



Development and Evaluation of Orange Juice and Moringa Extract Based Fizzy Drink

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Abstract: *This study aimed to develop and evaluate a nutritionally enriched fizzy drink formulated by blending orange juice with Moringa oleifera extract. The experiment was conducted at the National Institute of Food Science and Technology, University of Agriculture, Faisalabad. Different formulations (T0–T4) were prepared by combining orange juice (100–80%) with moringa extract (0–20%) and analyzed for physicochemical, antioxidant, color, and sensory parameters. Results revealed that an increase in moringa concentration significantly influenced beverage quality. Total soluble solids (TSS) increased from 13.00 to 13.72 °Brix, while pH decreased from 3.05 to 2.73, indicating higher acidity. Vitamin C content rose from 49.25 to 81.91 mg/100mL, and antioxidant activity (DPPH) improved from 75.23% to 84.58%, reflecting enhanced nutritional potential. The treatment with 15% moringa extract (T3) exhibited optimal sensory attributes, including taste, color, aroma, mouthfeel, and overall acceptability. The findings suggest that moringa–orange formulations can serve as functional beverages with superior nutritional and sensory properties compared to conventional soft drinks, promoting a healthier and more natural alternative for consumers.*

Keywords: *Moringa oleifera, orange juice, functional beverage, antioxidant activity, vitamin C, sensory evaluation, carbonated drink, nutrition enhancement, total phenolic content (TPC), DPPH assay*

1. INTRODUCTION

Carbonated beverages, which contain dissolved carbon dioxide, create a pleasant tingling sensation when consumed due to the formation of carbonic acid that stimulates the tongue and nerves. This sensory experience, known as trigeminal stimulation, makes such drinks widely popular. The global carbonated beverage market includes soft drinks, energy drinks, fruit-flavored sodas, colas, iced teas, and soda waters, accounting for nearly half of global soft drink consumption (Barker *et al.*, 2021). These effervescent drinks rank third in global beverage consumption (Richa *et al.*, 2023). The consumption of soft drinks in India alone is higher than 5.9 billion liters per annum (Pareek *et al.*, 2023). Simons originally discovered artificial carbonation in 1999, commercial production of which started in Switzerland.

Eating habits have a significant influence on the human health. Drinks such as fruit juices and drinks are also considered crucial sources of nutrients and medicinal elements that promote good

health (Tsuchiya *et al.*, 2023). Carbohydrates, vitamins, minerals, polyphenols, and carotenoids are naturally abundant in fruits and combat chronic diseases, as well as enhance immunity, digestion, and metabolism (Vlădescu *et al.*, 2021). Juices and fresh fruits are crucial in balancing nutrients particularly in areas where they are not easily available throughout the year. Citrus fruits especially are well appreciated due to their refreshing taste and health value (Saint-Eve *et al.*, 2010).

Orange juice is the most consumed fruit juice globally, and it is one of the signs of a shift to the consumption of natural, preservative-free products with high concentrations of vitamins, minerals, and antioxidants (Tsuchiya *et al.*, 2023). Citrus genus, which is grown in more than 114 nations refers to oranges, lemon, lime, mandarins, and grapefruits, and among the top producers is China (Saint-Eve *et al.*, 2010). The citrus fruits are non-climacteric, which means that they have to be picked when they reach optimal ripeness to achieve maximum quality (Richa *et al.*, 2023). They are also famous due to their medicinal and nutritional effects, such as anti-inflammatory, antibacterial, and anti-cancer effects (Tsuchiya *et al.*, 2023). Specifically, blood oranges have high concentrations of anthocyanins that not only render their red color, but also cardiovascular and antioxidant properties (Redondo *et al.*, 2014; Jan *et al.*, 2025). Besides, citrus also contains carotenoids and polyphenols, which also help in antioxidant, antidiabetic, and anti-cancer activity (Kowalska *et al.*, 2023).

Likewise, the fast-growing tree, *Moringa oleifera* that grows in tropical areas has been known to have impressive nutritional and therapeutic value. Moringa leaves contain anti-inflammatory, antioxidant, and antidiabetic effects, which are full of flavonoids, phenolic acids, vitamins, minerals, and polyunsaturated fatty acids (Karki *et al.*, 2024). It also works well in lowering cholesterol and addressing other conditions, including asthma, hypertension, and skin infections (Richa *et al.*, 2023). Moringa is an excellent source of key micronutrients, such as calcium, iron, as well as vitamins C and A, which maintain the health of bones, the immune system, and the digestive system (Karki *et al.*, 2024). It possesses bioactive compounds that make it antibacterial and having a healing effect, which include alkaloids, saponins, and triterpenoids (Kowalska *et al.*, 2023).

Moringa extract mixed with citrus juice in soft drinks is a new concept of creating a refreshing, nutritive and purposeful drink. Citrus would add natural antioxidants and flavor and moringa would add essential nutrients and bioactive compounds to the beverage. The blend does not only

improve the taste, but also leads to health and vitality through the synergistic therapeutic effects created by the combination.

2. MATERIALS AND METHODS

It was conducted at the National Institute of Food Science and Technology, university of agriculture, Faisalabad, Pakistan. The experiment involved the use of moringa and orange as the raw materials. This was done by the extraction of juice out of these products and then they were carbonated and stored in glass bottles. Analytical analysis was then carried out comprehensively to determine different parameters.

2.1. Acquisition of raw materials.

Orange fruits (*Citrus sinensis*), super-fresh and without any disease and moringa (*Moringa oleifera*) leaves were obtained in the local market of Faisalabad and processed in Beverage Laboratory, NIFSAT, University of Agriculture Faisalabad. All the samples were cleaned properly, checked, and kept in some cool, dry location to be used further.

2.2. Carbonated beverage preparation.

Fresh oranges were chosen, washed and then extracted and filtered using muslin cloth to prepare the juice. This is done by boiling dried leaves and filtering of the solution to produce moringa extract. The two extracts were combined with sugar syrup, preservatives, and pigments and carbonated and bottled in dark glasses to make high-quality citrus moringa beverages (Pareek *et al.*, 2023).

Table 3.1 Treatment plan of orange juice and moringa extract based fizzy drink

Treatments	Citrus juice (%)	Moringa extract (%)
T ₀	100	----
T ₁	95	5
T ₂	90	10
T ₃	85	15
T ₄	80	20

T₀ was the control treatment carrying only orange juice with no moringa extract. While other treatments contained different percentages of moringa extract combined with orange juice to make formulation.

2.3. Analysis of raw materials

A thorough inspection of the raw materials was done to determine their quality by performing physicochemical and antioxidant analysis. TSS, pH, acidity and ascorbic acid content were some of the parameters used to determine the composition/processing suitability of the juice. Moreover, DPPH assay and Total Phenolic Content (TPC) were also used to measure the antioxidant activity to guarantee the high nutritional and functional quality of the final product (Pareek et al., 2023).

2.4. Product analysis

A set of tests were performed to forecast the quality and consumer acceptability of the end beverage. It was measured in physicochemical parameters of acidity, pH, TSS, and ascorbic acid besides antioxidant activity to determine the health benefits. Carbonation and visual appeal were determined by gas volume and color analysis whereas taste, aroma and texture were evaluated by the sensory analysis of trained panel and consumer panel. Results were then interpreted through statistical analysis in order to optimize the product to gain the satisfaction of consumers (Pareek et al., 2023).

2.4.1. Physicochemical analysis

The following physicochemical analysis (TSS, Ph and titratable acidity) was done on citrus juice and moringa extract based fizzy drink:

2.4.1.1 Total soluble solids

Refractometer was used to obtain the total soluble solids (TSS) of citrus juice and moringa-based fizzy drinks and the data were expressed in terms of Brix. Beverage samples were calibrated using distilled water after which the samples were put on the prism to be read after which three readings were averaged as an accuracy measure. The obtained Brix value was an indicator of the concentration of soluble solids, which allowed obtaining important information about the composition and quality of the beverage (Hewson et al., 2018).

2.4.1.2 pH analysis

Measurement of the pH of each treatment of beverages was done using a standardized digital pH meter according to the standard method of Chiş et al. (2024). Samples were put in the 100 ml beakers, and the electrode was completely immersed in each drink. Each sample was read three times and the average was made to be the ultimate pH value in a bid to offer accuracy and consistency in determining the quality and composition of the drink.

2.4.1.3 Titratable acidity

The measurement of the acidity of end product was done by acid-base titration method.

Acid-base titration method, the acidity of the samples was assessed by means of acid-base titration according to the procedure of Chiş et al. (2024). The 5 mL of the sample was diluted to 100 mL and 10 mL of the solution was titrated with 0.1 N NaOH with phenolphthalein as the indicator until the color changed. The amount of NaOH that was used was noted and the percent of titratable acidity was calculated using a standard formula to determine the amount of acidic content of the beverage accurately.

$$\text{Titratable acidity (0)} = 0.1 \text{ NaOH used} \times 0.0064/\text{ml of juice used} \times 100$$

2.4.2. Findings on antioxidant activity

The following methods were used to measure the value of antioxidant in citrus and moringa extract based fizzy drink;

2.4.3. Color analysis

A calorimeter was utilized when measuring L, a and b values in the color measurement of citrus and moringa extract based carbonated beverages. The first step was to take a sample of the carbonated drink and pour it into a clean and transparent vessel to ensure that it is representative of the whole batch and also well stirred to evenly spread any particle in the sample. This was then put in the calorimeter apparatus that had a light source and detector. The sample was placed in a source of constant light and the intensity of light going through the beverage was recorded by a detector. This was measured against a reference measurement of a standard solution or blank. The calorimeter was used to measure the L, a, and b values of the beverage. The L value is used to determine the lightness of the beverage in a range of 0 (black) to 100 (white). The a-value is an indication of the red-green axis with positive a-values indicating red colors and negative a-values indicating green colors. b value is the measure of yellow-blue axis where a positive value defines the yellow hue and negative the color is blue. Based on the evaluation of these L, a, and bs values measured using the calorimeter, the color properties of the carbonated beverage were measured in terms of its brightness, red-green coloring, and yellow-blue coloring (Gopalakrishnan et al., 2016).

2.4.5. Sensory analysis

The trained food science specialists performed a sensory assessment of the citrus and moringa-based fizzy drink according to the technique used by Barker et al. (2021). The panelists evaluated the color, smell, flavor, and mouthfeel of the beverage and paid attention to such qualities of the beverage as hue, sweetness, acidity, and carbonation. A standardized evaluation procedure was

employed to make sure that the feedback was consistent and reliable giving the valuable information regarding the sensory quality of a drink and its appeal to the consumers.

2.4.6. Statistical analysis

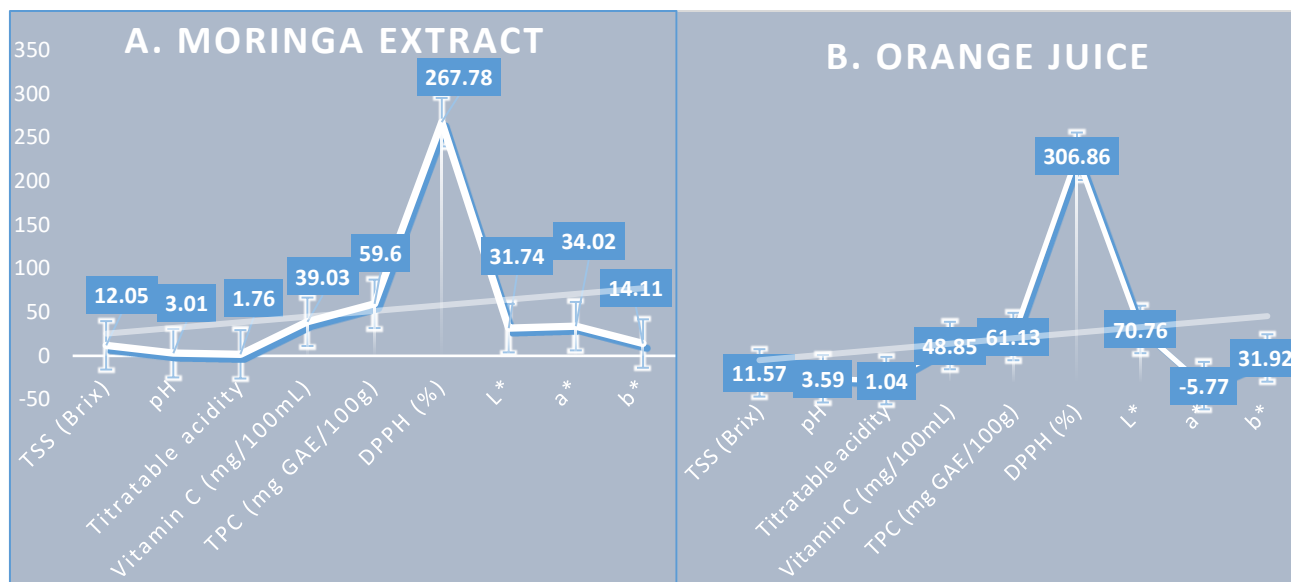
The analysis was done in the form of statistics 10.0 software in accordance with the standardized procedure. The significance of the treatments was determined using the ANOVA that was conducted in one-way, with fully random assignments. To make the findings of the study statistically dependable and valid, the results were formulated in the means form to enhance clarity and precision.

3. RESULTS AND DISCUSSION

The products need to be analyzed analytically to achieve quality, safety, and consistency that comply with the regulation standards. It assists manufacturers to make the production optimal and enhance the efficiency, and detect problems to be corrected in time. Besides, it promotes research and development, as it helps in providing information about the formulation and material characteristics, which make sure that there is innovation in the product. The analysis also enhances the credibility of the research results which steer the evidence-based decisions and consumer trust using safe and high-quality products.

3.1. Analysis of raw materials

Analysis of the raw materials was done in order to determine the quality of citrus juice and moringa extract in the fizzy drink. Several tests, such as physicochemical, phytochemical, antioxidant, and color, were conducted to determine TSS, pH, titratable acidity, vitamin C, total phenolic content, and DPPH activities. Graph 1 A, Moringa extract contained TSS, pH, acidity and vitamin C of 12.05 ± 0.50 , 3.01 ± 0.05 , 1.76 ± 0.09 , and 39.03 ± 3.1 respectively. As showed in graph 1 B, Orange juice recorded a TSS of 11.57 ± 0.12 , pH of 3.59 ± 0.08 , acidity of 1.04 ± 10.28 , and vitamin C content of 42.85 ± 40.05 , aligning with Hewson *et al.* (2018). Its total phenolic content was 61.13 ± 94 mg GAE/100g (Xu *et al.*, 2023), and DPPH activity was 306.86 ± 0.23 . Color values were $L^* = 70.76 \pm 0.23$, $a^* = -577 \pm 0.08$, and $b^* = 31.2 \pm 0.02$, consistent with Patil *et al.* (2024).



Graph 1: Comparative means of physicochemical, phytochemical, antioxidant activity and color parameters of Moringa extract and orange juice

3.2. Analysis of citrus juice and moringa extract based fizzy drink

3.2.1. Physicochemical analysis

3.2.1.1. Total soluble solids (TSS)

Total Soluble Solids (TSS) represent the concentration of all soluble substances in a solution, including sugars, vitamins, proteins, pigments, phenolics, and minerals, measured using a refractometer in °Brix (Chiş *et al.*, 2024). The analysis of variance for TSS in orange juice and moringa extract-based fizzy drinks showed in graph 2 A, which are highly significant results, with mean values ranging from 13.00 to 13.72. Among the treatments, T4 recorded the highest TSS (13.72), while T0 had the lowest (13.00), consistent with findings on whey-carrot functional beverages reported by Hewson *et al.* (2018).

3.2.1.2. pH analysis

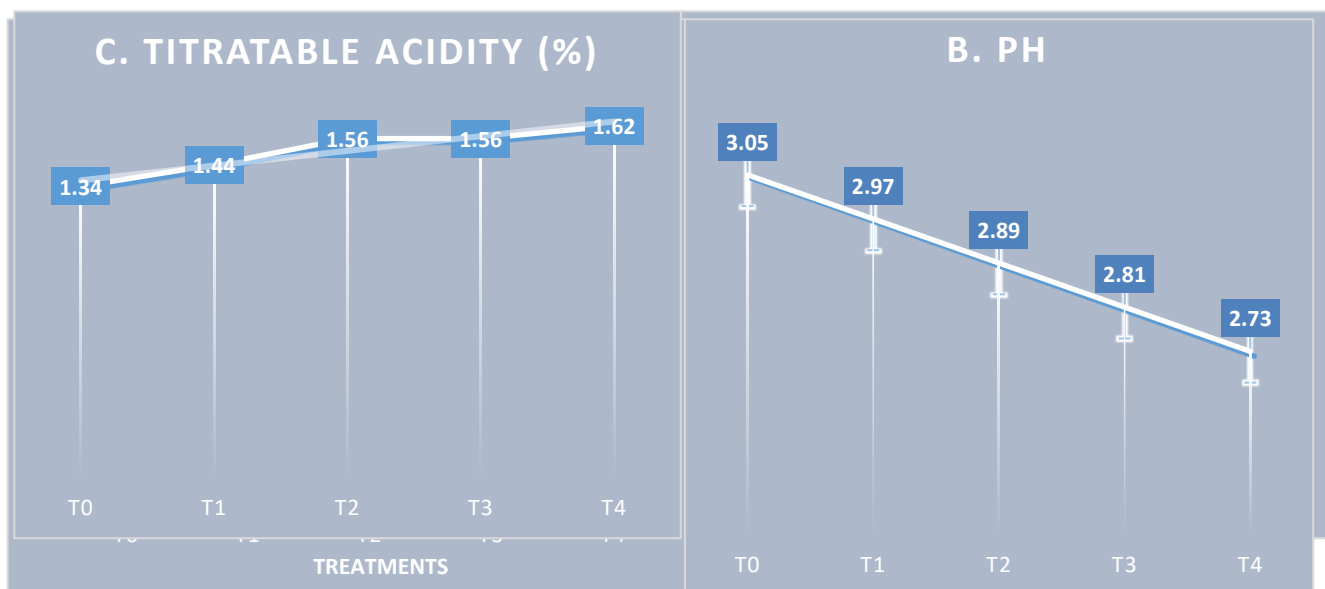
pH, or “power of hydrogen,” measures the acidity or alkalinity of a solution and is expressed as the negative logarithm of hydrogen ion concentration, with a scale ranging from 0 (acidic) to 14 (alkaline) (Chiş *et al.*, 2024). The results of the analysis of variance of pH of citrus and moringa extract-fizzy drinks were in graph 2 B, the mean value of 3.05 to 2.73 of five extracts (T0-T4). T0 (3.05) was the highest pH, and T4 (2.73) was the lowest, which showed a declining trend in pH with an increase in moringa concentration- the same results were obtained by Barker *et al.* (2021).

3.2.1.3. Titratable acidity

Also, titratable acidity is calculated by titration of the acids in a solution with a standardized alkali, i. e. sodium hydroxide (NaOH) until a pH indicator indicates the end point, as a result of which the concentration of acids in the solution can be expressed in grams per liter or percent (Chiş *et al.*, 2024). ANOVA analysis of titratable acidity in citrus and moringa extract-based fizzy drinks found out that there was a significant difference among the treatments with the mean values between 1.34 and 1.62. The T4 exhibited the greatest acidity (1.62) in the graph 2.C and T0 the lowest (1.34), and this agrees with Barker *et al.* (2021).

3.2.2. Determination of vitamin C

The analysis of vitamin C in food and beverages is vital in terms of nutritional value and health of the consumer. It assists in tracking the degradation all through the processing and storage, which ensures the stability of products and regulatory compliance (Hewson *et al.*, 2018). The results of ANOVA of vitamin C in citrus juice and moringa extract-based fizzy drinks, as represented in graph 2 D, is very significant differences among treatments. The least value of 49.25 and the highest value of 81.91 are within the range of mean values (49.25-81.91) which have been reported by Barker *et al.* (2021).



Graph 2: Comparative means of Vitamin C, titratable acidity, and total soluble solids of citrus juice and Moringa extract-based fizzy drinks.

3.2.3. Phytochemical analysis

3.2.3.1. Total phenolic content (TPC)

Total phenolic content (TPC) represents the overall concentration of phenolic compounds, which are known for their antioxidant and health-promoting properties (Redondo *et al.*, 2018). ANOVA results for TPC in citrus juice and moringa extract-based fizzy drinks showed highly significant differences among treatments, with mean values ranging from 457.24 to 515.65. As showed in graph 3 A, Treatment T1 had the highest TPC (515.65), while T4 showed the lowest (457.24), aligning with previous findings by Vlădescu *et al.* (2021).

3.2.4. Determination of antioxidant activity

3.2.4.1 DPPH (2,2-diphenyl-1-picrylhydrazyl) assay

DPPH analysis is a common method for evaluating the antioxidant activity of samples, where antioxidants reduce the purple DPPH radical to a yellow-colored compound, measurable spectrophotometrically (Redondo *et al.*, 2018). ANOVA results for DPPH scavenging activity in citrus juice and moringa extract-based fizzy drinks showed highly significant differences among treatments, with mean values ranging from 75.23 to 84.58. As showed in graph 3 B, Treatment T4 had the highest DPPH value (84.58), while T0 showed the lowest (75.23), consistent with the findings of Vlădescu *et al.* (2021).

3.2.5. Color analysis

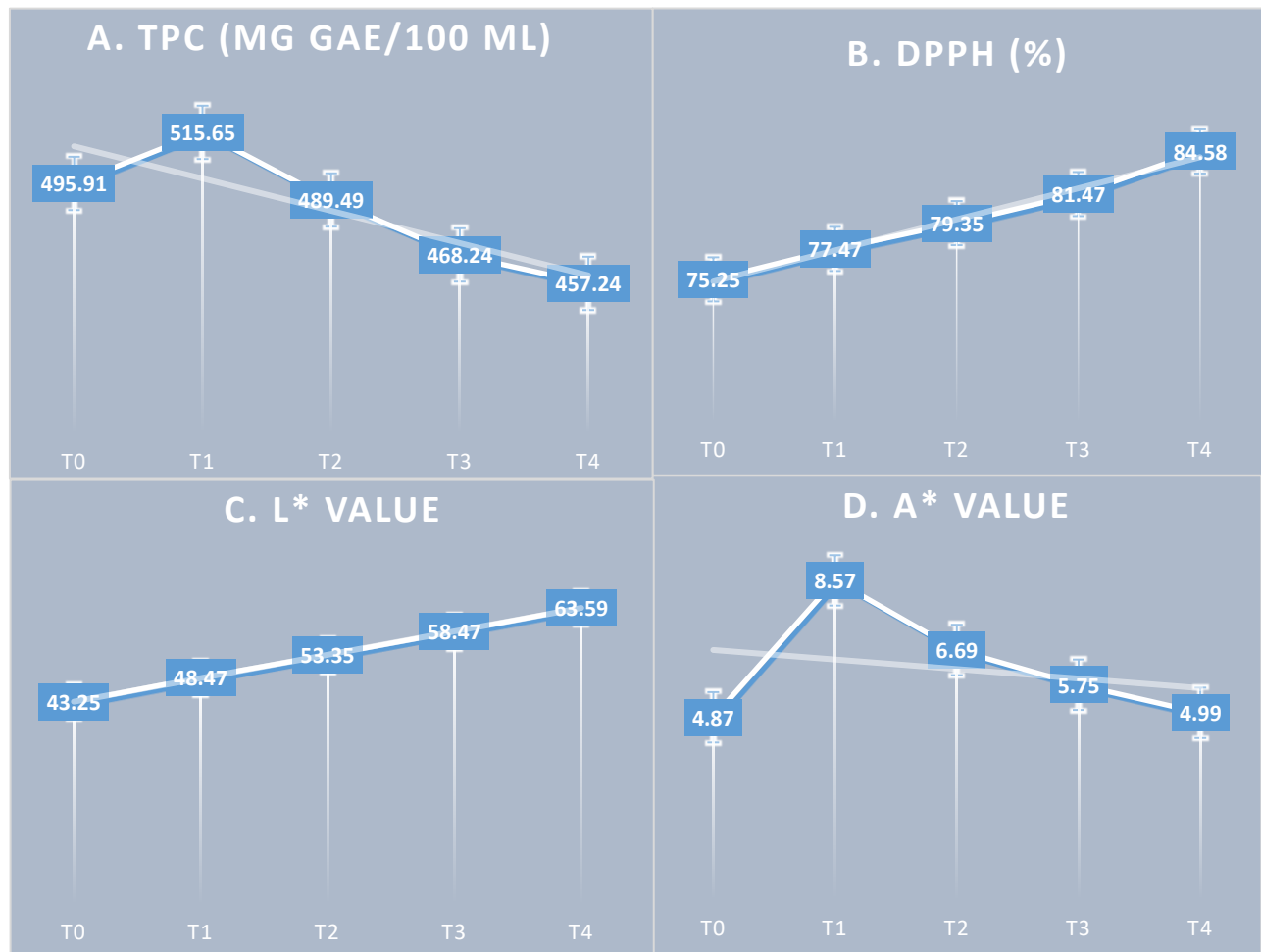
Color analysis quantifies the visual appearance of a sample using a colorimeter, which measures light intensity and hue through reflected or transmitted light. It uses filters and photodetectors to produce numerical color values that help assess product quality and consistency (Barker *et al.*, 2021).

3.2.5.1. L* value

L* value shows the lightness of sample. Analysis of variance for L* values of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 43.25 to 63.59. As showed in graph 3 C, in which five treatments (T₀, T₁, T₂, T₃, T₄) were considered, with treatment T₄ exhibiting the highest mean value of L* of 63.59, while T₀ treatment showed the lowest mean value of 43.25. The current study corroborated this trend, consistent with the findings of previous research represented (Barker *et al.*, 2021).

3.2.5.2. a* value

The a^* value shows the redness of sample. Analysis of variance for a^* values of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 4.87 to 8.56. As showed in graph 3 D, in which five treatments (T_0 , T_1 , T_2 , T_3 , T_4) were considered, with treatment T_1 exhibiting the highest mean value of a^* of 8.56, while T_0 treatment showed the lowest mean value of 4.87. The current study corroborated this trend, consistent with the findings of previous research represented (Barker *et al.*, 2021).



Graph 3: Comparative means of a , L, DPPH, and TPC values of citrus juice and Moringa extract-based fizzy drinks.

3.2.5.b. b^* value

The b^* value shows the yellowness of the food sample. Analysis of variance for b^* values of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 3.36 to 6.54. As showed in graph 4 A, in which five treatments (T_0 , T_1 , T_2 , T_3 , T_4) were considered, with treatment T_0 exhibiting the highest mean value of b^* of 6.54, while T_1 treatment showed the lowest mean value of 3.36. This trend is supported by the results of the present work which aligns with the results of prior studies that signify the same (Barker et al., 2021).

3.2.6. Sensory evaluation

A panel of trained experts was used to provide sensory analysis of citrus and moringa extract based fizzy drink. The parameters used to assess the product were considered based on the following key parameters such as color, taste, aroma, mouth feel, and overall acceptability using a 9-point hedonic scale. Each of the panelists was given some samples of the drink to analyze following the given sensory parameters before the assessment. At the evaluation, the panelists had been requested to evaluate the color of the drink based on the color, intensity and transparency. Taste analysis was done based on the flavor profile, sweetness, acidity, bitterness, and any other taste attributes in the drink (Aghajanzadeh *et al.*, 2023).

3.2.6.1. Color

Color is an important aspect of the sensory perception and it can be used to determine how we see and perceive the food product that has been offered to us. ANOVA of color values of fizzy drink made of citrus juice and moringa extract. Findings of ANOVA showed that the treatments were very significant. The average of treatments was between 7.60 and 9.54. As the graph 4 B below, which took into account five treatments (T_0 , T_1 , T_2 , T_3 , T_4), and T_2 treatment had the largest mean value of color of 9.54, T_5 treatment, on the other hand, had the lowest mean value of color of 7.60. The present research supported this trend, in line with the available results of previous studies represented (Aghajanzadeh *et al.*, 2023).

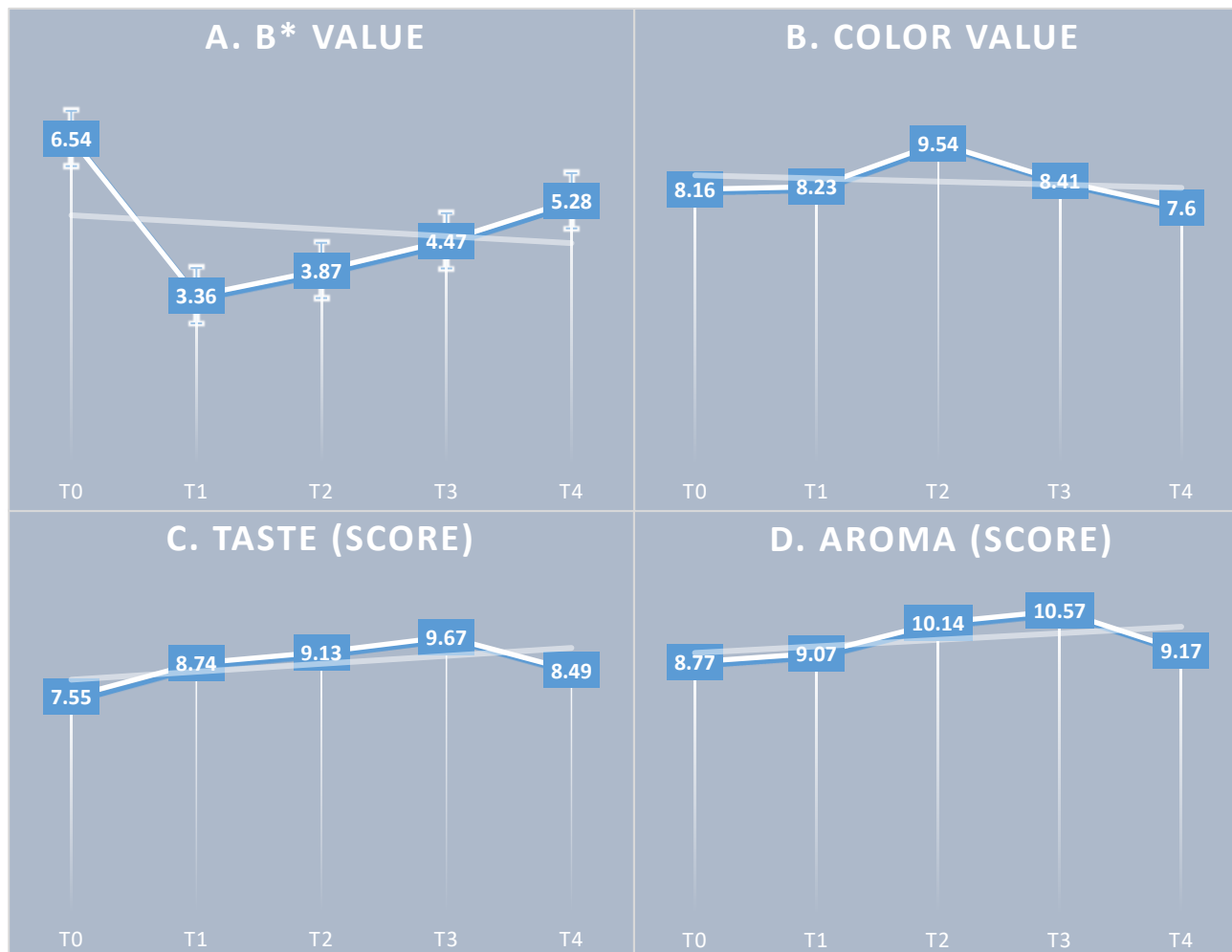
3.2.6.2. Taste

One of the main senses is taste or gustation, which is known together with sight, hearing, touch, and smell. It is a very important part of sense perception and it is the one that detects the chemical substances in food and drinks. Comparison of the taste values of citrus juice and fizzy drink made using the moringa extract. The findings derived in ANOVA revealed that treatments were very significant. The mean values of treatments was between 7.55 and 9.67. Indeed, as

illustrated in graph 4 C, whereby Five treatments (T₀, T₁, T₂, T₃, T₄) were taken into account, with T₃ treatment having the highest mean value of taste of 9.67, where T₀ treatment had the lowest mean value of 7.55. This tendency was supported by the existing study, which is in line with the results of the previous research that the current study represented (Aghajanzadeh *et al.*, 2023).

4.2.6.3. Aroma

Our sense of smell helps us navigate and identify our surroundings. It allows us to detect potential dangers such as spoiled food, fire, or hazardous chemicals. Analysis of variance for aroma values of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 8.77 to 10.67. As showed in graph 4 D, in which five treatments (T₀, T₁, T₂, T₃, T₄) were considered, with treatment T₃ exhibiting the highest mean value of aroma of 10.67, while T₀ treatment showed the lowest mean value of 8.77. The current study corroborated this trend, consistent with the findings of previous research represented (Aghajanzadeh *et al.*, 2023).



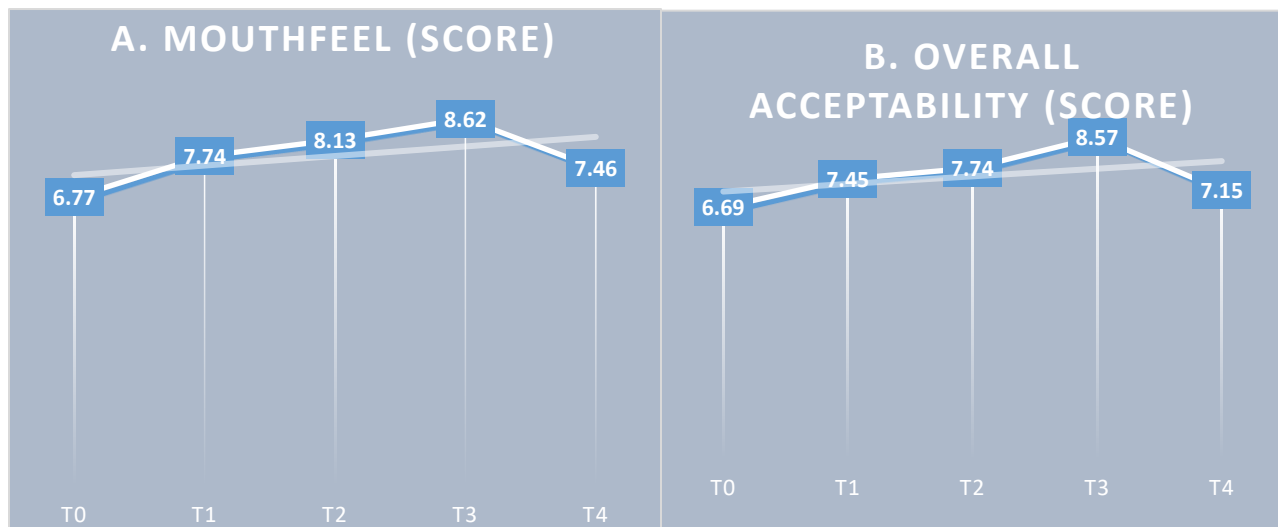
Graph 4: Comparative means of b, color, taste, and aroma values of citrus juice and Moringa extract-based fizzy drinks.

3.2.6.4. Mouthfeel

Analysis of variance for mouthfeel values of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 6.77 to 8.62. As showed in graph 5 A, in which five treatments (T₀, T₁, T₂, T₃, T₄) were considered, with treatment T₃ exhibiting the highest mean value of mouthfeel of 8.62, while T₀ treatment showed the lowest mean value of mouthfeel of 6.77. The current study corroborated this trend, consistent with the findings of previous research represented (Aghajanzadeh *et al.*, 2023).

3.2.6.5. Overall acceptability

Analysis of variance for overall acceptability of citrus juice and moringa extract-based fizzy drink. Results obtained through ANOVA indicated that treatments were highly significant. The mean values of treatments, ranging from 6.59 to 8.57. As showed in graph 5 B, in which five treatments (T₀, T₁, T₂, T₃, T₄) were considered, with treatment T₃ exhibiting the highest mean value of overall acceptability of 8.57, while T₀ treatment showed the lowest mean value of acceptability of 6.59. The study was corroborated the trend, consistent with the findings of previous research represented (Aghajanzadeh *et al.*, 2023).



4. SUMMARY

The study was conducted at the National Institute of Food Science and Technology, University of Agriculture, Faisalabad, focused on developing and analyzing a citrus juice and moringa extract-based fizzy drink. Carbonated beverages are globally popular due to their refreshing nature, despite sometimes causing sensations like oral soreness due to carbonic acid formation. Fruits, especially citrus varieties, play a vital role in promoting health by providing essential nutrients such as vitamin C and potassium, which strengthen the immune system and help prevent chronic diseases. The citrus fruits, which are cultivated in more than 114 countries, are considered to be antioxidant, anti-inflammatory and anti-cancer but the moringa (*Moringa oleifera*) is touted as a miracle plant because of its outstanding nutritional and medicinal value. Moringa contains high levels of proteins, vitamins, minerals, and antioxidants and can be used as an immune enhancer, oxidative stress reducer, as well as providing therapeutic benefits against things like anemia, high blood

pressure, and infections. The fresh citrus juice and the moringa leaf extract were prepared in the laboratory in the research manually. The extract was obtained by washing, extracting and filtering citrus fruits and boiling and filtering moringa leaves. All these were mixed with sugar syrup, preservatives and colors, carbonated and put in dark glass bottles. The last drink was subjected to elaborate physicochemical and sensory tests in order to determine the quality of the drink. The parameters analyzed were Total Soluble Solids (TSS), pH, titratable acidity, vitamin C, total phenolic content (TPC), antioxidant activity (DPPH assay), color, and sensory parameters. The findings indicated that there was a great disparity between treatments (T0 -T4). TSS rose by a small percentage of 13.03 to 13.72 but pH declined by 3.05 to 2.73 indicating that moringa becomes acidic as it is subjected to a greater concentration in the solution. Titratable acidity improved to 1.62 and vitamin C increased amazingly to 81.91 thus showing improved nutritional value. TPC reduced slightly between 515.65 and 457.24 and the antioxidant activity (DPPH) enhanced between 75.25 and 84.58 with good antioxidant potential. The color analysis showed a lighter shade (L63.53 with an increase of 43.25) with some fluctuations in a* and b* parameters. Sensory analysis including color, taste, flavor, aroma, mouthfeel and acceptability revealed the treatment T3 (15 percent moringa extract and 85 percent orange juice) to have the most preferred by the consumers. The paper has been able to develop a healthy and attractive carbonated beverage with citrus juice and moringa extract. The combination did not only increase the antioxidant and vitamin C levels in the beverage but also ensured the desirable sensory properties. The conclusions imply that the selected functional beverages may be used as healthier options to standard soft drinks to facilitate nutrition and consumer satisfaction.

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