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Biochemical Assessment of Some Common Commercial Fruit Juices Consumed in Maiduguri Metropolis, Borno State Nigeria

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Abstract
Biochemical assessment was carried out on six different samples of fruit juice labeled A to F (3 each), commonly consumed within University of Maiduguri (UNIMAID) and Maiduguri Metropolis. Malondialdehyde, malonaldehyde and thiobarbituric acid reactive substances (TBARS) assay which are indicators of lipid peroxidation (deterioration) as well as concentration of vitamin C (ascorbic acid) in the fruit juice samples were determined spectrophotometrically using spectrum Lab 22 model spectrophotometer. Results were analyzed statistically using T-test statistic at $p<0.05$ level of significance. Samples F had the highest values of 2.515 mg/ml ± 0.15, 2.867 mg/ml ± 0.15 and 2.116 mg/ml ± 0.10 respectively, among all the samples analyzed for malondialdehyde, malonaldehyde and TBRS concentrations ($p<0.05$). The above values correlated with the concentration of 3.47 mg/ml ± 0.08 of vitamin C in sample F which was the lowest among all the samples. This may suggest that the juice sample labeled F, which was locally produced, showed higher level of deterioration than other samples (samples A to E),while the others also showed varied levels of peroxidation. The above shows that caution should be exercised in the consumption of these locally prepared fruit juices.
Key words: Deterioration, Malondialdehyde, Malonaldehyde, Peroxidation.

1.0. Introduction

A lot of Nigerians have resorted to consumption of locally processed fruit juices as an alternative to fruit juices processed in industries whose costs are very high and, therefore, not affordable by them. It has not been possible for Nigeria as one of the developing nations to have control over processing of hawked fruit juices because most of the food vendors in Nigeria lack the adequate knowledge of processing and handling techniques (Essien and Monago , 2011, Marnett, 1999).Some of these fruit juices include orange juice, pineapple juice, pawpaw juice and mango juice.

Juices which can be defined as any biological fluid that can be extracted from plant tissues by squeezing or cooking (*Wilson et al*; 2012), are consumed due to their perceived health benefits. The major components of fruit and fruit juices are vitamin C and glucose (Livine *et al*; 2000, Shrubsole *et al*,2009). The diets of man and its domesticated animals are derived predominantly from plant sources but only a small fraction of these plant foods are available nutritionally to the animals (*Kwan et al*; 2004, Maserejian *et al.,* 2006). Fruit juices which are among the perishable foods must be preserved well enough when processed to avoid lipid peroxidation (deterioration), thereby rendering the fruit juices unsafe for consumption. Peroxidation is responsible not only for deterioration of foods but also for damages to tissues in-vivo, where it may be a cause of cancer as was reported by Livine *et al*.,(2000). Franke *et al* .,(2005) reported that canning, pasteurization, freezing, evaporation and spray drying are common methods for preservation and processing of fruit juices. Adequate preservation is one of the greatest problems which are militating against local juice processing and hawking. The nature, source and state of hygiene of foods and drinks consumed within Maiduguri metropolis have some health implications. This research addressed itself to carry out biochemical analysis of fruit juices commercially consumed in Maiduguri metropolis, Borno State of Nigeria, in order to ascertain their safety to health. Parameters determined are lipid peroxidation indices as evidenced by malondialdehyde, malonaldehyde and thiobarbituric acid reactive substances (TBARS) and concentration of vitamin C.

2.0. Materials and methods.

2.1. Sources of materials.

Six different samples of fruit juice commercially consumed in Maiduguri metropolis were randomly purchased from local provision shops in University of Maiduguri. These samples were labeled A to F.

2.2. Methods.

2.2.1. Determination of malondialdehyde and malonaldehyde concentrations.

These were determined using method of Marnett, (1999).

2.2.2 Thiobarbituric acid reactive substances (TBARS) Assay.

This was determined using method of Marnett, (1999).

2.2.3 Determination of Ascorbic acid concentration.

This was done using method of Roe (1993), as was modified by Sini *et al*., (2011).

3.0. Results

The results of malondialdehyde concentration of six different commercial samples of fruit juice consumed in Maiduguri metropolis were presented in table 1. The concentration of malondialdehyde in sample F (locally processed juice), was high ($p< 0.05$) when compared with other samples (samples A to E) which were juice processed in industries. The concentration of malondialdehyde in samples C, D and E was not significantly different from one another but higher in samples A and B respectively. Concentration of malondialdehyde was lowest in sample B (table 1). Table two shows the concentration of malonaldehyde of six different commercial samples of fruit juice consumed in Maiduguri metropolis. The concentration of malonaldehyde in sample F (2.515 mg/ml ± 0.5) was higher significantly when compared to other samples ($p< 0.05$). There was no significant difference in concentration of malonaldehyde among samples A to E (table 2).The TBARS reactivity of six different commercial samples of fruit juice consumed in Maiduguri metropolis is presented in table 3 below. TBARS reactivity was high in sample F when compared to other samples (samples A to E). Samples A to E did not show any significant difference in TBARS reactivity when compared to one another ($p<0.05$), but were higher than sample B. The vitamin C concentration of the samples A to F determined as ascorbic acid is as detailed in table 4 with sample F having the least value while sample B had the highest ascorbic acid content, showing that the samples were protected from deterioration by the antioxidant.

4.0. Discussion

All samples of juice studied so far showed varying degrees of malondialdehyde, malonaldehyde and TBARS. The level of peroxidation was significantly highest in sample F which was locally produced ($p<0.05$). This may be suggesting that the level of deterioration was higher in sample F than in other samples (samples A to E). This finding is supported by the similar work reported by Marnett(1999). Peroxidation was reported to cause damage to the cell membrane (Marnett, 1999, Maduka *et al*., 2003). The results of this work showed a significant inverse linear correlation between malonaldehyde, malondialdehyde and ascorbic acid. The amount of ascorbic acid (vitamin C) which was very high in samples A to E and very low in sample F as witnessed in this work, is suggesting that high level of deterioration (peroxidation) in sample F had affected the level of ascorbic acid in the sample. Similar works had been reported by Maduka *et al*., 2003, Maduka and Okoye, 2002a, 2002b and Maduka *et al*., 2003). Maduka and Okoye(2002b) had reported positive effect of additive on the peroxidative deterioration of stored vegetable oil. The high level of deterioration as witnessed in sample F, is suggesting that there was no adequate additive added to the sample during storage, hence, its deterioration. Most fruit juices processed locally do not contain additives, thereby deteriorating within a short time(Livine *et al*., 2000, Maduka and Okoye, 2006). It has been observed by Maduka(2005) that additive causes anti-lipid peroxidizing effect. Antioxidant effect on lipid peroxidation and tissue ascorbic acid had been observed with the crude extract of *Sacoglottis gabonensis* stem bark (Maduka and Okoye, 2003, Maduka and Okoye, 2002a and 2002b). Lipid peroxidation by malondialdehyde had been reported by Marnette(1999) to cause DNA damage. However, every commercial fruit juice analyzed in this research showed a correlating value of ascorbic acid. Furthermore, sample B showed the least level of peroxidation and highest amount of ascorbic acid in it. This may be suggesting that sample B might had the least level of spoilage. This finding is supported with the similar works reported by Maduka and Okoye (2006) and Livine *et al*., (2000).

Sample F might not have contained adequate additives to prevent high level spoilage. Other samples which showed high level of ascorbic acid and low level of peroxidation might have contained adequate additives necessary to prevent high level spoilage. Caution should therefore be exercised while processing juices locally to avoid spoilage. This can be achieved by adding adequate additives.

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Table 1. Malondialdehyde concentration

Sample	Malondialdehyde concentration (mg/ml)
A	$0.337^{c} \pm 0.46$
B	$0.184^{b} \pm 0.44$
C	$0.552^{a} \pm 0.19$
D	$0.582^{a} \pm 0.15$
E	$0.659^{a} \pm 0.15$
F	2.5.5* ± 0.50

Tabulated values are mean ± SE of triplicate determination. Values having the same symbols in the same column are not significantly different from one another($p<0.05$).

Table 2. Malonaldehyde concentration

Sample	Malonaldehyde concentration (mg/ml)
A	$0.950^{a} \pm 0.15$
B	$0.966^{a} \pm 0.0$
C	$0.950^{a} \pm 0.15$
D	$0.996^{a} \pm 0.15$
E	$0.859^{a} \pm 0.15$
F	$2.867^{b} \pm 0.15$

Tabulated values are mean ± SEM of triplicate determination. Values having the same symbols in the same column are not significantly different from one another($p<0.05$).

Table 3. TBARS reactivity

Sample	TBARS reactivity (mg/ml)
A	$0.368^{c} \pm 0.01$
B	$0.196^{b} \pm 0.11$
C	$0.539^{a} \pm 0.01$
D	$0.556^{a} \pm 0.01$
E	$0.506^{a} \pm 0.01$
F	2.112* ± 0.10

Tabulated values are mean ± SEM of triplicate determination. Values having the same symbols in the same column are not significantly different from one another ($p<0.05$).

Table 4. Determination of vitamin C values

Sample	Concentration of vitamin C (mg/ml)
A	$12.87^{a} \pm 0.00$
B	$14.16^{b} \pm 0.12$
C	$12.63^{a} \pm 0.17$
D	$12.88^{a} \pm 0.10$
E	$12.87^{a} \pm 0.27$
F	3.47* ± 0.08

Tabulated values are mean ± SEM of triplicate determination. Values having the same symbols in the same column are not significantly different from one another ($p<0.05$).