

## Comparative Study of Water Quality Parameters of Different Brands of Soft Drinks

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**ABSTRACT :** A soft drink is a drink that contains no alcohol but is usually referred to as a sugary drink. We overwhelmingly order Soft drinks or Soda cans as a part of the meal. It's a proven fact, that today's youth mostly prefers Soft drinks or Soda cans to fresh Fruit juices. Soft Drinks Impact on Health is getting adverse day by day. For determining bad effects of soft drinks, ten popular brands of soft drinks were collected from local market in Solapur & qualitative analysis is carried. The analysis included different testing carried in chemistry lab viz. pH, Acidity, Dissolved Oxygen, Chlorides, Sodium (Na) & Potassium (K) content, Electrical conductivity & Total Dissolved Solids (TDS). The results obtained were correlated with Bureau of Indian Standards (BIS). It has been noticed from the results of testing that most of the soft drinks exceeds drinking water standards given by BIS. Hence soft drinks are not beneficial for health. Drinking soft drinks regularly really is slow poisoning. The over-consumption of sugar sweetened soft drinks is associated with obesity, diabetes, dental caries, kidney stones and low nutrient levels. The aim of this study was to make others to be aware about bad effects of soft drinks on human health to people specially to youths.

**Keywords -** Soft drinks, BIS- Specification, Health hazards.

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### I. INTRODUCTION

“Soft drinks” is a term used for beverages that doesn't contain alcohol (“hard” liquor). If you really know what the contents of soft drinks are, you would not think it is “soft”. It is really “hard” on our health. Soft drinks have become so much a part of modern living, especially in major cities around the world. It particularly appeals to the younger generation who drinks soft drinks in place of water. Soft drinks advertisements target young people who are oblivious to the harm these drinks can do to their bodies. No wonder the people love drinking soft drinks too—they give the refreshing feeling and seem to quench thirsts on a blistering hot day. Vending machines are making the “killing” easier. <sup>[1]</sup> Soft Drinks Impact on Health is getting adverse day by day. Soft drinks are becoming more popular now a day. In fact, instead of reaching a cup of coffee, people are drinking soft drinks for a quick buzz. Hence every day thousands of people are being admitted in hospitals, just due to over consumption of these soft drinks. <sup>[2]</sup>

We need to know more about this drink that we love so much. And so here are five reasons why people drink soda:

- i. It's Very Tasty!
- ii. Convenience, "Grab & Go"!
- iii. Promotion and advertising.
- iv. It is cheap.
- v. Caffeine addiction. <sup>[3]</sup>

Most of us drink soda. Some drink more than others. And probably many regular soda drinkers are aware that soft drinks are bad for the health. To know how soft drinks impact on health, let's see some of the common issues found in people who regularly consume these drinks:

- i. Obesity: Sugary drinks can cause weight gain because they contain a lot of energy. This is a major problem for children and teenagers as a third of the fluids they drink are sugary soft drinks. <sup>[4]</sup>
  - ii. Diabetes: Drinking soda not only contributes to making people fat, but it also stresses the body's ability to process sugar.
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iii. Dental Caries: Soda eats up and dissolves the tooth enamel. Researchers say that soft drinks are responsible for doubling or tripling the incidence of tooth decay.

iv. Increased blood pressure: Experts have reasons to believe that overconsumption of fructose, particularly in the form of soft drinks, leads to increase in blood pressure. [3]

v. Osteoporosis: It's observed that calcium is urinated with phosphoric acids, by the consumption of soft drink. This leads to osteoporosis. [2]

## II. MATERIALS & METHODS

### 2.1 Materials

Ten popular brands of soft drinks were collected from local market in Solapur district, Maharashtra, in India.

Table 2.1: List of soft drinks

Sr. No.	Soft Drink Brand	Sample code
1	7-up	S.D-1
2	Appy Fizz	S.D-2
3	Coca-Cola	S.D-3
4	Duke	S.D- 4
5	Mirinda	S.D-5
6	Mountain Dew	S.D-6
7	Pepsi	S.D-7
8	Slice	S.D-8
9	Sprite	S.D-9
10	Thumbs-up	S.D-10

### 2.2 Methods

Following water quality tests were conducted for above samples as per standard methods.

Table 2.2: Tests & BIS-Specifications [5]

Sr. No.	Tests (As per standard methods)	Drinking water standard as per BIS 10500
1	pH	6.5-8.5
2	Acidity (mg/lit)	500-2000
3	Dissolved oxygen (mg/lit)	6
4	Na (mg/lit)	5-10
5	K (mg/lit)	5-6
6	Electrical Conductivity ( $\mu$ s)	-
7	Total Dissolved Solids ( mg/lit)	500-2000
8	Hardness (mg/lit)	200-600
9	Chlorides (mg/lit)	250-1000

### III. RESULTS & DISCUSSION

Water, as the main component of a soft drink, usually accounts for between 85 and 95% of the product and acts as a carrier for the other ingredients. [6] Therefore, it is important to determine all the water quality parameters of soft drinks.

The results obtained from analysis of samples are given in Table 3.1

Table 3.1: Analysis of Soft Drinks For Various Parameters

Sr. No	Parameters	Drinking water standards as per BIS 10500	Soft Drink Brands									
			7-up (S.D-1)	Appy fizz (S.D-2)	Coca-Cola (S.D-3)	Dukes (S.D-4)	Mirinda (S.D-5)	Mountain dew (S.D-6)	Pepsi (S.D-7)	Slice (S.D-8)	Sprite (S.D-9)	Thums-up (S.D-10)
1.	pH	6.5-8.5	3.96	3.81	2.96	4.46	3.3	3.44	3.02	3.65	3.65	2.95
2.	Acidity (mg/lit)	500-2000	2300	2260	1302	884	2120	1620	1820	2200	2020	1480
3.	Dissolved Oxygen	6	2.8	3.1	3.1	3.6	1.6	1.6	2.8	3.2	3.0	2.8
4.	Chlorides (mg/lit)	250-1000	800.9	1051.2	1101.2	1001.1	2002.2	2152.4	750.8	1251	901	600.7
5.	Sodium (mg/lit)	5-10	9.6.	8.6	9.6	9.3	9.1	9.2	8.8	8.3	8.8	9.8
6.	Potassium (mg/lit)	5-6	4.9	4.9	4.6	4.4	5.1	5.6	5.1	4.8	5.5	5.6
7.	EC (µs/cm)	-	1679	2224	2493	1204	1742	890	2614	2143	1046	2616
8.	TDS (mg/lit)	500-2000	425.4	577	644.9	285.9	442	262	683.2	566.1	268.1	681.6
9.	Hardness (mg/lit)	200-600	380	400	436	348	504	528	352	460	388	396

#### 3.1 pH

The pH of all the soft drinks ranges from 2.95 to 4.46. This range is lower than the BIS range for drinking water (6.5-8.5) and fall outside of the acceptable values. The lower value of pH will have serious effects on human health. Fig. 3.1 shows pH value of soft drinks.

Soft drinks are generally acidic because of the presence of citric acid and phosphoric acid. pH values of cold drink of different brands are different due to the variation in amount of acidic contents. The pH of Coca-Cola & Thums-up was found lower than 3. pH lower than 3 can give brain damage to people. A pH of 3 is ten times more acidic than a pH of 4. Likewise, a pH of 3 is one hundred times more acidic than a pH of 5. [7]

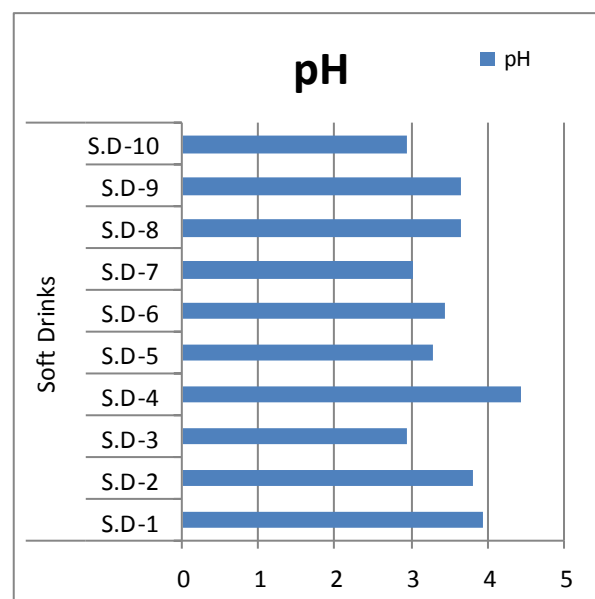


Fig. 3.1 pH of soft drink samples

### 3.2 Acidity

Acidity is related to pH. Acidity is a measure of the capacity of water to neutralize bases. Acidity is the sum of all titrable acid present in the water sample (soft drink). Soft drinks containing high mineral acidity are not fit for drinking purpose. [8] Fig. 3.2 shows results for acidity of soft drinks.

Although teeth are the hardest parts of our bodies, they do have one weakness: they can be easily destroyed by acids. [9] Amongst these soft drinks 7-up is the most acidic (2300 mg/lit). Acidity of this soft drink is strong enough to dissolve teeth & bones! It's been observed that acidity of some soft drink samples are high, but have moderate pH values. Likewise, the pH of a sample (Coca-Cola) is very low but has a relatively low acidity.

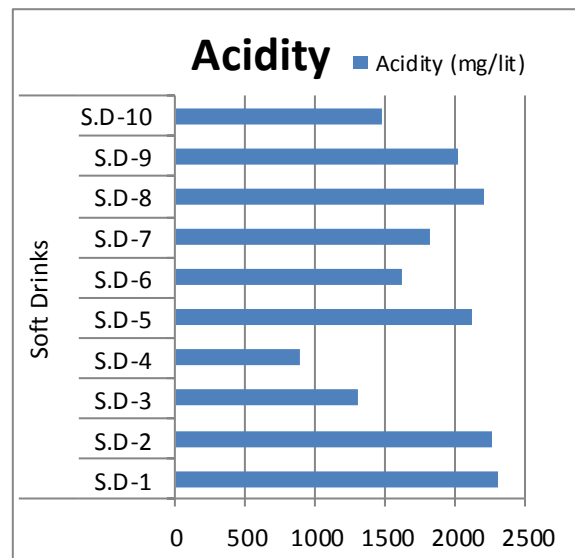


Fig. 3.2 Acidity of soft drink samples

### 3.3 Dissolved Oxygen

Dissolved oxygen (DO) refers to the volume of oxygen that is contained in sample. All soft drinks are sensitive to dissolved oxygen. Water used for soft drinks must be free from micro-organisms, taints and odours, clear and colorless and, especially if it is to be carbonated, free from dissolved oxygen. [10] Accurate measurement and control of the dissolved oxygen is necessary for soft drinks. This is essential to ensure consistent flavor, color and shelf-life. [11] Fig. 3.3 shows results for dissolved oxygen of soft drinks.

Additionally, dissolved oxygen adversely affects filler performance and causes excess filler foaming, resulting in poor fill-volume control. [11] DO of Mirinda & Mountain dew found lowest during testing. Minimum oxygen levels are desired to maintain optimum product quality and maximize shelf-life. [11]

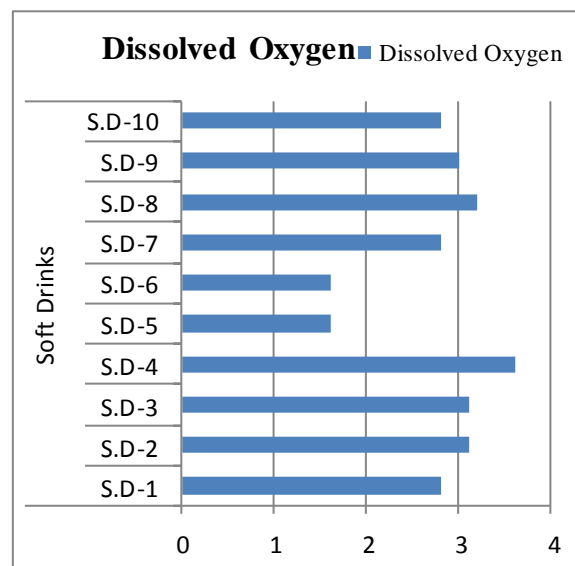


Fig. 3.3 Dissolved Oxygen of soft drink samples

### 3.4 Chlorides

Chlorides are widely distributed in nature as salts of sodium (NaCl), potassium (KCl), and calcium (CaCl<sub>2</sub>). The major taste producing salts in water are sodium chloride and calcium chloride. The salty taste is due to chloride anions and associated cations in water. In some water which is having only 250 mg/lit of chloride may have a detectable salty taste if the cation present in the water is sodium. On the other hand, a typical salty taste may be absent even if the sample is having very high chloride concentration for example 1000 mg/lit. This is because the predominant cation present in the water is not sodium but either calcium or magnesium may be present. <sup>[12]</sup> Fig. 3.4 shows results for chloride content of soft drinks.

The highest chloride content was 2152.4 mg/lit for Mountain Dew and the lowest was 600.7 mg/lit for Thums-Up. The permissible limit of chloride in water is 250 mg/lit as per BIS. <sup>[5]</sup> No health-based guideline value is proposed for chloride in drinking-water sample. <sup>[13]</sup>

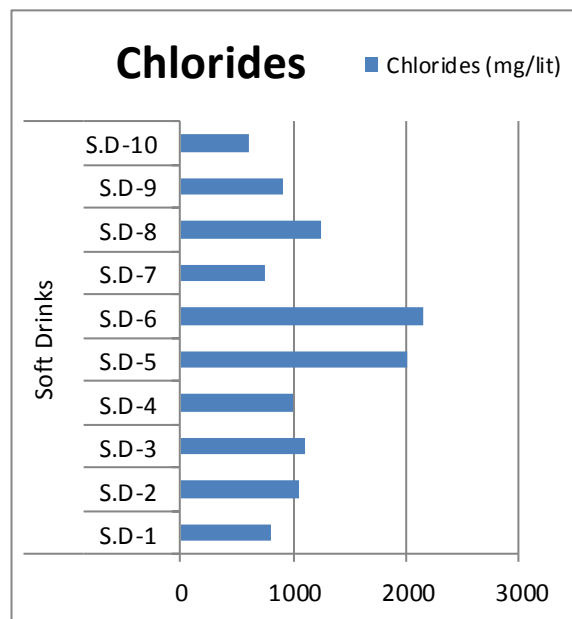


Fig. 3.4 Chloride content of soft drink samples

### 3.5 Sodium

Sodium has a small role in your diet because it helps your muscles contract and relaxes normally, and it helps your nerves work properly as well. Small amounts of salt are essential for our health. <sup>[14]</sup> If you drink several sodas a day, however, the beverages can contribute large amounts of sodium to your daily intake. Regularly consuming too much salt can cause water retention and chronic health problems. Too much sodium, however, can contribute to certain illnesses and disease, such as stroke and kidney disease. <sup>[15]</sup> Fig. 3.5 shows results for sodium (Na) content of soft drinks.

All the soft drinks were in range of drinking water standards given by BIS. For optimal sports performance, especially in hot environments, it is important to drink regularly. Soft drinks that contain sodium may help to rehydrate faster than those without, and added carbohydrates may ward off muscle fatigue. However, sodium intake should generally be reduced in most diets to avoid adverse health effects. <sup>[16]</sup>

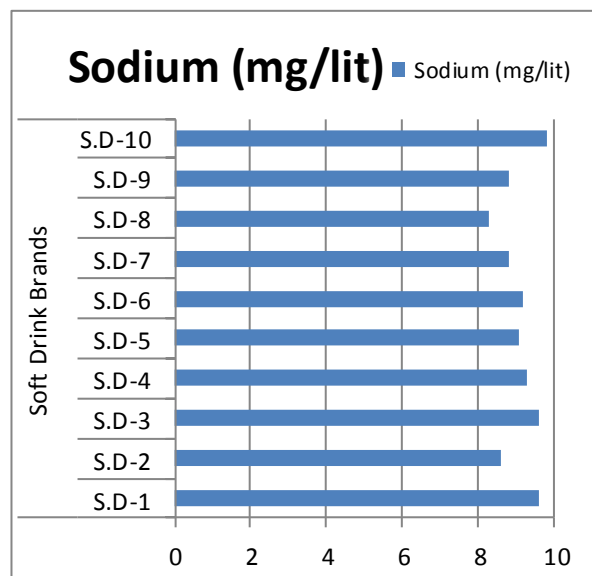


Fig. 3.5 Sodium (Na) content of soft drink samples

### 3.6 Potassium

Potassium is one of the electrolytes essential to the smooth running of the human body. Potassium comes from the foods and soft drinks we consume. Soft drinks supplies small amounts of potassium. There is no benefit to restricting potassium unless our levels are high. <sup>[17]</sup> Fig. 3.6 shows results for Potassium content of soft drinks.

Five out of ten soft drinks exceeded drinking water standards given by BIS. Potassium has a variety of important functions within the body, it can be extremely dangerous when levels become too high or too low. In fact, the body must maintain narrow range of potassium at all times. <sup>[15]</sup>

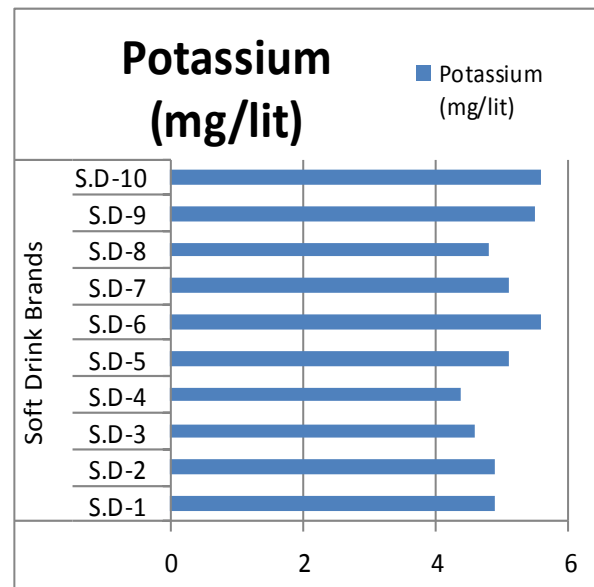


Fig. 3.6 Potassium (K) content of soft drink samples

### 3.7 Electrical Conductivity (EC)

Electrical conductivity is a measurement of the dissolved material in an aqueous solution, which relates to the ability of the material to conduct electrical current through it. <sup>[18]</sup> EC is important because it directly affects the quality of the water used for drinking, because conductivity measurements are based on the ionic composition of the water. <sup>[19]</sup> Scientists use conductivity data as a measure of water quality. High values can mean water that tastes bad or is too salty. Scientists also look for trends in the conductivity data. <sup>[20]</sup> Fig. 3.7 shows results for electrical conductivity of soft drinks.

Among ten soft drinks, highest EC was 2616  $\mu\text{s}/\text{cm}$  for Thums-Up and lowest was 890  $\mu\text{s}/\text{cm}$  for Mountain Dew.

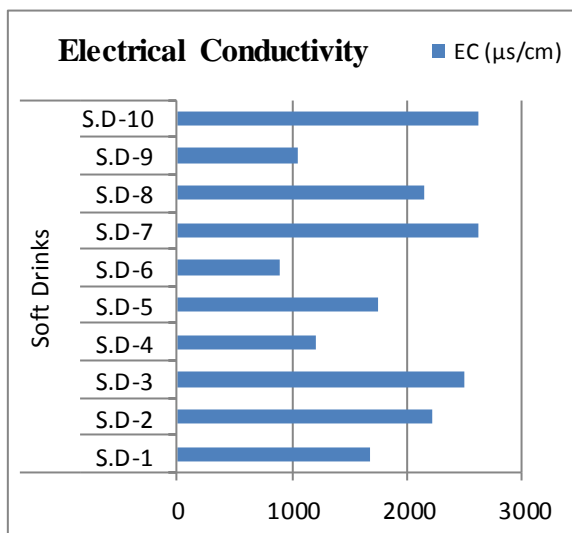


Fig. 3.7 Electrical Conductivity of soft drink samples

### 3.8 Total Dissolved Solids (TDS)

TDS represents the total concentration of dissolved substances in water. A high concentration of dissolved solids is usually not a health hazard. However, a very low concentration of TDS has been found to give water a flat taste, which is undesirable to many people. [21] Fig. 3.8 shows results for total dissolved solids of soft drinks.

The highest and lowest TDS was of Pepsi (683.2 mg/lit) and Mountain Dew (262 mg/lit) respectively. Water containing TDS concentrations below 1000 mg/lit is usually acceptable to consumers, although acceptability may vary according to circumstances. [13] BIS Standard says that the maximum desirable TDS is 500 mg/L and the maximum permissible level in the absence of a better source of water is 2000 mg/L. [5]

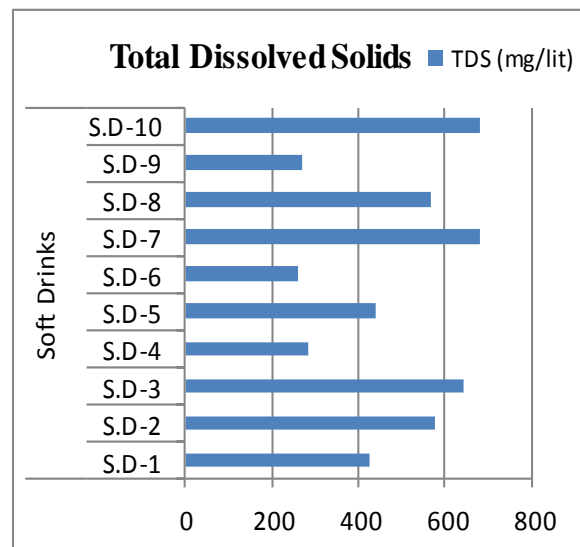


Fig. 3.8 Total Dissolved Solids of soft drink samples

### 3.9 Hardness

Hardness in drinking water is defined as those minerals that dissolve in water having a positive electrical charge. The presence or absence of the hardness minerals in drinking water is not known to pose a health risk to users. Hardness is normally considered an aesthetic water quality factor. [22] Fig. 3.9 shows results for hardness of soft drinks.

Water having hardness more than 180 mg/lit considered as very hard water. [5] All the soft drinks contain very hard water. The highest and lowest hardness are of Mountain Dew (528 mg/lit) and Duke Soda (348 mg/lit) resp.

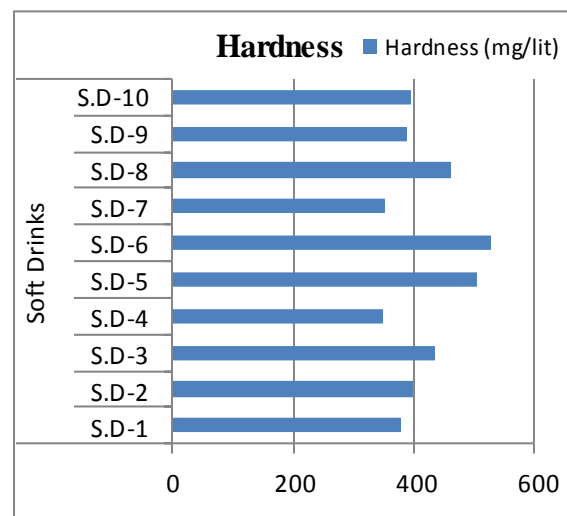


Fig. 3.9 Hardness of soft drink samples

## IV. CONCLUSION

This study gives an insight of major water quality parameters of ten popular brands of soft drinks collected from local market of Solapur district, Maharashtra, India. Most of the soft drinks were having very low pH and high acidity which is highly undesirable and are strong enough to dissolve teeth and bones. Also high content of chloride and sodium can be harmful which contributes to various illnesses and diseases. Hence over-consumption of these soft drinks leads to severe health hazards. For a healthy life-cycle it is better to not to consume even one or two soft drinks per day. The aim of this study is to make others to be aware about bad effects of soft drinks on human health to people specially to youths. Rather than drinking such sugary soft drinks it's better to drink traditional Indian drinks such as Neera, Thandaai, Coconut water, Nimbu-pani, Lassi and many more.



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