset the antioxidant stress and inflammation normally caused by high fat and high-sugar meals (Tosi and Hamedani, 1992). Report from a controlled clinical study showed that regular consumption of grape juice for 12 weeks did not cause weight gain in volunteers, while the consumption of soft drinks did (Hollis et al., 2009). Fruit juice in moderate amount can help children and adults meet daily recommendations for fruit consumption, nutrient intake and calories (Lewis et al., 2009). In developing nations like Nigeria, it has not been possible to have control over the processing of hawked fruit juice because most of the vendors lack the adequate knowledge of food processing and handling techniques (Essien et al., 2011). Various commercial fruit juices are sold in Federal University of Agriculture, Makurdi and also consumed by staff and students. The nature, source and state of hygiene of foods and drinks consumed in the university have health implications on the academic society. As part of our on-going studies on the safety of some food beverages in different parts of Nigeria (Maduka et al., 2013; Maduka et al., 2014 a,b), we carried out the safety assessment of some commercially available fruit juice samples sold in shops in Makurdi and consumed in the Federal University of Agriculture Markurdi in Benue State, Nigeria.

MATERIALS AND METHODS.

Collection of samples: A total of eighteen samples comprising three different samples of fruit juices were purchased from shops around the Federal University of Agriculture Markurdi. They were randomly labeled A-E, stored in a refrigerator and used within 24 h of collection.

Lipid peroxidation measurement: The concentration of lipid hydroxides carbonyls present in the fermented milk (yoghurts) as malondialdehyde was determined by the method of Hunter *et al*. (1963) as modified by Kirkova *et al*. (1995). 0.175 ml of KCL Tris buffer (0.02 M) pH 7.4 was used as the medium for incubation after which 0.12 ml of 5N HCL was added. After mixing, 0.35 ml of 2% sodium barbituric acid solution was promptly added (TCA, HCL and thiobarbituric solution alone eliminate difficulties that arise due to absorption of colour due to protein precipitates),(Hunter*et al*., 1963). The tubes were then stopped with cotton wool and placed in boiling water for 10 min and the colour absorbance read at 532 nm. The concentration of the malondialdehyde formed was calculated using the molar extinction coefficient, 1.56×105 per m.cm using the formula:

Absorbance ×46
Sample wt/Volume.

where, 46 = Constant or factor of lipid peroxide absorptivity. The results were presented as means of triplicate determinations ± standard deviations as described earlier (Maduka, 2008).

Malonaldehyde measurement: The lipid hydrogen peroxide aldehyde determined by malonaldehyde was carried out by the method of Wills (1987) by the thiobarbituric acid reactivity. The levels of malonaldehyde formed were calculated using molar extinction coefficient 1.56×104 cm3mole/s. Results were expressed as mean±standard deviation and could be reproduced within±5%. The experiment was repeated three times.

Determinatiion of ascorbic acid concentration: The method used in the estimation of the ascorbic acid in the fruit juice was that of Roe and Kuetler (1943) and Natelson (1961) as modified by Tietz (1970). It was based on the conversion of ascorbic acid in strong acid to diketoglutonic acid in a strong acid and the reaction of diketogluconic acid with 2, 4-DNPH to form diphenyl hydrazine. The hydrazine dissolves in strong H2SO4 to produce a red colour which can be determined spectrophotometrically at 520 nm.

Statistical analysis: Data were subjected to Analysis of Variance (ANOVA). In order to test whether or not significant differences exist between groups, we analyzed the mean values with the paired T-test. The acceptable level of significance was $p<0.05$. The analysis was carried out on SPSS windows version 13.0.

RESULTS

The results of the lipid peroxidation and ascorbic acid concentrations in the fruit samples is shown in Table 1. The results show that there was significant differences ($p<0.05$) on the malondialdehyde concentration in samples D and F compared to the other samples. The malonaldehyde content was not significantly different ($p>0.05$). The results show that the ascorbic acid contents of samples A and B were significantly higher compared to sample F.

DISCUSSION

Many studies have been published that support the health benefits of increased antioxidant content in foods, such as prevention of disease and aging and improved health. These reported effects are mediated by the reduced damage caused by reactive oxygen species (Aoki *et al*., 2010; Herrera *et al*., 2009). The major components of fruit and fruit juices are ascorbic acid and glucose (Livine et al., 2000). Fruit juice belongs to the perishable foods and should be adequately preserved to avoid lipid peroxidation that will render it unsafe for consumption. Adequate preservation is one of the greatest challenges which are militating against local juice production and hawking especially in hot climatic conditions.

It is well known that lipid peroxidation occurring in food products causes deteriorations in food quality, like rancid flavor, unacceptable taste and shortening of shelf life. Furthermore, oxidative stress plays a significant role in a number of age specific disease (Philanto, 2006; Halliwell, 2001; Collins, 2005).

To prevent fruit juices from undergoing deterioration and to provide protection against serious disease, it is important to inhibit the peroxidation of lipids and formation of free radicals occurring in the living body and food stuffs. This study also, examined the lipid peroxidation states of commercially produced fruit juice samples in order to assess their safety levels

The results from this study indicate that the fruit juice samples had varying concentrations of malondialdehyde with samples D and F having appreciably higher concentrations than samples A, B, C and E ($p<0.05$). We also observed from the study that the malonadeyde levels were correspondingly high in samples D, and F. From the ascorbic acid determination the samples with lesser levels of malondialdehyde values had higher ascorbic acid concentrations respectively. Ascorbic acid is a known effective scavenger of alkoxy radicals (RO*). These findings are in line from similar studies we carried out in Maiduguri, Borno State on fruit juice peroxidation levels (Maduka et al., 2014).

The relationship between food and health is well established (Halliwell, 2001; Liu *et al*., 2003; Abuja

and Albertini, 2001) and some results have shown that modifiable risk factors seem to be of greater significance for health than previously thought (Yusuf *et al*., 2004). Prevention of disease may in future be just as important as treatment of diseases. Indeed, many consumers are highly conscious of the health-properties of food and they take antioxidant supplements to improve the antioxidant capabilities of the body (Prior *et al*., 2000; Leonard *et al*., 2002). Ascorbic acid is only one aspect of the Reactive Oxygen Species (ROS) scavenging capacity of food (Lindermark-Mansson and Akesson, 2000).

Therefore, regular vitamin C consumption in the form of food (fruit juice) or supplements may reduce risk of disease pathology by reducing oxidative stress in vivo (Johnston *et al*., 2003; Joshipura *et al*., 2001; Lennie, 2001). The higher amounts of Ascorbic acid in samples A and B with their corresponding lower levels of malondialdehyde suggest lower levels of deterioration while the reverse situation in sample F is indicative of peroxidation. The higher level of peroxidaton in sample F could be that adequate additives may not have been added during processing and thereby reducing the shelf life (Maduka, 2005).

CONCLUSION

The study shows that some of the fruit juice samples marketed in Makurdi have appreciable degree of peroxidation in them as indicated on their malondialdehyde levels and corresponding low levels of ascorbic acids. The public perception of food quality is critical in the marketing of any product. It is, therefore, very important that high aseptic conditions and proper monitoring be maintained in the Nigerian milk products industry.

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Table 1. Lipid peroxidation and ascorbic acid concentrations in the commercial fruit juices.

Sample	Malondialdehyde (mg/mL)	Malonaldehyde (mg/mL)	Ascorbic acid(mg/mL)
A	0.578± 0.19[a]	0.415±0.14[a]	6.852±2.28[a]
B	0.523±0.17[a]	0.713±0.24[a]	8.090±2.71[a]
C	0.544±0.14[a]	0.496±0.65[a]	4.094±1.36
D	1.048±0.35[b]	0.859±0.29[a]	4.546±1.52
E	0.725±0.24[a]	0.86±0.29[a]	4.055±1.35
F	1.22±0.41[b]	0.667±0.22[a]	2.866±0.96[b]

Results are mean± standard deviation of triplicate determinations. Values with different superscripts in a column are significant ($p<0.05$).