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Physico-Chemical Analysis of Some Soft Drinks Available in Pakistan

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Abstract

Soft drinks are widely consumed worldwide; therefore, it is necessary to study their qualitative and quantitative analysis. For this purpose, we studied 18 brands of soft drinks purchased from the local market of Bahawalpur, Pakistan. Carbon dioxide, glucose, sucrose, ascorbic acid, phosphates, caffeine, and alcohol were analyzed qualitatively, while pH, conductivity, density, potassium, sodium, and total soluble solids were estimated quantitatively. This physico-chemical analysis was determined by the Association of Official Analytical Chemists (AOAC) methods. The obtained results demonstrated that these soft drinks were highly acidic, ranging from 2.3±0.01 to 3.68±0.01 due to carbon dioxide and phosphates. Most soft drinks contain traces of caffeine and alcohol, while very few contain ascorbic acid. The conductivity of all the soft drinks was high due to soluble ions. Similarly, density was higher than water due to a large amount of sugar. The concentration of total soluble solids, mainly known as sucrose, was also high, ranges 64±0.01 g/L (2.56±0.01 Brix°) to 126.5±0.02 g/L (21.57±0.02 Brix°). Most cold drinks contain some amount of sodium (0.3±0.01 to 3.0±0.01 mg/L), potassium (0±0.00 to 12.8±0.01 mg/L), and a small amount of calcium (0.1±0.01 to 0.53±0.01 mg/L), the potassium concentration was higher than the sodium. In contrast, calcium concentration is very small. The strength of acid was estimated quantitatively using a titrimetric method, the maximum concertation of acid is 20.92±0.01. Similarly, using redox titration, alcohol concentration was measured, ranges 0.46±0.01 to 0±0.00, but this concentration was less than WHO's concentration, therefore considered safe to use.

Keywords: Soft drink, Alcohol, Caffeine, Ascorbic acid, Flame photometer, Conductivity.

Introduction

During the last few years, the beverage industry in Pakistan has grown rapidly. This industry has expanded a wide range of products which consists of soft drinks, squashes, fruit juices, milk, energy drinks, etc. [1]. According to the statistics, the Pakistan beverage industry has experienced an increased growth of 30% more in the past few years. It is also observed that more than 170 beverage industrial units are working in Pakistan [2]. Beverages are classified as alcoholic and non-alcoholic, and non-alcoholic is further categorized as cold and hot beverages [2-4].

A soft drink is a carbonated beverage known as a non-alcoholic beverage that typically contains water 90%, a sweetener (sugar), acid, carbon dioxide 3-5%, fruit juice, minerals, vitamins, preservative, colorant (artificial or natural) and flavoring agent [5, 6]. Although a small amount of alcohol, less than 0.5%, is also present in soft drinks [7]. Due to this low limit of alcohol drink, is

referred to as soft. If the concentration of alcohol increase from 0.5%, the drink will be known as a hard drink or hard beverage [8]. A small amount of caffeine, an alkaloid, may also be present in soft drinks [9-11]. According to the statistics, 82.5 liters of soft drinks are consumed per person per year [12]. In America, more than 50 billion liters of soft drinks per year are consumed [13]. The limit reached 2 million liters in Pakistan last year [2].

Data from IRIS communications (National marketing organization) has shown a steady increase in soft drink consumption in Pakistan. According to this survey, Pakistanis spend 110 billion PKR on carbonated beverages annually, and 46% of male and 40% of female consumers increased last year [14]. In Pakistan, Coca Cola and Pepsi Co are two major brands, while some local brands like Gourmet and Amrat are also on the competition list. The Coca-Cola system provides 54 years of service in Pakistan and serves over 200,000 customers/retail outlets, which have 2500 employees that are working continuously for the company [15]. The company has 11 brands Cappy, Coca-Cola, Coca-Cola zero, Diet Coke, Fanta, Kinley, Monster, Rani, Sprite, Sprite 3G, and Sprite zero. Pepsi was introduced in 1971 and is known as a Pakistani National Drink. Pepsi Co has 6 brands, including Pepsi, 7up, Marinda, Strings, Slice, and Mountain Dew. In Pakistan, Pepsi with 7up enjoys 70% of the market share while Coke has only 20% market share. Gourmet is a local beverage company in Pakistan with more than 120 outlets in Lahore and Faisalabad. The high utilization of cold drinks is credited to their good taste and thirst quenching potential [15].

Soft drinks contain a large amount of sugars in the form of glucose and sucrose, while artificial and non-energetic sweeteners such as aspartame are used in diet soft drinks [9]. The sweeteners in soft drinks contain highly caloric than ordinary sugar and induce physiologic and hormonal responses that lead to weight gain, obesity, liver disease, dental diseases, and diabetes [16, 17]. Soft drinks are carbonated drinks and contain a high amount of acid in the form of phosphoric acid, benzoic acid, citric acid, and carbonic acid, which reduces the pH of these drinks, normally 2.5 to 3.5 [18-20]. This low pH causes dental erosion, especially in children aged 5-7 years [21]. Sugar concentration is different usually 5-10% [18]. Moreover, artificial colors like tartrazine, erythrosine, etc., can also be used, and flavors are used to give a pleasant and unique taste which cause serious health problem [7, 22]. Caffeine is also present in most soft drinks, which acts as a mild stimulant and increases nervous activity [10, 11, 23, 24].

Keeping in view the above facts, the present study was conducted to explore the quantitative or qualitative analysis of soft drinks collected from the local market of Pakistan. In this study, 18 different brands of cold drinks collected from the local market of Bahawalpur, Pakistan were analyzed by using different experiments.

Materials and Methods

Study Area

18 different Soft drinks (SD-1 to SD-18) were purchased from the local market of Bahawalpur, Pakistan. These brands were qualitatively analyzed for the presence of sugar, alcohol, carbon dioxide, phosphates, ascorbic acid, caffeine, and acidity, while sucrose, sodium, potassium, density, and pH were quantitatively analyzed. These samples were brought to the Analytical Chemistry Lab of the Department of Chemistry, Sadiq College Women University Bahawalpur,

stored at room temperature. All the experiments were performed in triplicate.

Reagents & Chemicals

All the chemicals used for this research work were of analytical grade and purchased from Sigma Aldrich.

Preparation of Solutions

The preparation of different aqueous solutions used for this research work is listed below.

Preparation of Fehling's solution

Fehling solution A was prepared by dissolving 7 g copper sulphate in 100 mL distilled water with 2-3 drops of sulphuric acid, resulting in a blue solution. Fehling solution B was prepared by mixing 35 g potassium tartarate in 100 mL water with 12 g of sodium hydroxide resulting in a clear solution. These were used for the detection of reducing sugars.

Benedict reagent

The reagent was prepared by adding 1.74 g copper sulphate, 10 g anhydrous sodium carbonate, and 17 g of sodium citrate in 100 mL distilled water. This reagent was used for glucose determination.

Starch indicator

0.5 g starch was dissolved in 100 mL distilled water to make a 0.5% (w/v) solution and used to facilitate endpoint detection of ascorbic acid via titrimetry. The reagent was stored in a dark brown reagent bottle to avoid photodegradation.

Similarly, 1 g of soluble starch was dissolved in 100 mL distilled water to make a 1% solution used in redox titration for alcohol estimation.

Iodine solution: 2 g of potassium iodide and 1.3 g iodine were mixed in a minimum amount of water. When dissolved, the solution was marked up to 1 L.

Potassium iodide solution: 5 g of potassium iodide was dissolved in 25 mL distilled water and stored in a brown colored bottle used in redox titration for alcohol.

Acidified potassium dichromate solution: 125 mL of distilled water was taken into a 500 mL conical flask. 70 mL concentrated sulphuric acid was added with constant shaking. After cooling the flask, 0.75 g of potassium dichromate was added, mixed, and diluted up to the mark with distilled water.

Sodium thiosulphate solution: 7.44 g of sodium thiosulphate to a 1 L volumetric flask, dissolved in distilled water, and diluted up to the mark.

Seliwanoff's reagent: 50 mg of m-hydroxybenzene (resorcinol) was dissolved in 33 mL of HCl, and the volume was made up of 100 mL with distilled water.

Instrumentation

PH meter WTW 82362 and EC Meter 1056 were used for pH determination and electrical conductivity, respectively. Flame photometer 410-Sherwood Scientific was used for the determination of sodium and potassium.

Test for Carbon Dioxide

As soon as the bottles were opened, 10 mL of the sample for each brand of soft drinks was added to 6 mL of lime water (calcium hydroxide). The change of lime water from colorless to milky confirmed the presence of dissolved carbon dioxide in soft drinks [5, 25].

$$Ca(OH)_{2\,(s)} + CO_{2\,(g)} \rightarrow CaCO_{3\,(s)} + H_2O_{\,(s)}$$

Test for Reducing Sugar: 2 mL of a mixture of Fehling's A and Fehling's B solutions was added to 3 mL of soft drink of each brand in a test tube and heated in a water bath for 10 min. Brown colored precipitates indicated the presence of reducing sugar in soft drinks [5, 25].

Test for Phosphate: 20 mL of soft drinks were taken in the test tubes, and the ammonium molybdate with a few drops of concentrated nitric acid was added to the test tubes. The solutions were heated, and the appearance of yellow precipitates confirmed the presence of phosphate ions in the soft drinks [5].

Test for Glucose: 3 mL samples of different brands were taken in the test tubes, and 2 mL of Benedict's solution was added. The test tube was heated for a few minutes. The formation of red color confirmed the presence of a large amount of glucose [5].

Test for Alcohol: 3 mL samples of each brand of cold drinks were taken in separate test tubes and added 1 mL of iodine, followed by 1 mL potassium iodide and 1 mL sodium hydroxide solution. The test tubes were heated in a water bath for 30 min. Yellow colored precipitates confirm the presence of alcohol in soft drinks [2, 5, 25].

Test for Ascorbic Acid: 20 mL of soft drink with 150 mL of distilled water and 1 mL of starch indicator solution (0.5 %) was added to a conical flask. The mixture was titrated against 0.005 M iodine solution, and a permanent trace of a dark blue-black color due to the starch-iodine complex formed [26].

Determination of pH: The pH of each sample was measured by "PH meter Model No. WTW 82362". Glass electrode of the pH meter was dipped in 20 mL of soft drink, and pH was measured [24].

Determination of Conductivity: The electrical conductivity of all the samples was determined using "Electrical Conductivity Meter Model 1056".

Density Determination: The density of soft drinks was calculated by using a glass hydrometer.

Determination of Sodium, Potassium and Calcium: The concentration of sodium (Na), potassium (K) and calcium (Ca) in soft drinks were estimated by flame photometer 410. Standard stock solutions of 1000 mg/L of Na, K, and Ca were prepared by dissolving 2.352 g of sodium chloride, 1.805 g of potassium chloride, and calcium acetate in one liter of deionized water. From this stock solution, different working solutions 0.5 ppm, 1 ppm, 2 ppm, 3 ppm, 5 ppm, 10 ppm and 1000 ppm were prepared. After calibration, the concentrations were recorded in mg/L of Na and K from 587-766.5 nm.

Test for Caffeine: 150 mL soft drink was mixed with 2 g sodium carbonate. Organic layer was extracted using 50 mL methylene chloride three times. To this organic layer, 5 g of magnesium sulphate was added to remove water. Filter the solution and evaporate methylene chloride leaving few precipitates. Few potassium chlorate crystals were added, followed by 2-3 drops of concentrated HCl. The mixture was heated in a water bath till all the solvent evaporated. Few drops of 2 M ammonium hydroxide were added, and the residue turned purple, indicating caffeine [20].

Total Soluble Solids: 20 mL of soft drink in a china dish heated slowly until all the soft drink evaporated. The remaining black residue was cooled and collected, which indicates the presence of total soluble solids, mainly sucrose [19].

Test for Sucrose (Seliwanoff's test): 3 mL of Seliwanoff's reagent with a 0.5 mL sample in

a test tube was heated for 2-5 min in a water bath. Cherry red color or brownish red precipitates indicates the presence of sucrose in the soft drink.

Concentration or Strength of Acid: The strength of acid in soft drinks was be calculated by the AOAC method with few modifications. 20 mL soft drink with 2-3 drops of Phenolphthalein was titrated against 0.5 M sodium hydroxide solution to attain pink colored endpoint.

Concentration of Alcohol: Quantitative estimation of alcohol was determined using the redox titration method reported in AOAC (Association of Official Analytical Chemists). 10 mL sample was diluted 20 times with distilled water. From this diluted beverage sample, 1 mL was mixed with a 10 mL acidified standard solution of potassium dichromate. The solution was diluted again with distilled water to mark up 100 mL. 2-3 drops of starch solution (indicator) were added to the solution, followed by 4 mL potassium iodide solution indicating a blue-black colored solution due to the formation of a starch-iodine complex. The resulting solution was titrated against sodium thiosulphate until the blue color completely disappeared.

Results and Discussion

Soft drink consumption dramatically increased over the past few decades. These cold drinks contain a high amount of sugar and acid, which cause serious health problems, especially in children. These soft drinks are supposed to be safe according to customer thinking. Therefore, it is necessary to educate costumer about the ingredients of cold drinks. For this purpose, we use the titrimetric method, which is supposed to be precise, accurate, and cheap [27, 28]. The method described by AOAC with slight modifications were used for qualitative and quantitative analysis [25, 29].

According to the results, all soft drinks contain dissolved carbon dioxide (CO_2) [30], giving fizzy effects and as an ultimate taste quencher. This CO_2 is present in the form of carbonic acid, which causes serious and dangerous effects on human health, especially in children [25]. According to the literature, the pH of soft drinks must be 2.5 to 3.5 due to the presence of acids [31]. This low pH is necessary for killing gastro-intestinal bacteria but causes enamel erosion. In this study, all samples are acidic in nature with a pH range of 2.33±0.01 to 3.68±0.01. SD-1 and SD-7 are supposed to be more acidic due to low pH 2.33±0.01 and 2.4±0.01 than the optimum pH. Similarly, the optimum acidic concentration for soft drinks is 3.6 g/L, but all samples have a high acid concentration ranging from 3.61±0.01 g/L to 5.81±0.01 g/L except SD-11 and SD-16, with an acid concentration of 3.48±0.02 and 3.26±0.01 g/L. Results are summarized in Fig. 1 and Table 2.

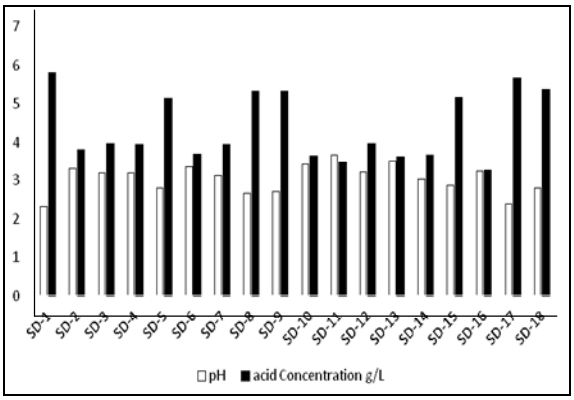

Figure 1. **pH and acid concentration of soft drinks**

All soft drinks contain a large amount of sugar in the form of reducing as well as non-reducing sugar [32, 33]. This reducing sugar (glucose) and non-reducing sugar (sucrose) contents were qualitatively estimated. All the samples contain a high amount of these sugars, which are responsible for sweetness and cause diabetes. The predicted results are shown in Table 1. Due to high concentrations of sugars, the

density of soft drinks is higher than water, ranges 1.01±0.01 to 1.1±0.00, while the density of water is 0.99 g/mL (Table 2 and Fig. 2).

Caffeine is used as a flavor additive, stimulates nervous activity, and increases heart rate, mode enhancer as well as arousal [34]. Caffeine was estimated qualitatively in sample SD-1-SD-18. SD-2, SD-5, SD-6, SD-7, SD-9, and SD-18 do not contain traces of caffeine, while the rest contain some caffeine (Table 1).

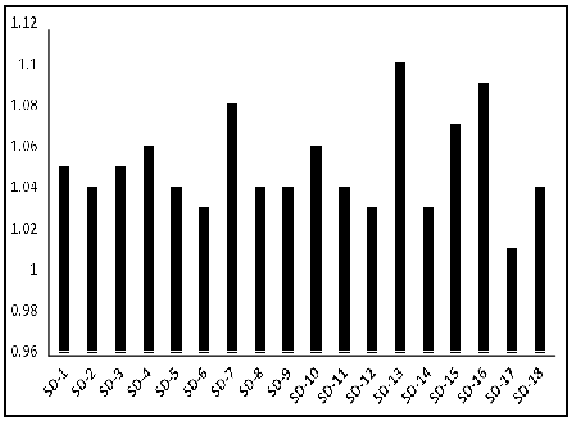

Figure 2. **Density (g/mL) of soft drinks**

According to the literature, soft drinks contain alcohol in traces while the concentration must be less than 0.5% according to the WHO limit [8]. It is predicted that some bacterial contaminations may ferment sugar into alcohol due to poor sterilization [9]. Alcohol was tested in beverages qualitatively as well as quantitatively. Quantitative estimation was done using the redox titration method reported in AOAC. Most of the drinks contain traces of alcohol. The maximum concentration of alcohol was 0.46±0.01 in SD-3 (Table 2, Fig. 3). Although some drinks contain alcohol but the limit was less than 0.5%. Due to this low limit, these are supposed to be safe for use.

Phosphorus is a very important constituent of bones, teeth, DNA, RNA, and cell membrane, repairs cells, reduces muscle pain, and helps filter out waste in kidneys. Naturally, phosphorus exists in the form of phosphates that are acidic in nature. Mostly phosphates are present in the form of phosphoric acid, which gives tartness, increases flavor, and slows the growth of bacteria in soft drinks. A very small amount of phosphoric acid is present in cold drinks, but this low concentration is also dangerous for human health [35]. According to WHO, 500 mg phosphoric acid per cold drink is considered safe, while more than 4000 per day causes serious health problems. Phosphates were confirmed qualitatively, and among 18 brands, 10 brands (SD-1, SD-3, SD-4, SD-7, SD-8, SD-11, SD-12, SD-16, SD-17, and SD-18) gave positive tests for phosphates while remaining 8 do not contain phosphates.

Ascorbic acid, also known as vitamin C and antioxidant, fights against bacterial infections, detoxifies reactions, and increases immunity [26]. A very few soft drinks (SD-3, SD-4, SD-11, SD-12, SD-13, SD-14, SD-15, SD-16, and SD-18) among the tested cold drinks contain ascorbic acid. The presence of ascorbic acid was checked by a qualitative test. Total soluble solids (TSS) were checked according to the reported method, and the resulting values were converted into g/L as well as Brix° (SI unit of TSS). Brix° was calculated as:

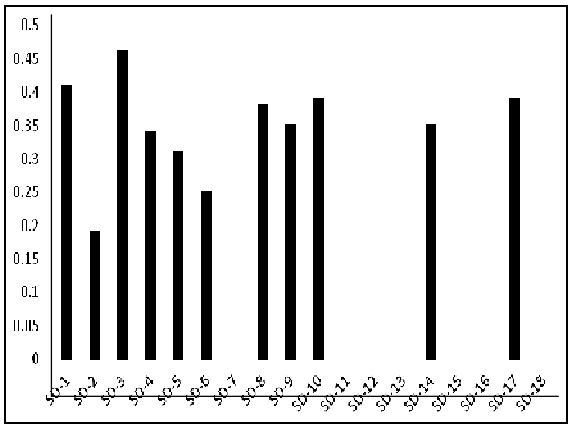

Figure 3. **Alcohol concentration (g/L) of soft drinks**

Table 1. **Qualitative estimation of carbon dioxide, caffeine, phosphates, alcohol, glucose, sucrose and ascorbic acid in soft drinks.**

Sample Code	Caffeine	CO_2	Phosphates	Alcohol	Glucose	Sucrose	Vitamin C (ascorbic acid)
SD-1	+	+	+	+	+	+	-
SD-2	-	+	-	+	+	+	-
SD-3	+	+	+	+	+	+	+
SD-4	+	+	+	+	+	+	+
SD-5	-	+	-	+	+	+	-
SD-6	-	+	-	+	+	+	-
SD-7	-	+	+	-	+	+	-
SD-8	+	+	+	+	+	+	-
SD-9	-	+	-	+	+	+	-
SD-10	+	+	-	+	+	+	-
SD-11	+	+	+	-	+	+	+
SD-12	+	+	+	-	+	+	+
SD-13	+	+	-	-	+	+	+
SD-14	+	+	-	+	+	+	+
SD-15	+	+	-	-	+	+	+
SD-16	+	+	+	-	+	+	+
SD-17	+	+	+	+	+	+	-
SD-18	-	+	+	-	+	+	+

+ = present; - = absent

$$\text{Brix}^{o} = \frac{SP - 1}{0.004} \quad (1)$$

Where SP-specific gravity and was calculated by density of $\frac{\text{density of sample}}{\text{density of water}}$

The high value of TSS indicated a large amount of sugars (sweet flavor) in soft drinks as in SD-16 (21.57±0.02 Brix° or 126.5±0.02 g/L), while a low value indicates tart flavor as in SD-17 (2.56±0.01 Brix° or 64±0.01 g/L). Results are abridged in Table 2 and Fig. 4.

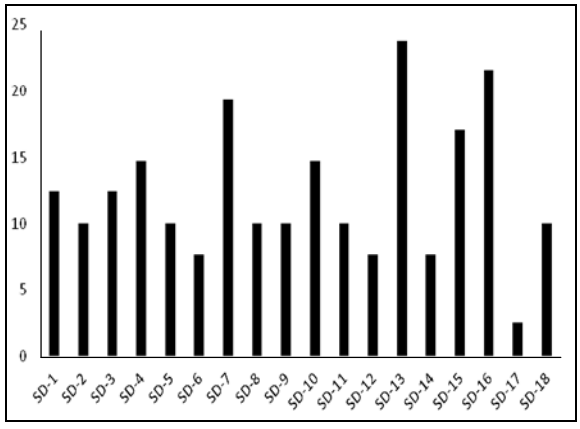

Figure 4. **Total soluble solid (Brix) of soft drinks**

Table 2. **Quantitative estimation of pH, density, TSS, sodium, potassium, calcium, alcohol, acid concentration and conductivity.**

Sample Code	pH	acid Conc. (g/L)	Density (g/mL)	TSS (g/L)	TSS (Brix)	K (mg/L)	Na (mg/L)	Ca (mg/L)	Conductivity (µS/cm)	Alcohol Conc. (g/L)
SD-1	2.33±0.01	5.81±0.01	1.05±0.00	90.5±0.01	12.38±0.01	7.9±0.02	0.8±0.01	0.31±0.01	1256±0.01	0.41±0.01
SD-2	3.31±0.02	3.79±0.01	1.04±0.00	81±0.01	9.99±0.01	0.1±0.01	1.3±0.01	0.1±0.01	506±0.01	0.19±0.01
SD-3	3.2±0.01	3.95±0.03	1.05±0.00	83.5±0.01	12.38±0.01	0.2±0.01	1.8±0.01	0.11±0.01	456±0.01	0.46±0.01
SD-4	3.2±0.00	3.94±0.02	1.06±0.01	96±0.01	14.74±0.01	11.9±0.02	2.8±0.01	0.34±0.02	1170±0.01	0.34±0.01
SD-5	2.8±0.01	5.13±0.00	1.04±0.01	78.5±0.01	9.99±0.02	4.6±0.01	0.5±0.01	0.76±0.01	979±0.01	0.31±0.01
SD-6	3.34±0.01	3.69±0.01	1.03±0.01	84±0.01	7.55±0.01	4.1±0.01	0.3±0.01	0.13±0.03	418±0.04	0.25±0.01
SD-7	3.13±0.02	3.94±0.01	1.08±0.02	78.5±0.02	19.33±0.02	1.1±0.01	0.67±0.01	0.11±0.03	423±0.01	0±0.00
SD-8	2.67±0.03	5.31±0.01	1.04±0.01	105.5±0.01	9.99±0.01	0±0.00	1.4±0.00	0.28±0.03	1280±0.05	0.38±0.01
SD-9	2.72±0.02	5.3±0.01	1.04±0.00	110.5±0.01	9.99±0.01	12.6±0.01	1.7±0.00	0.21±0.01	572±0.01	0.35±0.01
SD-10	3.43±0.02	3.64±0.03	1.06±0.01	115.5±0.01	14.74±0.01	1.4±0.01	1.5±0.00	0.16±0.02	620±0.01	0.39±0.01
SD-11	3.68±0.01	3.48±0.02	1.04±0.01	83±0.00	9.99±0.00	0.2±0.00	2.1±0.00	0.11±0.02	553±0.01	0±0.00
SD-12	3.22±0.01	3.95±0.01	1.03±0.01	89.5±0.01	7.55±0.01	0±0.00	1.2±0.01	0.06±0.01	501±0.01	0±0.00
SD-13	3.5±0.01	3.61±0.01	1.1±0.00	126.5±0.01	23.78±0.01	0.2±0.00	1.9±0.00	0.12±0.02	411±0.01	0±0.00
SD-14	3.02±0.01	3.65±0.02	1.03±0.01	64.5±0.01	7.55±0.01	0.6±0.01	0.7±0.01	0.11±0.01	915±0.01	0.35±0.01
SD-15	2.86±0.00	5.14±0.02	1.07±0.00	116±0.01	17.05±0.01	0.1±0.00	2.1±0.01	0.53±0.01	717±0.01	0±0.00
SD-16	3.24±0.00	3.25±0.01	1.09±0.00	126.5±0.02	21.57±0.02	12.7±0.01	3.0±0.01	0.28±0.01	1338±0.02	0±0.00
SD-17	2.4±0.03	5.67±0.01	1.01±0.01	64±0.01	2.56±0.01	0.45±0.00	0.86±0.02	0.21±0.01	1211±0.02	0.39±0.01
SD-18	2.79±0.01	5.34±0.01	1.04±0.00	84.5±0.00	9.99±0.01	12.8±0.01	1.8±0.01	0.12±0.02	581±0.02	0±0.00

Density of water= 0.99 g/mL; TSS= total soluble salts, ±SD

The conductivity of soft drinks is to measure the ability to conduct electricity. More the ions present in a solution high will be the conductivity. Pure water does not conduct electricity, while distilled water's conductivity is 0.5 to 3 µS/cm. Conductivity of drinking water increases due to the presence of soluble ions and is 200 µS/cm to 800 µcg/cm. Conductivity was quantitatively estimated with the highest value 1280±0.05 in SD-8 and the lowest at 411±0.01µS/cm in SD-13. This increase in conductivity is due to the presence of more soluble ions (cation as well as anions) in soft drinks (Table 2 and Fig. 5).

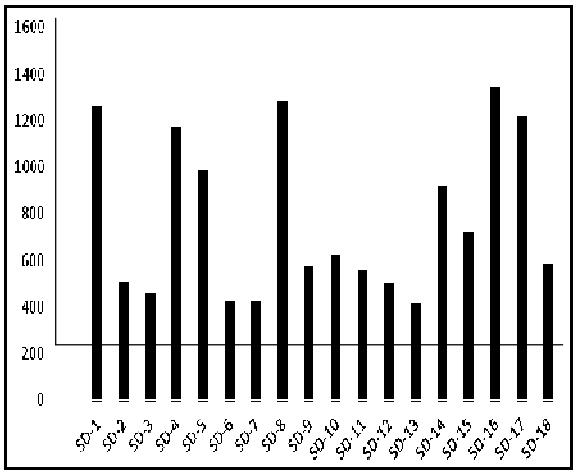

Figure 5. **Conductivity (µS/cm) of soft drinks**

Na and K are important electrolytes for proper body functioning [36, 37]. WHO suggested that 2000 mg (2000 ppm) of Na per day is considered safe for proper body functions like regulating body pH, balancing osmotic pressure, regulate blood volume and pressure [38, 39]. K is important for regulating water balance, and normal intake should not increase from 4700 mg per day [40]. Similarly, Ca is necessary to build and maintain strong bones. 0.2 to 20 mg of Ca is supposed to be safe, according to the literature. A high concentration of these electrolytes may increase the heart attack risk, coronary heart disease, stroke, and reduced blood pressure [37]. These cations are important for proper electrical neutrality and were estimated quantitatively by a flame photometer. All the soft drinks contain some amount of Na, K, and Ca. In some samples, the concentration was very small, as summarized in Table 2 and Fig. 6.

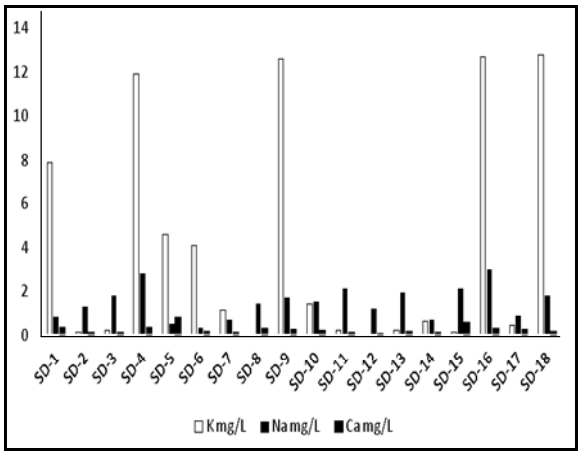

Figure 6. **Concentration of Sodium, Potassium and Calcium (mg/L) in soft drinks**

Conclusion

Based on the results obtained in this study, we concluded that all soft drink brands contain a high concentration of sugar (glucose and sucrose), carbon dioxide, and phosphates, giving them a characteristic taste. Alcohol depresses the central nervous system, also known as a depressant and is present in most of the soft drinks. Among all the test cold drinks, only seven brands SD-7, SD-11, SD-12, SD-13, SD-15, SD-16, and SD-18 do not contain alcohol, while the rest contain some traces. Hence the concentration of alcohol is less than 0.5%, highest in SD-3 with a value 0.46±0.01 g/L, which may be due to poor sterilization process, therefore, supposed to be safe. Caffeine causes alertness and is present in SD-1, SD-3, SD-4, SD-8, SD-10, SD-11, SD-12, SD-13, SD-14, SD-15, SD-16 and SD-17. Some soft drinks (SD-3, SD-4, SD-11, SD-12, SD-13, SD-14, SD-15, SD-16, and SD-18) contain vitamin C (ascorbic acid). Soft drinks are highly acidic, denser than water due to a high concentration of sugars, and more conductive. Also, the analysis confirmed that acid strength in almost all drinks is much higher than the mentioned or reported value (3.6g/L). As sodium and potassium are important for proper body function, except SD-8 and SD-12 all tested cold drinks have some amount of potassium ranges 0.1±0.00 to 12.8±0.01 mg/L, while sodium is present in all cold drinks range 0.3±0.01 to 3±0.01 mg/L. Similarly, calcium is important for bone's development and is present in very litter amounts in all soft drinks with a range 0.06±0.01 to 0.53±0.01. From this study, it was also concluded that the consumption of high concentrations of these cold drinks could cause obesity and heart diseases due to the presence of sugar, tooth decay due to acids, cause alertness due to caffeine, depressed central nervous system due to the presence of alcohol, dehydration, dryness, increase confusion, slow heart rate, tiredness, pains and increase thirst due to the presence of sodium, potassium and phosphates.

Conflict of Interest

Authors have no conflict for publishing this article.

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