



Studies of heavy metal content in dates, grapes, pineapple, rambutan, apple, banana and mango as fruit pollutant

ABM Sharif Hossain

Biotechnology Program, Institute of Biological Sciences, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia
Biology Department, Faculty of Science, Hail University, Hail, KSA, Saudi Arabia

DOI: <https://doi.org/10.33545/26646501.2020.v2.i1a.14>

Abstract

Background and objective: Fruits are the prime horticultural crops in all of the Arab region as well as over the world. The fruit is mostly used as fruit and source of different types of food products. Protection of the fruit from contamination, pollution and maintaining quality as environmental friendly is a significant factor in the fruit production and processing industry. Contaminated fruit is harmful for human health benefits. People consume the fruit as traditional food without knowing the health benefits and nutritional value. In addition to that many fruits nutrient and biochemical content may be contaminated by heavy metal inaugurated from smoke, emission, dust and spray pesticide. The study was carried out to investigate the heavy metal like Pb, Si Al, Ni, Ba, Ag, Sn, Cr, Ti in different fruit varieties. **Materials and Methods:** Nine ripen fruits were collected from 3 plants for each sample of fruit. Total of 63 ripen fruits were collected for dates, pineapple, rambutan, mango, banan, apple and grapes.

Results: Lead (Pb), Al, Ba, Cr, Ti and Ni were found zero in grapes, pineapple, rambutan, apple, banana and mango except dates. However, Si was found higher in pineapple and mango than in grapes, rambutan, apple, banana and dates. Moreover, Sn was found higher in dates and mango than in apple, pineapple, rambutan and grapes.

Conclusion: The results conclude that dates, mango and pineapple contain more heavy metal than grapes, rambutan, apple and banana though it is as trace amount.

Keywords: dates fruit, heavy metal, PB, Ni, Cr, SN

Introduction

Fruits keep a significant role as edible and favorite food. It is extensively grown in Middle East, Asia, African Countries as well as all over the world. Saudi Arabia produces 15% dates of world production and 30% of the world trade in the world demand [1]. Fruit is rich a lot of nutrition and used as food consumption as the healthiest alternative food content from fruit source. Fruits contain a form of sugar that gives the body high levels of mobility and heat energy and which can be easily broken down in the body [2, 3]. High blood sugar is one of the main causes of disorders as serious as loss of sight, heart attacks and kidney insufficiency [4, 5]. Dates and other fruits contain a great many vitamins and minerals. They are very rich in fiber, fat and proteins. They also contain sodium, potassium, calcium, magnesium, iron, sulfur, phosphorus and chlorine, as well as vitamins A, beta-carotene, B1, B2, B3 and B6 [2].

Saving the fruits from contamination is a significant factor in the fruit production in the field and processing industry. Contaminated fruit is harmful for human health benefits. People consume the fruits as traditional food without knowing the fruits that contain heavy metal due to the lack of production and processing management. Fruit may be contaminated by heavy metal inaugurated from smoke, emission, dust and spray pesticide etc. and nutrient content may be affected by such type of environmental factors [5]. It was stated [6] that vegetable and fruits contained heavy metal like Cu, Zn Pb and Cd. It was reported [7] that fruit nutrient content was affected by environmental factors like temperature, smoke, emission, dust and spray pesticide etc.

in Kiwi fruit. They are very rich in fibre, fat and proteins. It has been reported that iron, zinc, copper etc. in dates were affected by environmental factors and varieties [8]. It was reported [9] that dates contained the Pb at the range of 0.16-6.5ppm in the different place of KSA.

The study of the assessment of the heavy metal content of different fruits for the awareness of healthy benefits in Hail region is totally new. Only very few literatures are found in the KSA as well as all Arab regions related to this research. For this reason the following objectives of this research has been undertaken to investigate the heavy metal like Pb, Si Al, Ni, Ba, Ag, Sn, Cr, Ti in dates, grapes, pineapple, rambutan, apple, banana and mango.

Materials and Methods

Plant Materials

Dates were harvested from the Farmer's Farm Jeddah, KSA. Pineapple, rambutan, mango, banan and grapes fruit were harvested and collected at the same time from the experimental field, University of Malaya, Kuala Lumpur and farmers Farm in Serdang, Malaysia. Fresh apple (gala) was collected from the University Malaya fruit Garden, Kuala Lumpur, Malaysia.

Methods

Design for sample collection

Nine ripen fruits were collected from 3 plants for each sample of fruit. Total of 63 ripen fruits were collected for dates, pineapple,

rambutan, mango, banan and grapes. For apple, nine ripen fruits were collected from 3 lots randomly. All samples were collected randomly following the completely randomized design (CRD).

Sample preparation

Fruit samples were thoroughly washed with distilled water, cut using a sterile knife and were blended by using a sterilized automatic juice blender and distilled water as 1:0.5, fruit: water ratio. Then the juice samples were filtered and kept in the freezer to analyze. The 5ml of juice were used from each sample.

Heavy metal content analysis

Pb, Si Al, Ni, Ba, Ag, Sn, Cr and Ti were determined by Multi oil analyzer (MOA) Spectrophometry.

Statistical Analysis

Data were analyzed statistically. Standard error (SE) and Duncan Multiple Range Test (DMRT) were employed.

Results and Discussion

The highest Al, Ba, Cr, Ti and Ni content were found in dates (Table 1). Al, Ba, Cr, Ti and Ni were found zero in grapes, pineapple, rambutan, apple, banana and mango except dates (Table 1). However, Si was found higher in pineapple (16.5 ppm) and mango (8.5 ppm) than in grapes (0), rambutan (1.65 ppm),

apple (0), banana (1.7 ppm) and dates (1.8 ppm) (Table 1). Moreover, Sn content was 5.0 ppm in dates followed by 4.7, 4.5, 4.3, 4.3, 4, 2, 2.5 ppm in mango, apple, pineapple, banana rambutan and grapes (Table 1). The highest polynomial correlation between fruit samples and Si content was found in dates (Fig.1). There was a strong linear correlation between the fruits varieties and Ag content and the highest correlation was found in dates (Fig. 2). Besides, exponential correlation between the fruits varieties and Sn content exhibited stronger in dates, pineapple, rambutan, apple, banana and mango than in grapes (Fig. 3).

For the above results it can be observed that the highest heavy metal contents were found in dates content compared to the others fruits. It may be due to the location and environmental factors like from dust, smoke, emission, and spray pesticide affected the fruits. It was stated [2] that micronutrient (Zn, Cu, Fe) content were significantly difference in different fruit species It has been observed that fruits depending on the variety and location as well as weather, contained significant micro-elements, iron, zinc, copper [5, 8]. It was stated [6] that vegetable and fruits contained heavy metal like Cu, Zn Pb and Cd. The results showed the heavy metals were found in fruits Zn (4.9-55.9 ppm) Cu (1.9-24.7 ppm), Pb (0.04-8.82 ppm) mg/kg. Our results suggests the above mentioned results. Ibrahim *et al.* (2011) stated that dates contained the Pb at the range of 0.16-6.5ppm.

Table 1: Heavy metal content from different fruits. Mean ±SE (Standard Error) (n=3)

Fruits	Pb ppm	Al ppm	Si ppm	Ba ppm	Ag ppm	Sn ppm	Cr ppm	Ti ppm	Ni ppm
Dates	0.5±0.01	3.0±0.2	1.8±0.1	1.0±0.01	9.0±0.2	5.0±0.1	1.0±0.01	1.0±0.01	1.0±0.01
Mango	0	0	8.5±0.3	0	7.0±0.1	4.7±0.2	0	0	0
Pineapple	0	0	16.5±0.2	0	5.5±0.1	4.3±0.1	0	0	0
Apple	0	0	0	0	5±0.2	4.5±0.3	0	0	0
Banana	0	0	1.7±0.02	0	0.5±0.001	4.3±0.1	0	0	0
Rambutan	0	0	1.65±0.01	0	1.85±0.01	4.2±0.1	0	0	0
Grapes	0	0	0	0	3.0±0.01	2.5±0.02	0	0	0

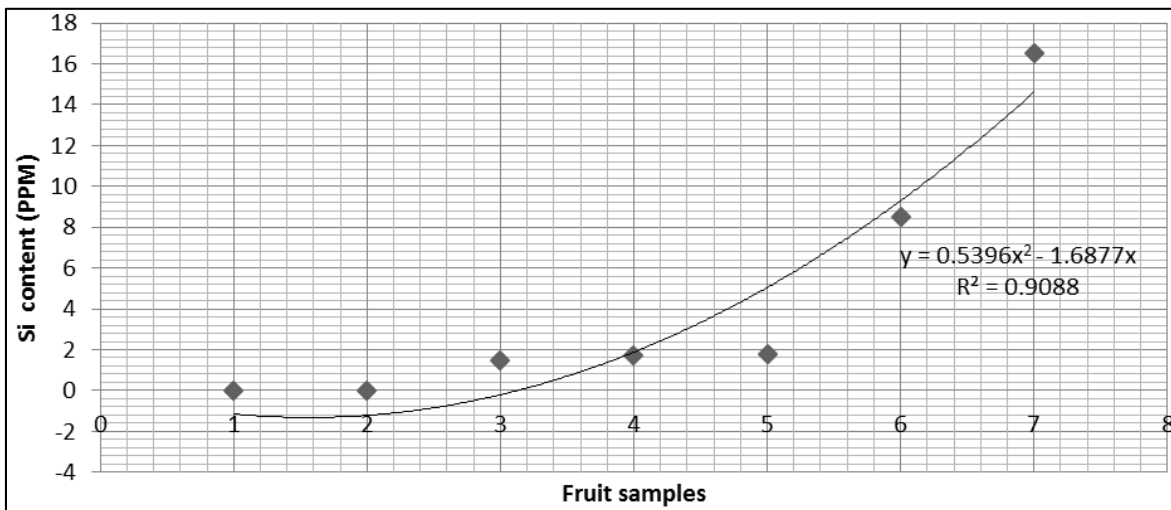


Fig 1: Polynomial correlation between the fruits varieties and Si content, 1= Apple, 2= Grapes, 3 = Rambutan, 4= Banana, 5= mango, 6= pineapple, 7= Dates.

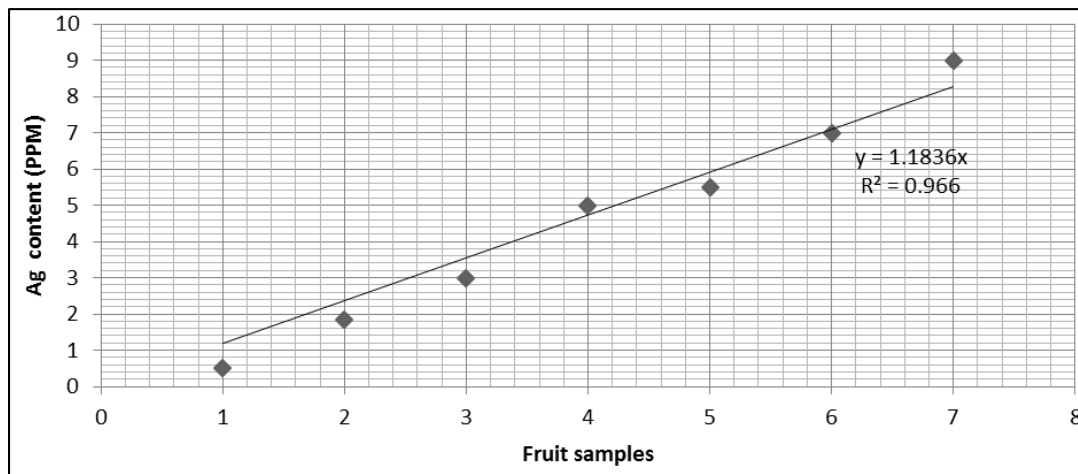


Fig 2: Linear correlation between the fruits varieties and Ag content, 1= Apple, 2= Grapes, 3 = Rambutan, 4= Banana, 5= mango, 6= pineapple, 7= Dates

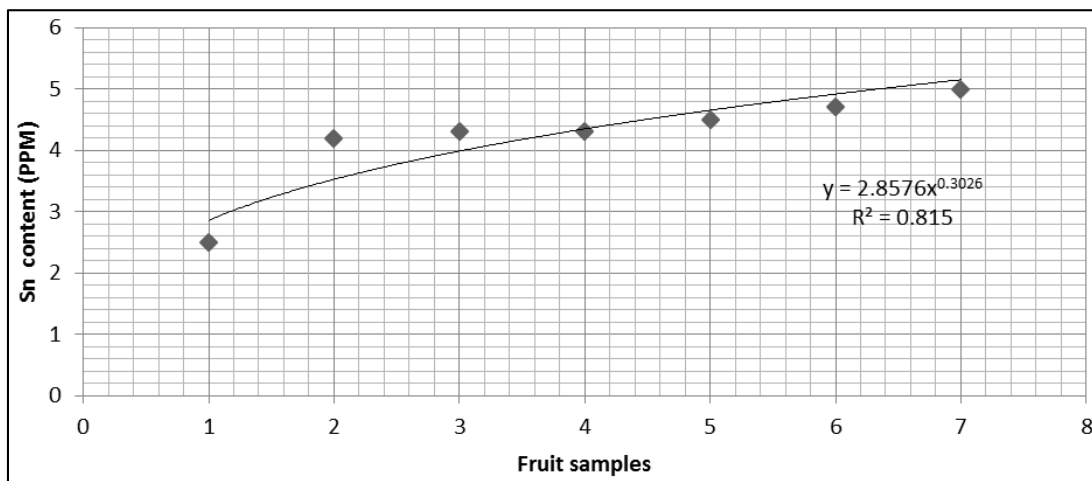


Fig 3: Exponential correlation between the fruits varieties and Sn content, 1= Grapes, 2=Banana 3 = Rambutan, 4= pineapple 5= apple, 6=mango, 7= Dates

Conclusion and recommendation

It can be concluded that Pb, Al, Ba, Cr, Ti and Ni were found zero in grapes, pineapple, rambutan, apple, banana and mango except dates. Si was found higher in pineapple and mango than in grapes, rambutan, apple, banana and dates. Moreover, Sn was found higher in dates and mango than in apple, pineapple, rambutan and grapes. Therefore, present results show that all fruits are contaminated by heavy metal which are the trace amount and negligible. Finally it can be recommended that fruits should be washed with warm water frequently and well processed before eating where dust is available.

References

1. FAOSTAT. Food and Agriculture Statistical report. P 30
2. Hossain ABMS and Abdelmuhsin A. 2018. Carbohydrate, biochemical and nutrient content in different dates varieties. Journal of Biological Records. 2009; 2(1):181-189.
3. SMQ. Scientific Miracles of the Quran, 2012. http://www.miraclesofthequran.com/articles_index.html
4. Naser S Khalifah. Arab Palm Conference. 2011. Improving nutritional status and yield and fruit quality of date palm, 2011. <http://www.arabpalm.org/2011/eng/contact.as>

5. Hossain ABMS, Ahmed AA, Ibrahim NA. Antioxidant, flavonoid and nutritional content and Genomic DNA Characterization of Date Fruits. Advances in Bioresearch. 2017; 8(5):175-182.
6. Roba C, Roşu C, Piştea I, Ozunu A, Baciuc C. 2016. Heavy metal content in vegetables and fruits cultivated in Baia Mare mining area (Romania) and health risk assessment. Environ Sci Pollut Res Int. 23(7):6062-73.
7. Miller SA, Smith GS, Bolding HL, Johansson A. Changes in vascular and transpiration flows affect the seasonal and daily growth of kiwifruit (*Actinidia deliciosa*) berry Ann Bot. 2010; 105(6):913-923.
8. WLB. The World Leading Biotech. Bioportfolio, Health care and Medicinal value. Nutritional quality of date fruit varieties, 1997. <http://www.bioportfolio.com/resources/pmarticle/171091/Nutritional-Quality-Of-18-Date-Fruit-Varieties.html>
9. Ibrahim MA, Mohamed H, Al-W, Salim SA, Manzer HS. Determination of heavy metals in the fruit of date palm growing at different locations of Riyadh. Saudi Journal of Biological Sciences. 2011; 18(2):175-180.