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Chemistry and technology of health safety soft drinks

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Abstract

The widespread consumption of soft drinks, often containing artificial colors, preservatives, refined sugars, and synthetic flavors raises concerns about health safety. This study explores the development of healthier soft drinks by replacing artificial components with natural alternatives. Utilizing fruit sources such as orange, pomegranate, lemon, and carrot, alongside natural sweeteners like stevia, the proposed formulations aim to enhance nutritional value while maintaining sensory appeal. Additionally, natural additives like hibiscus and mint contribute to flavour complexity and potential health benefits. In order to guarantee a safer and more useful beverage, this study looks at the chemical composition, antioxidant qualities, and pH balance of these substances. Experimental results demonstrate that these natural soft drinks provide a viable alternative to traditional commercial options, offering improvement in health benefits without the adverse effects of synthetic additives.

Key Words:
Soft drinks, stevia, orange, lemon, pomegranate

1.Introduction

Rising demand for healthy drinks drives research into natural fruit-based soft drinks as nutritious, antioxidant-rich alternatives to sugary beverages, promoting wellness and disease prevention. Lemons (C. limon) are rich in a variety of phytochemicals and nutrients that offer significant health benefits. Among these include anti-inflammatory and anti-cancer qualities (Mohanapriya *et al*, 2013). Lemon phytochemicals provide a number of therapeutic benefits, including cytotoxic, estrogenic, anti-ulcer, antihelmintic, insecticidal, and antioxidant properties (Ajugwo *et al,* 2012). Additionally, lemon extracts

exhibit hepatoprotective, antihyperglycemic, and antimicrobial properties (Hertog *et al,*1993 ; Al-Qudah *et al*, 2018) These therapeutic qualities make lemons a key component in traditional herbal remedies and support their role in promoting overall health (Mamede *et al,* 2020).

Additionally, Mint's nutritional value is significant, with high mineral, carbohydrate, vitamin, protein, and water content (Ahmed *et al,* 2015). Its oil contains flavonoids and phenols, providing antifungal and antibacterial properties**.** Mint is used in cosmetics, medications, detergents, and soaps (Saqib *et al,* 2022). It also improves animal health by improving milk concentration and blood circulation (Elansary *et al*, 2013)

Drinks made from oranges have numerous health benefits, including vitamin C, fiber, and bioactive chemicals that help prevent cancer and other illnesses (Arora & Kaur, 2013). Additionally, as oranges containing antioxidants and flavonoids that fight free radicals, reducing inflammation and supporting immune function (Rawal *et al,* 2023). they also provide essential B-vitamins that promote eye, skin, and overall health (Etebu & Nwauzoma, 2014). Oranges protect against cancer and arteriosclerosis with their phytonutrients and help prevent DNA damage by absorbing UV radiation (Tütem *et al,* 2020).

Low in calories and fat, oranges support weight management and reduce cholesterol levels (Palvi *et al*, 2023 ; Grosso *et al*, 2013)

The conversion of beta-caroten, a provitamin A carotenoid, into vitamin A is essential for maintaining good skin, eyesight, and immune system function (Shrinath *et al*, 2023). As an antioxidant, it helps neutralize free radicals, reducing oxidative stress and the risk of chronic diseases. Beta-caroten also promotes eye health by preventing cataracts and macular degeneration, while protecting the skin from sun damage and promoting a healthy complexion (Grune *et al*, 2010; Ebadi *et al,* 2023).

Pomegranate drink contains Hibiscus is a crucial crop in Nigeria, used in salads, calyces, and sauces. Its seeds are used in cooking, soap production, and cosmetics (Faria & Calhau, 2011). In Nigeria, seeds are used in traditional seasoning "kuiru" but containing antinutritional elements. (Arab & Salem, 2011 ;Salami & Afolayan,2021). Pomegranate, a fruit rich in potassium, vitamin C and antioxidants, has numerous health benefits, including cardiovascular and immune health, cognitive enhancement, disease prevention and oral health (Ismail *et al*, 2012 ;Sabale *et al*, 2020). In lemon, chlorophyll a,b and carotenoid are responsible for color pigmentation. For mint, menthol is the main compound responsible for the taste and smell,

while various functional groups such as esters, ethers, ketones, alcohols, and hydrocarbons contribute to the overall sensory experience of mint essential oil (Craveiro,2015). Besides, in orange, limonene ($C_{10}H_{16}$), linalool ($C_{10}H_{18}O$) and citral (C10H16O) are responsible for the citrusy smell and flavour (Calabrese & Scuderi, 2013) but, ascorbic acid ($C_6H_8O_6$), citric acid (C_6H_8O) for sour taste. On the other hand Natural sugars like glucose ($C_6H_{12}O_6$), fructose ($C_6H_{12}O_6$), and sucrose ($C_{12}H_{22}O_{11}$) provide essential energy (Etebu & Nwauzoma, 2014) while plant-derived bioactive compounds such as the flavonoids hesperidin ($C_{28}H_{34}O_{15}$) and naringin ($C_{27}H_{32}O_{14}$) (Rawal *at el*, 2023) act as antioxidants, helping combat oxidative stress and inflammation linked to chronic diseases, as cancer (Bracke *et al*,1989). Citrus fruits, abundant in these protective compounds, also supply high levels of immune-boosting vitamin C (Grosso *et al,* 2013 ;Roberts&Gaddum,1937). Beyond these benefits, the vivid red, orange, and yellow hues in many fruits and vegetables come from carotenoids like α-carotene ($C_{40}H_{56}$), β-carotene ($C_{40}H_{56}$), and lycopene ($C_{40}H_{56}$), which support health through antioxidant activity and, in some cases, vitamin A conversion (Sánchez *et al,* 2003). Furthermore, soluble fibers such as pectin enhance digestion by forming viscous gels in the intestines and may help regulate cholesterol by interacting with bile acids highlighting the diverse advantages of incorporating plant-based foods into the diet (cara *et al*, 2022). Additionally In Pomegranate Polyphenols It gives pomegranate their rich color and have antioxidant properties (Ain *et al,* 2023). Hydrolysable Tannins They add astringency to the taste and also contribute to the fruit's health benefits. Flavonoids enhance both the color and flavour (Asgary & Keshvari, 2017;Mo *et al*, 2019). Vitamins and Minerals Essential for health, which also influence the taste. Dietary fiber found mainly in the peels, it supports digestive health (Martos *et al*, 2010). Volatile compounds are responsible for the unique aroma and In Hibiscus Anthocyanins are the primary pigments responsible for the red color of hibiscus. Organic Acids, The acidic taste of hibiscus is primarily due to the presence of various organic acids including citric acid, malic acid, tartaric acid and Hibiscus acid (Amos & Khiatah, 2022 ;Zhao *et al*, 2017). These acids contribute to the tart flavor . additionally volatile compounds are responsible for the floral and fruity scents that enhance the sensory experience of hibiscus products(Jeffery & Richardson, 2021).

2. The Theoretical Framework

According to reports from the World Health Organization, around 89% of the global population consumes sugary beverages at least once per week (Le Bodo*et al,* 2024).However, the frequent intake of sugary drinks is recognized as a significant public health concern in many countries, particularly among children and

adolescents (Vin *et al,* 2020 ;Rogers *et al*, 2024). It is important to highlight that excessive consumption of these beverages can contribute to various health issues, including weight gain, obesity, and an increased risk of cardiovascular diseases. (Bellisle *et al*, 2010; Vartanian *et al*, 2007).

Sugary drinks often contain several harmful substances that can negatively impact public health. These beverages are typically high in sugar, which plays a key role in weight gain, obesity, and cardiovascular conditions (Lana *et al*, 2015). Additionally, artificial flavors used in these drinks may elevate the risk of certain diseases among children and adolescents, while artificial colorants have been linked to potential harm to both the skin and internal organs. (Tahmassebi& Banihani, 2020).

In response to concerns regarding excessive sugar intake and artificial additives, there has been a rising demand for healthier alternatives to conventional soft drinks. These healthier beverage options aim to provide the same refreshing and fizzy experience as traditional sodas but are made using natural ingredients, reduced or natural sweeteners, and fewer artificial additives. (Hasselkvist *et al*, 2014. Many of these drinks incorporate natural fruit extracts and plant-based sweeteners such as stevia or honey (Agulló *et al*, 2022) .offering improved nutritional value, fewer calories, and additional health benefits, including enhanced digestion, hydration, and antioxidant properties. (Çetinkaya & Romaniuk, 2020).

Considering the numerous health benefits of natural ingredients, certain fruit and plant combinations can be used as flavors in these healthier beverages. Examples include mint and lemon, orange and carrot, as well as pomegranate and hibiscus, these combinations not only enhance the taste but also contribute to overall well-being (Longo-Silva *et al,* 2015).

2.1. Characteristics of natural Dyes:

natural dyes have gained increasing attention in the industry due to their superior biodegradability and environmental compatibility. These dyes, derived from natural sources, can be classified into plant-based, animal-1derived, mineral, or microbial categories and are commonly used to color various natural fibres (Garcıa& Simal, 2005). Recent research also suggests their potential application in dyeing certain synthetic fibers. Beyond textiles, natural dyes are also utilized in food production, pharmaceuticals, handicrafts, and leather processing (Tupuna *et al,* 2020).

The extraction and purification processes play a crucial role in the effective utilization of natural dyes (Gholami *et al,* 2021; Sk *et al*, 2021). Several extraction methods are currently available, including solvent extraction, aqueous extraction, enzymatic extraction, fermentation, microwave or ultrasonic-assisted extraction, supercritical fluid extraction, and alkaline or acid-based extraction. Each of these techniques has its own advantages and limitations, depending

on the specific parameters that need to be controlled during the process (Scotter, 2011). Selecting the most suitable extraction method can enhance the efficiency and quality of these dye This paper systematically explores the classification, properties, extraction techniques, and diverse applications of natural dyes (Zahra *et al*, 2015).

2.2. Characteristics of Industrial Dyes:

2.2.1. Types of Industrial Dyes:

Direct dyes are predominantly utilized in the textile industry as they can attach directly to (Garcıa&Simal, 2005). They are simple to apply, though additional chemicals may sometimes be needed to enhance color fastness. Acid dyes are mainly used for dyeing protein-based fibers such as wool and silk, as they remain stable in acidic environments and provide strong color intensity (Chou *et al*, 2002). Basic dyes are commonly applied to synthetic fibers like polyester, recognized for their vivid, bright shades and high transparency. Additionally, reactive dyes are valued for their strong chemical bonding with fibers, ensuring excellent color fastness, making them particularly suitable for dyeing cotton (De Andrade *et al,* 2014). Disperse dyes, primarily used for synthetic fibers such as polyester, are water-insoluble and require a specialized process to fix onto the fiber (Ashurst, 2016).

2.2.2. Advantages of industrial dyes

Industrial dyes allow for precise control over the colour outcome, making it possible to achieve a wide range of hues (Hunger, 2007). These dyes provide excellent resistance to environmental factors like light and water, ensuring that the colors last longer(Teng & Low, 2012). It can be applied to a variety of materials, including fabrics, plastics, paper, and even food products in certain cases (Bal&Thakur, 2022).

2.2.3. Challenges associated with industrial dyes

Industrial dyes can contribute to water pollution (Hyde *et al*, 1996). While many companies are striving to create more environmentally friendly dyes. Some industrial dyes still contain harmful chemicals that pose risks to human health if not handled with care (Islam *et al,* 2003). Additionally, dyeing processes require significant amounts of water, which presents challenges in regions where water resources are scarce workers involved in the production or use of these chemicals may also experience adverse chemical reactions if exposed without proper safety measures (Shindhal *et al,* 2021).

2.2.4. Innovations and Future trends

There is a growing emphasis on developing dyes that are biodegradable and environmentally friendly, aiming to reduce their impact on both soil and water (Castro *et al,* 2011). The dyeing industry is gradually transitioning towards the use of natural resources and less harmful chemicals

in the manufacturing process to minimize negative environmental effects (Fernandes *et al,* 2019). . Furthermore, advancements in technology, such as nano-dyeing, are being explored to decrease both water and chemical consumption while enhancing the overall efficiency of the dyeing process (Busarovs, 2013).

2.2.5. Industrial Dyeing Process

To prepare the dye solution, it is usually diluted with water or another suitable solvent (Chequer *et al*, 2013; De Oliveira, 2013).Once the solution is ready, it is applied to the material using methods such as immersion, spraying, or printing (Khattab *et al*, 2020). In certain cases, additional substances like mordants or fixatives are added to help the color bond securely to the material (Maldonado *et al*, 2000). After dyeing, the product is dried to stabilize the color and prevent fading (Kant, 2011). The use of industrial water dyes continues to advance as industries work toward improving dyeing techniques, enhancing color fastness, and minimizing environmental impact (Clark, 2011).

2.3. The effect of pH on healthy soft drinks

Traditional soft drinks tend to be highly acidic (pH ~2.5 - 3.5), (Bartlett *et al*, 2003). which can harm dental health and negatively affect digestion (Birkhed,1984). Ingredients like carrot and mint help achieving a healthier acidbase balance, making the drink less harmful to the stomach and teeth (Van Eygen *et al*, 2005; Tahmassebi *et al*, 2006). Maintaining an appropriate pH balance in the beverage improves its sensory appeal and consumer acceptance, especially for individuals with acid reflux issues. (Johansson *et al,* 2007).

2.3.1. Artificial preservatives and their harmful effects

Artificial preservatives, such as nitrates, are widely used to extend the shelf life of food, cosmetics, and pharmaceuticals by preventing spoilage (Anand&Sati, 2013). Antimicrobial agents, including nitrites, nitrates, benzoates, and sulfur dioxide, inhibit the growth of bacteria, yeast, and molds (Kregiel, 2015). Antioxidants like butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), and propyl gallate help slow down or prevent the oxidation of fats and oils (Mirza *et al*, 2017). Additionally, anti-enzymatic preservatives, such as citric and erythorbic acids, interfere with enzymatic reactions that continue even after food is harvested,
(Dwivedi *et al*, 2017). While natural preservatives like salt, sugar, vinegar, and spices have been used for centuries, modern industries predominantly rely on artificial preservatives
(Kalpana& Rajeswari, 2019). Howver, many of these synthetic compounds pose health risks, with some exhibiting toxic or potentially life-threatening effects (Clark, 2011).

Scientific studies indicate that artificial preservatives, including nitrates,

benzoates, sulfites, sorbates, parabens, formaldehyde, (Frazier *et al,* 2000). BHT, and BHA, may contribute to various health concerns such as hypersensitivity, allergies, asthma, hyperactivity, neurological disorders, and even cancer (Khatri&Shalini, 2008). In contrast, research highlights the potential of natural preservatives derived from plants, animals, microbes, and minerals, which exhibit antioxidant, antimicrobial, and anti-enzymatic properties. Natural extracts from basil, clove, neem, and rosemary have emerged as promising alternatives to artificial preservatives (Abu *et al*, 2000).

2.3.2. Harmful effects of color and taste

Food safety is a critical aspect of human health. The Food and Drug Administration (FDA) has approved more than 3,000 ingredients as safe food additives, which are used to preserve, color, flavor, or thicken various food products (Marković *et al*, 2023). However, some of these ingredients have been restricted due to unexpected adverse effects. (Iregren *et al*, 2002). the adulteration of food and additives can lead to significant health risks, including learning disabilities, hyperactivity, kidney damage, tumors, skin rashes,(Singha *et al*, 2021). migraines, asthma, sleep disturbances, and digestive issues. (El-sikaily *et al*, 2012).

Modern food products frequently contain multiple flavoring and coloring agents derived from both natural and synthetic sources. In recent years, their consumption has risen, partly due to a lack of awareness regarding potential health risks (Çubukçu *et al*, 2025). The aim of this chapter is to highlight the dangers associated with flavoring agents and dyes in foodrelated products (Winstock *et al*, 2001). Understanding these food additives can assist manufacturers in producing safer food, pharmaceutical, and cosmetic products (Gnambs *et al*, 2010)

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2.4 Health benefits of the ingredients in healthy soft drinks

As shown in (figure 1), Carrots are an excellent source of antioxidants, particularly beta-carotene, which plays a vital role in promoting skin and eye health, (Varshney& Mishra, 2022 ;Rebecca *et al*, 2014), strengthening the immune system, and reducing inflammation. Additionally, carrots have a neutral pH level of approximately 5.5 to 6.5, making them useful for lowering excessive (Wang *et al*, 2015).

As shown in (figure 5), Mint contains phenolic compounds with antioxidant properties, aids digestion, reduces bloating and has alkaline properties helping to balance acidity when combined with other
acidic beverages Plavsic *et al*,2020).

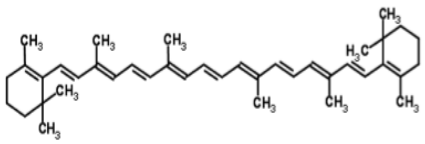
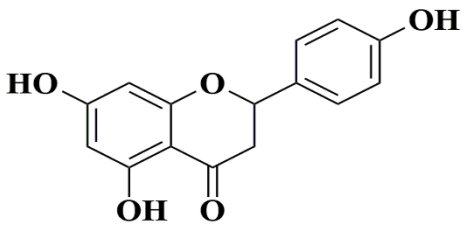


Figure (1): Beta carotene ($C_{40}H_{56}$)

As shown in (figure 2&3), Orange is a rich source of vitamin C and flavonoids, which strengthen immunity and fight free radicals,(Kerfeld *et al*, 2017). supports heart health, helps lower blood pressure, and has a relatively low pH (~3.3 - 4.2), which giving soft drinks a refreshing acidic taste(Iancu, 2023).



Naringenin

Figure (2): Naringin (C27H32O14)

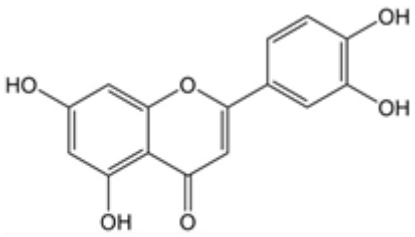
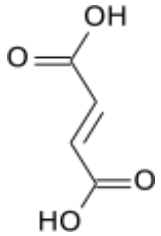
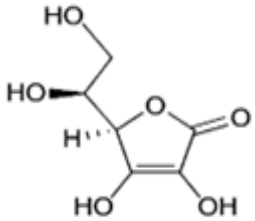


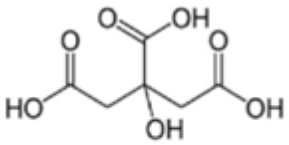
Figure (3): Hesperidin (C28H34O14)



Malic acid



Ascorbic acid



$C_6H_8O_7$

Citric Acid

Figure (4): citric acid ($C_6H_8O_7$), malic acid(C4H6O5) ascorbic acid (C6H8O6)

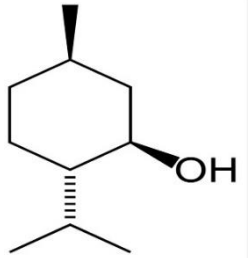


Figure (5): menthol ($C_{10}H_{20}O$)

As shown in (figure 6), Hibiscus is rich in anthocyanins, potent antioxidants that promote heart health and lower blood pressure, despite its acidic nature (pH ~2.5 - 3.5), it has an alkalizing effect on metabolism and contains anti-inflammatory properties, making it an excellent ingredient for healthy drinks .
(Shruthi& Ramachandra, 2019).

As shown in (figure 4), Lemon is one of the strongest natural sources of antioxidants such as vitamin C and flavonoids, helps detoxify the body and supports liver health, and has a very low pH (~2.0 – 2.6), making it a powerful acidifier that requires balancing in beverages(Jana *et al,* 2020).

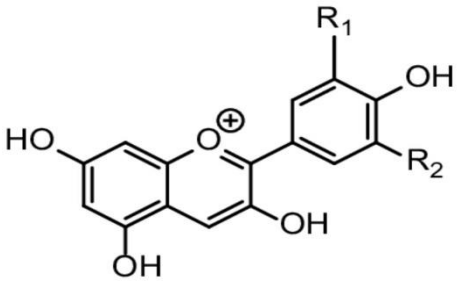


Figure (6): Anthocyanins acid($C_{15}H_{11}O^{+}$)

As shown in (figure 7), Pomegranate is a powerful source of polyphenols and tannins, which fight free radicals and improve heart health (Naeem, 2023). Pomegranate also inflammation and enhances brain function, and has a relatively low pH (~2.9 - 3.2), providing a tart flavor that complements healthy soft drinks . (Zaouay *et al*, 2014).

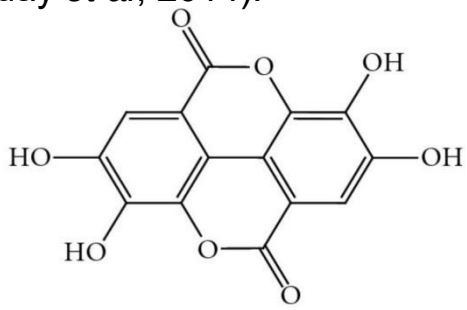


Figure (7): punicalagins ($C_{48}H_{28}O_{30}$)

2.5. The relationship between antioxidants and healthy beverage properties

The antioxidants found in these fruits and vegetables play a vital role in minimizing oxidative stress within the body, helping to prevent premature aging and heart disease, (Gupta *et al*, 2023 ;Charanjit & Kapoor, 2001). They also contribute to the chemical stability of healthy soft drinks, extending their shelf life and enhancing natural flavor and color without relying on artificial additives(Siddiqui *et al,* 2004). Incorporating carrot, mint, orange, lemon, hibiscus, and pomegranate into these beverages offers a scientifically supported method for creating nutritious, flavorful, and functional drinks (Seeram *et al,* 2008 ;Corando_Reyes *et al,* 2021). These ingredients provide essential health benefits, such as boosting the immune system, improving digestion, promoting heart health, and offering antioxidant protection. (Pinto & Vilela, 2021). Each ingredient brings unique antioxidant compounds, including beta-carotene in carrots, polyphenols in pomegranate, anthocyanins in hibiscus, and vitamin C in citrus fruits,(Fakhri *et al*, 2023). which work to combat oxidative stress, reduce inflammation, and support overall well-being (Yoon Kin Tong *et al*, 2012).

More over, maintaining proper pH balance is essential when formulating healthier soft drinks, as excessive acidity can negatively impact both dental and digestive health (Wootton-Beard& Ryan, 2011). Ingredients like mint and carrot help neutralize acidity, making these beverages gentler on the stomach while still delivering a refreshing ttaste (Tahmassebi *et al*, 2006).

Figure (8): amount of sugar in different harmful soft drinks

Comparison between harmful and healthy soft drinks

Harmful soft drinks	Healthy soft drinks
-White sugar	-Stevia sugar
-Artificial Flavors	-Natural Flavors from fruits
-Artificial colours	-Natural colours from fruits
-Artificial antioxidants	-Natural antioxidants as lemon
-Doesn't provide body with nutrients	-Provide body with nutrients

3.Methods of Research and the tools used

Materials

Orange-Lemon- Pomegranate-Sparkling water-Citric acid-Carrot-Stevia sugar-Salt-Hibiscus-Mint-Honey -Water

Tools

Beakers -Balance-Filter papers-Hot plate with stirring-Conical

Methods

Orange soft drink	Lemon soft drink	Pomegranate soft drink
1- Put 50ml sparkling water in bottle 2- 4gm stevia sugar 3- 50ml orange juice 4- 20ml Beta-carotene 5- 5ml limon juice 6- 0.50 g Salt 7- 0.50 g Citric Acid	1- 50ml of sparkling water 2- 4g of stevia 3- 10ml of lemon juice 4- 15ml of mint syrup 5- 1/2 g of salt 6-1 / 2g of citric acid Mint extract: 1- Put 2cup of water 2- 1cup of mint 3- 5 spoons of honey Then put them on a medium heat for 10 min	1-50 ml Sparkling Water in bottle 2- 4g Stevia Sugar 3- 75 ml Pomegranate Juice 4- 5 ml Hibiscus Extract 5- 0.50 g Salt 6-0.50 g Citric Acid

4. Results of Research

After many experiments on producing a healthy soft drink rich in benefits, the result is that healthy orange soft drink experiment succeeded by substituting the harmful ingredients by healthy one as in substituting white sugar by stevia and gives natural color to drink instead of industrial one and adding beta carotene from carrot that increase the benefits of the drink. The pomegranate soft drink experiment succeeded by using healthy ingredients which benefit human body(figure9). Then experimented lemon mint soft drink succeeded but for beets soft drink experiment not succeeded because The taste is not good.

Figure(9):illustrate the ingredients of healthy soft drinks

5. Interpretation of Results

First : Orange soft drink

First, Sparkling water was used as a source of soda “Co_2” then orange juice was extracted from citrus aurantium, It was used as a natural flavour instead of artificial flavors. Stevia sugar was used as an alternative to harmful white sugar found in unhealthy drink in addition to that is zero calories, and the color is based on a natural source, beta-carotene, instead of artificial colors by squeezing carrots.

A small amount of lemon juice was used to increase the acidity and as an antioxidant, 0.5 gm of salt to enhance the taste and feel it best, and

0.5 of citric acid rely on it as a drink preservative. Note that the expire date of the drink does not exceed seven days because it is based on natural sources and not harmful preservatives like in unhealthy drinks.

Beta-carotene is a provitamin A carotenoid that the body converts into vitamin A, essential for healthy skin, vision, and immune function. As an antioxidant, it helps reduce oxidative stress and may lower the risk of chronic diseases. It also supports eye health by preventing conditions like cataracts and macular degeneration and enhances skin health by promoting a healthy complexion and protecting against sun damage.

We extract the yellow color from the carrot by adding purified water and sodium chloride solution. Using separating funnel, after a vigorous shaking, the mixture is setting aside to allow the layers to separate. Carotenoids are found in the upper layer, which collected independently after removing the aqueous layer. (figure10)

Figure(10): illisturate the steps for carotien extraction

Second : pomegranate soft drink

For our drink, we used sparkling water as a natural source of carbon dioxide and soda. Instead of artificial and harmful flavors, we extracted fresh pomegranate juice from Punica Granatum to provide a natural and authentic taste. Also, to enhance the drink's color, we opted for the natural pigment of Hibiscus Sabdariffa rather than artificial coloring. Besides, using stevia as a natural and safe source of sugar instead of white sugar. We also added 0.5 gram of salt to enhance the flavor and 0.5 gram of citric acid as a mild preservative.Since our drink is made from natural ingredients without harmful preservatives commonly found

in unhealthy drinks, its expire date does not
exceed 7 days. A small tradeoff for a healthier and more natural beverage.
Hibiscus is not only used to enhance the drink's color but also for its numerous health benefits. It is rich in antioxidants, anti-inflammatory properties, and supports heart and liver health. Additionally, it helps lower blood pressure, boosts immunity, aids digestion, and improves mood.
Hibiscus Color extraction process was obtained by boiling dried hibiscus flowers in water for 2–3 minutes. The hibiscus was then left to steep in water for 15 minutes, allowing the full extraction of its color and flavor. Finally, the liquid was strained to obtain the extracted color.(figure11)

Figure(11): illustrate the pomegranate juice

Thirdly : lemon soft drink

We poured sparkling water in a beaker as CO_2, soda source and then we added mint syrup that used as a natural color and flavor. In the next step, we added lemon as a flavor, acidity, an
antioxidant, contains vitamin C, which is called ascorbic acid. After that, we added stevia sugar as a sweetener and a healthy and safe substitution of white sugar. Finally, addition of salt to enhance the flavor of the drink and citric acid as a preservative for the drink.(figure12)
Mint has many benefits as in treatment of nausea, anorexia, bronchitis due to its anti-inflammatory and anti-emetic.

Figure (12):illustrate the lemon juice

6.Conclusion

From our experiments, we concluded that

First: orange soft drink.

Sparkling water is used as a source of carbon dioxide. Orange juice is extracted from Citrus Aurantium to provide a natural flavor instead of artificial ones. Stevia is used as a healthy alternative to white sugar, contributing zero calories. The color comes from beta-carotene extracted from carrots. A small amount of lemon juice is added to enhance acidity and act as an antioxidant, along with a small amount of salt to improve taste. The drink has a shelf life of no more than seven days due to its reliance on natural ingredients**.**

Second: pomegranate soft drink. Sparkling water serves as a natural source of carbon dioxide, while fresh pomegranate juice is extracted from Punica Granatum for an authentic taste. The color is enhanced with a natural pigment from Hibiscus Sabdariffa instead of artificial coloring. Stevia is used as a healthy alternative to harmful white sugar, with a small amount of salt and citric acid added as a mild preservative. The drink's shelf life is limited to seven days, and hibiscus provides various health benefits, including antioxidants and support for heart health**.**

Third: lemon soft drink

sparkling water is combined with mint syrup for natural flavor and color. lemon juice are added for flavor, acidity, and vitamin C. stevia sugar serve as a healthy sweetener, along with salt and citric acid for preservation. Mint offers various benefits, including treating nausea and inflammation**.**

These drinks emphasize the use of natural, healthy ingredients with a short shelf life, reflecting the absence of harmful preservatives**.**

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