Libyan Med J. 2026;18(5):258-261
https://doi.org/10.69667/lmj.26509
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

Original article

Estimate the Contents of Citric acid and pH values in some Soft Drink Juice Samples Collected from Libyan Markets

Sajidah Aljamie[1], Haba Mohammed[2], Hamad Hasan[2]

[1]*Chemistry Department, Faculty of Science, Derna University, Derna, Libya*
[2]*Chemistry Department, Faculty of Science, Omar Al-Mukhtar University, Albaydah, Libya*
Corresponding email. lojy6766@gmail.com

Keywords:
Citric Acid, PH, Soft, Juice, Libya.

ABSTRACT
The foods contain different types of chemical materials and additives. Many of these compounds have different effects on human health when they are above the recommended limits given by some world Organizations as the WHO and FAO. This is study aims to estimate citric acid and pH values in juice samples collected from some Libyan markets, about Twelve samples were selected including different brands, the citric acid contents were measured by Titration method, the results of this study recorded that the concentrations of Citric acid were ranged between (0.0832 – 0.5440 g/mL) and the PH values ranged between (2.6 – 3.6), the citric samples were lower than the values of WHO /FAO limitations.

Introduction
Citric acid (IUPAC name: 2-hydroxypropane-1,2,3-tricarboxylic acid) is a colorless, weak organic acid with the skeletal formula $HOC(CO_2H)\ (CH_2CO_2H)_2$. Naturally found in citrus fruits, it plays a crucial biochemical role as an intermediate in the citric acid cycle, which drives the metabolism of all aerobic organisms. Due to its high demand, with global production exceeding two million tons annually, it is extensively utilized as an acidifier, flavoring agent, preservative, and chelating agent [1]. "Citrate" refers to a derivative of citric acid, encompassing its salts, esters, and polyatomic anions. For example, trisodium citrate is a common salt, while triethyl citrate is a typical ester. When acting as a trianion within a salt, the citrate ion can be represented by the formulas $C6H5O7^{-3}$- or $C3H5O(COO)3^{-3}$. The chemical structure of citric acid is illustrated in (Figure 1).

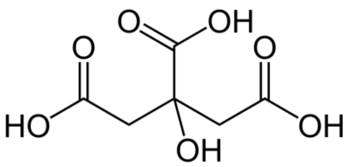

Figure 1. The chemical Structure of Citric acid

Citric acid is naturally present in many fruits and vegetables, with citrus fruits containing the highest levels. Lemons and limes are particularly rich in the compound, accounting for up to 8% of their dry weight (approximately 47 g/L in their juice [2]. Generally, citric acid concentrations in citrus fruits range from 0.005 mol/L in oranges and grapefruits to 0.30 mol/L in lemons and limes, varying based on cultivar and growing conditions. The acid was first isolated in 1784 by Carl Wilhelm Scheele, who crystallized it from lemon juice. Industrial production began in 1890 in Italy using a precipitation method involving hydrated lime (calcium hydroxide) and diluted sulfuric acid. Today, commercial production relies on microbial fermentation using inexpensive sugar sources like molasses, hydrolyzed corn starch, or corn steep liquor. Following fermentation, the mold is filtered out, and the acid is isolated using the same calcium hydroxide precipitation and sulfuric acid regeneration method utilized in direct fruit extraction. The pH of citrus juices is directly dictated by their citric acid concentration; higher acid levels yield a lower pH. By carefully adjusting the pH prior to crystallization, specific acid salts such as sodium citrate can be synthesized. Furthermore, the citrate ion acts as a potent chelating agent. Due to the chelate effect, it forms highly stable complexes, even with alkali metal cations [3].Citric acid can also undergo esterification at one or more of its three carboxyl groups to produce various mono-, di-, tri-, and mixed esters. As one of the strongest edible acids, citric acid is predominantly used as a flavoring agent and preservative in foods and beverages, particularly soft drinks and candies. In the European Union, it is designated as E330, while in the United States, its purity as a food additive is governed by the Food Chemicals Codex published by the USP. The compound yields 247 kcal per 100 g [4], and its mineral salts are frequently

***Received**: 27-02-2026 - **Accepted**: 24-04-2026 - **Published**: 01-05-2026*

Libyan Med J. 2026;18(5):258-261
https://doi.org/10.69667/lmj.26509
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

used in dietary supplements to enhance bioavailability. Beyond flavoring, citric acid serves as an emulsifier in ice cream to prevent fat separation, inhibits sucrose crystallization in caramel, and can substitute for fresh lemon juice or vinegar in recipes. When combined with sodium bicarbonate, it creates effervescent reactions in products ranging from pharmaceutical tablets to bath bombs and grease cleaners. In dry form, it is often sold in grocery stores as "sour salt" due to its visual similarity to table salt. It is also used to balance the pH of typically basic food dyes [6]. In light of its extensive use in the beverage industry, this study aims to evaluate the citric acid content and pH values of soft drink juices collected from various Libyan markets.

Methods

Sampling

Twelve different samples of soft drinks and power drink juices were collected from different brands of soft drinks available at some Libyan markets (Table 1).

Table 1. The studied samples

Sample No	Sample Name
1	Miranda Orange
2	Al Tybat Grape
3	Mix Fly Tot
4	Miranda Pear
5	Cirine Mango
6	Africana Aper
7	Manja (Ladeda)
8	Seven Up
9	Schweppes
10	Bianca Apple
11	Rini Manjo
12	Mix Fly Lemon

Samples preparation

The selected samples of juice were filtered, then directly analyzed without any purifications from the Robe market were collected and transported to the laboratory of the Chemistry Department, Omar Al Mukhtar University.

Determination of Citric Acid

Acid (titratable acidity) is a measure of the total acid present in a juice. The predominant acid naturally occurring in some acidic and sub-acidic citrus fruits (Sweet lemon, Lime, Pineapple, and Mango) juice is citric acid. The amount of acid present in the juice is reported as percent citric acid. It needs to be noted that the total acid cannot be measured by 'pH' because the acids concerned are "weak acids" and not completely ionized. The acid content must be measured using titration with sodium hydroxide. The acidity of the juices was determined by acid-base titration with NaOH (0.1 N).

Percentage acid (g/ mL) = ***(Titrate x acid Factor x10) / (10 ml of juice)***

Acid factor for citric acid is 0.064 (citrus fruit), where Titer = Consumed volume of Sodium hydroxide by the juice.

pH measurements

Ten ml of juice was transferred to a beaker, then the pH meter (PH – JENWAY) was immersed in the juice.

Results

In the present study, the results showed small variations in citric acid content and pH values among the selected samples. The concentrations ranged between (0.0832 – 0.5440 g/mL), and small variations of PH were recorded in the studied samples, ranging between (2.6 – 3.6).

Table 2. The contents of Citric acid and pH values in the studied samples

Sample 1	Citric acid content (g/mL)	pH
1	0.1792	2.6
2	0.1344	2.7

Received: 27-02-2026 - **Accepted**: 24-04-2026 - **Published**: 01-05-2026

Libyan Med J. 2026;18(5):258-261
https://doi.org/10.69667/lmj.26509
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

3	0.5440	3.2
4	0.1216	3.0
5	0.2112	3.5
6	0.2040	3.3
7	0.0832	3.6
8	0.115	3.1
9	0.1344	2.8
10	0.256	2.7
11	0.2112	3.5
12	0.2496	3.2
±SD	0.120	0.34

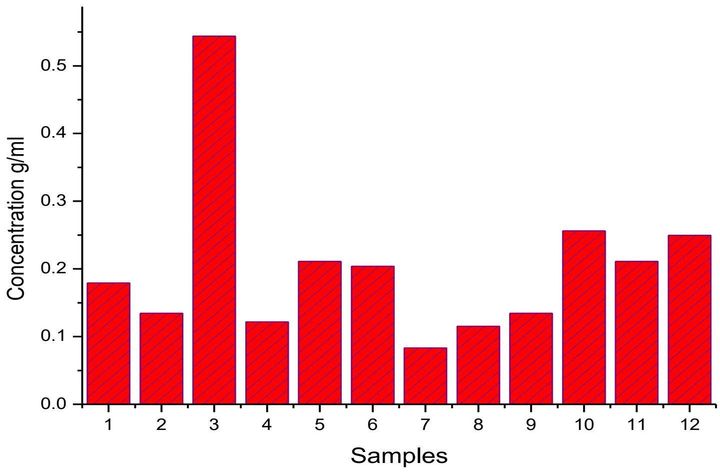

Figure 2. Contents of citric acid in the studied samples

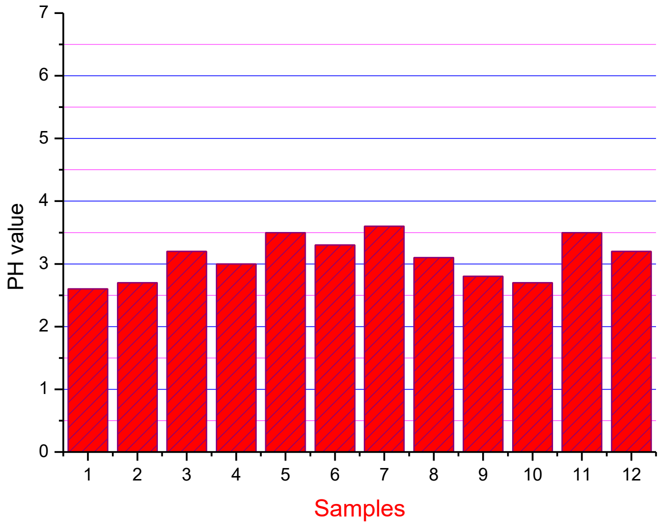

Figure 3. Levels of pH in the studied samples

Discussion

Citrus juice is highly valued for its rich nutritional and health-promoting profile, which includes vitamin C, carotenoids, flavonoids, pectin, calcium, and potassium. However, the exact concentrations of these nutrients and phytochemicals vary significantly depending on the fruit variety, maturity, growing conditions, and post-harvest processing methods [7]. As shown in (Table 1), the analyzed samples met the minimum acidity requirements for acidic citrus juices outlined in the Joint FAO/WHO Codex Standard (Codex Stan 247/2005). This compliance indicates that the evaluated fruits were cultivated under suitable

***Received**: 27-02-2026 - **Accepted**: 24-04-2026 - **Published**: 01-05-2026*

agro-climatic conditions and validates the effectiveness of the analytical methods used. Titration results, expressing total acidity as anhydrous citric acid, revealed that Sample 3 (Lime/MIX FLY TOT) possessed the highest citric acid content at 0.544 g/mL. While this is lower than the 3.82 g/mL range reported in some previous studies [8], it aligns with the broader titratable acidity range of 3.33–5.55 g/mL noted in other literature. In contrast, samples 4, 7, and 8 (Mango Pear, Mango, and 7-Up, respectively) exhibited significantly lower citric acid concentrations, measuring 0.1216, 0.0832, and 0.115 g/mL. The pH values recorded across all tested samples ranged from 2.6 to 3.6. The high citric acid content observed in lime juice has significant health implications, particularly regarding kidney stone prevention. Kidney stones most commonly composed of calcium, are crystal structures formed by excessive urinary salts that can grow until they obstruct the ureter. Research indicates that individuals prone to kidney stones often have insufficient urinary citrate levels [9]. Consuming citrate-rich foods, such as lime and other citrus fruits, elevates both urinary pH and citrate concentration. Furthermore, citrate inhibits stone formation by complexing with calcium. While further research is warranted, increasing citrus fruit consumption remains a highly recommended, nutritionally sound strategy for individuals at risk of developing kidney stones. Beyond citric acid, citrus fruits contain diverse phytochemical classes, including monoterpenes, limonoids, flavonoids, carotenoids, and hydroxycinnamic acids. These compounds exhibit potential anticarcinogenic properties through several mechanisms, such as antioxidant activity, promoting cell differentiation, enhancing detoxifying enzymes, altering the colonic environment, and blocking nitrosamines. Obtaining a regular, varied intake of these beneficial phytochemicals is best achieved by incorporating plant-based foods, such as citrus juices, into the normal diet [10].

Conclusion
This study is likely to represent the data on the juice contents. The results of the study did not record variations of citric acid, and the values were within the limits of WHO values.

Acknowledgment
The authors highly appreciated the collaboration of the central lab of chemical analysis members for their collaboration during the establishment of the experimental part of this study.

References
1. Penniston KL, Nakada SY, Holmes RP, Assimos DG. Quantitative assessment of citric acid in lemon juice, lime juice, and commercially-available fruit juice products. J Endourol. 2008;22(3):567-70. doi: 10.1089/end.2007.0304.
2. Verhoff F, Bauweleers H. Citric acid. In: Ullmann's encyclopedia of industrial chemistry. Weinheim: Wiley-VCH; 2014. doi: 10.1002/14356007.a07-103.pub.
3. Lotfy W, Ghanem K, El-Helow E. Citric acid production by a novel Aspergillus niger isolate: II. Optimization of process parameters through statistical experimental designs. Bioresour Technol. 2007;98(18):3470-7. doi: 10.1016/j.biortech.2006.11.032.
4. Goldberg R, Kishore N, Lennen M. Thermodynamic quantities for the ionization reactions of buffers. J PHys Chem Ref Data. 2002;31(1):231-370. doi: 10.1063/1.1416902.
5. Silva A, Kong M, Xiaole H, Robert C. Determination of the pKa value of the hydroxyl group in the α-hydroxycarboxylates citrate, malate and lactate by 13C NMR: implications for metal coordination in biological systems. Biometals. 2009;22(5):771-8. doi: 10.1007/s10534-009-9224-5.
6. Matzapetakis M, Raptopoulou CP, Tsohos A, Papaefthymiou V, Moon SN, Salifoglou A. Synthesis, spectroscopic and structural characterization of the first mononuclear, water soluble iron−citrate complex, (NH4)5Fe(C6H4O7)2·2H2O. J Am Chem Soc. 1998;120(50):13266-7. doi: 10.1021/ja9807035.
7. Hu Y, Rawal A, Schmidt-Rohr K. Strongly bound citrate stabilizes the apatite nanocrystals in bone. Proc Natl Acad Sci USA. 2010;107(52):22425-9. doi: 10.1073/pnas.1009219107.
8. Penniston KL, Nakada SY, Holmes RP, Assimos D. Quantitative assessment of lemon juice, lime juice and commercially available fruit juice products. NIHPA author manuscript. 2009;22(3):567-70.
9. Greenfield H, Southgate D. Food composition data: production, management and use. Rome: FAO; 2003. p. 146.
10. Turner T, Burri B. Potential nutritional benefits of current citrus consumption. Agriculture. 2013;3:170-87. doi: 10.3390/agriculture3010170.

***Received**: 27-02-2026 - **Accepted**: 24-04-2026 - **Published**: 01-05-2026*