

Acta Biomedica Scientia

e - ISSN - 2348 - 2168 Print ISSN - 2348 - 215X

www.mcmed.us/journal/abs

Research Article

QUANTITATIVE ESTIMATION OF CAFFEINE IN BEVERAGES AND READY TO DRINK JUICES BY UV SPECTROSCOPY

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ABSTRACT

Different brands of soft drinks and selected ready to drink juices were randomly sampled from different stores in Palakkad town. Two methods of extraction were employed; hydrochloric acid acidified water and distilled water. UV analysis of carbonated soft drinks with acidified water samples, the caffeine levels in them were found to be in the range of 0.02528mg/L and 0.8092mg/L, the lowest being Ozo lemon soda and the highest being Panickars refreshes respectively. With distilled water alone the concentration ranged from 0.04214mg/L to 0.7038mg/L. In Ready to drink soft drinks the caffeine levels in acidified extract was ranging from 0.4257mg/L to 0.8472mg/L, the lowest being Grape pulp and the highest being Dailee mango. With distilled water alone the concentration ranging from 0.4214mg/L to 0.8134mg/L the lowest being Grape pulp and the highest being Dailee mango.

Keywords :- Caffeine, Soft drinks, Ready to drink juices, UV spectroscopy.



INTRODUCTION

A soft drink is a drink that typically contains carbonated water and a natural or artificial sweetener. Soft drinks are made by mixing dry or fresh ingredient with water. Production of the soft drinks can be done at factories or at home. It can be made at home by mixing a syrup or dry ingredient with carbonated water. Carbonation of the water is done by a soda syphon or home carbonation system. The main ingredients of the soft drinks are cola, sweeteners, flavors, preservatives, colors. Colas were originally blends of extracts of coca leaves and cola nuts. The main active ingredient in the cola nuts are Caffeine and Theobromine. And among the sugars the high fructose corn syrup is been used. Acids are added to soft drinks for extra bite and mouth feel. The primary acid used is phosphoric acid and the one used in citrus flavored drinks are citric acid.

Caffeine is chemically 1,3,5-trime

thylxanthine. Caffeine is a naturally occurring alkaloid which is found in the leaves, seeds or the fruits of over 63 plants species worldwide. The most common source of caffeine are coffee, cocoa beans, cola nuts and tea leaves and the worldwide consumption of products derived from these natural materials means that caffeine is one of the most popular and commonly consumed drugs in the world. It is a bitter white crystalline xanthine alkaloid that act as a mild psychoactive stimulant drug.

Caffeine has quick effects on the central nervous system. It also increases heart beat rate, dilate blood vessels and elevate levels of free fatty acids and glucose in the plasma.1g of caffeine leads to insomnia, nervousness, nausea, ear ringing, flashing of light, delirium and tremulousness [1]. Caffeine has diuretic property when administered in sufficient doses to subjects who do not have a tolerance for it

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[2]. Caffeine also stimulates the stomach to pour out large amount of acids. This in turn leads to burning in the pits of stomach and aggravates peptic ulcer of the stomach and duodenum. It raises the blood sugar level as a result of quickening of respiration. It also reduces blood flow to the brain by causing the brains blood vessels to constrict. It also may induce benign breast diseases and may worsen pre menstrual symptoms in women who overuse it. Caffeine crosses the placenta and enters the fetal circulation and its use at a pharmacological level has been associated with low birth weight [3]. Excessive consumption during lactation may cause irritability and wakefulness in a breast fed baby [4].

An excessive intake of caffeine in some persons appears to augment the sensitivity of the heart to emotional and other factors and so increase the incidence of extra systoles and other arrhythmias. Caffeine is added to soft drinks as a flavoring agent, it is the part of overall profile of the soft drink, which consumers enjoy for refreshment, taste and hydration. Most of the caffeine in cola drinks are added during the fermentation process [5, 6]. All over the world, caffeine contents in the soft drinks varies according to the type of the brands. Yet its average content in soft drinks is approximately18 mg per six ounce. The Food and Drug Administration (FDA) limits the maximum caffeine amount in carbonated beverages to 6mg/oz [7]. In case of overdosing and in a combination with alcohol, narcotics and some other drugs, these compound produce a toxic effect, sometimes with lethal outcome [8-10].

A wide variety of methods have been employed including High Performance Liquid Chromatography (HPLC) being the method of choice by many researchers in determining the caffeine content of beverages [11-13], however HPLC is a high priced and resource consuming technique. Therefore the present study was undertaken to analyze and quantify the caffeine content of some soft drinks and ready to drink juices found at Palakkad market in India using fast alternative analytical method that uses UV spectroscopy [14-16].

Ultra violet spectroscopy refers to absorption spectroscopy or reflectance spectroscopy in the ultra violet visible spectral region. This means it uses light in the visible and adjacent ranges. The absorption or reflectance in the visible range directly affect the perceived color of the chemical involved. Molecules containing π electrons or non bonding electrons can absorb energy in the form of ultra violet or visible light to excite these electrons to higher anti bonding molecular orbitals. The more easily excited the electrons, the longer the wave length of light it can absorb.

MATERIALS AND METHODS Preparation and analysis of standard

Caffeine stock solution was prepared by dissolving 100mg of pure caffeine in 100mL of distilled water. Then 0.2ml to 2 ml of stock solution was withdrawn and mixed with 1ml of dil. Hydrochloric acid. The volume is finally made up to 100 ml with distilled water. This is then filtered through whatmann filter paper. Water extraction was performed in a similar manner omitting hydrochloric acid. The absorbance of the standard and sample was taken at a wavelength of 273nm.

15 local carbonated soft drinks and 6 ready to drink juices of different locally available brands are selected. Once the sample bottles were opened, the drinks were degassed by keeping at room temperature. Then all the samples were filtered using Whatmann filter paper. 1mL of the filtrate was taken from each drinks and is added to a 100 mL volumetric flask followed by addition of 1ml dil.hydrochloric acid before topping to the mark with distilled water in acidified extract. 1mL of filtrate is been added to volumetric flask and made up to 100 mL using distilled water in distilled water extract. The absorbance of the samples was measured at 273nm.

RESULT SUMMARY

From the table2, Caffeine is best extracted in acidified water. UV analysis of carbonated soft drinks with acidified water samples, the caffeine levels were found to be in the range of 0.02528mg/L and 0.8092mg/L, the lowest being Ozo lemon soda Panickars and the highest being refreshes With distilled respectively. water alone the concentration ranged from 0.04214mg/L to 0.7038mg/L. In Ready to drink soft drinks the caffeine levels in acidified extract was ranging from 0.4257mg/L to 0.8472mg/L, the lowest being grape pulp and the highest being Dailee mango. With distilled water alone the concentration ranging from 0.4214mg/L to 0.8134mg/L, the lowest being Grape pulp and the highest being Dailee mango. The results from both soft drinks and ready to drink juices were below the maximum of 200 mg/L allowed by the food and drug administration (FDA).

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Sl no	Concentration(mg/L)	Absorbance
1	4	0.223
2	8	0.400
3	12	0.569
4	16	0.713
5	20	0.949

Table 1. Standard caffeine absorbance

Table 2. Preparation and analysis of sample

Sl no:	Carbonated soft drinks	Caffeine concentration in acidified water extractmg/I	Caffeine concentration in distilled water extractmg/	
1	Manutain dam			
1.	Mountain dew	0.3203	0.3456	
2.	Panikar's refreshers	0.8092	0.5985	
3.	Coca-cola	0.6406	0.5479	
4.	Ozo lemon soda	0.0252	0.0421	
5.	Ozo fresh	0.5142	0.5015	
6.	Tilopepsicola	0.6912	0.7038	
7.	Tilo lemonade	0.3119	0.3076	
8.	Tilo orange	0.3498	0.3287	
9.	Panikar'sclear lemon	0.1011	0.1011	
10.	Tilo lemon	0.2360	0.2107	
11.	Panikar's orange	0.3034	0.2739	
12.	Ozo ginger lemon	0.1559	0.1475	
13.	Bisleri	0.3034	0.2950	
14.	Panikar's lemonade	0.1601	0.1306	
15.	Panikar'squminsoda	0.1138	0.1306	

Table 3. Concentration of caffeine in ready to drink juices with water and acid extraction

Sl no:	Ready to drink juices	Caffeine concentration in acidified water extract mg/L	Caffeine concentration in distilled water extract mg/L
1.	Grapes pulp	0.4257	0.4214
2.	Sparta	0.5521	0.5184
3.	Mango pep	0.5563	0.4973
4.	Dailee mango	0.8472	0.8134
5.	Dailee apple	0.2866	0.2360
6.	Mango trend	0.7291	0.7207





CONCLUSION

It is shown from the results of this study that the concentration of caffeine in the carbonated soft

drinks and ready to drink juices obtained from the local market of Palakkad was significantly lower than

the maximum authorized level by the FDA of 200mg/L. However since caffeine is an additive substance and because of health concerns arising from its consumption, it seems appropriate that warning labels, indication of the presence and amount of caffeine should accompany all caffeinated drinks. None of the drinks evaluated in this study were so labeled. The UV/visible spectrophotometric method employed in this study for the quantification of caffeine in soft drinks was found to be relatively easy, fast and cheap. The major instrument required is a modern computerized UV/ visible spectrophotometer

shimadzu UV 1800 which can be acquired at an affordable price. This analytical method may therefore, be recommended for the rapid, accurate and sensitive quantification of caffeine in carbonated soft drinks and ready to drink juices by any educational institution in developing countries.

ACKNOWLEDGEMENT Nil

CONFLICT OF INTEREST None

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Cite this article:

Ebin CJ, Sruthi .K, SosammaCicyEapen. Quantitative Estimation Of Caffeine In Beverages And Ready To Drink Juices By Uv Spectroscopy. *Acta Biomedica Scientia*, 2017; 4(2): 106-109. DOI: <u>http://dx.doi.org/10.21276/abs.2017.4.2.11</u>