Scientific Research Publishing

Food and Nutrition Sciences, 2023, 14, 287-299
https://www.scirp.org/journal/fns
ISSN Online: 2157-9458
ISSN Print: 2157-944X

Nutritional, Textural, Sensory Properties and Storage Stability Evaluation of Newly Formulated Strawberry Bar

Nargis Akter[1,2], Md. Sajib Al Reza[1*], Md. Esrafil[1*], Md. Al Amin[3], Sonyia Akter[1], Neaz Morshed Reza[1], Md. Nazmul Huda Nasim[1], Pratima Roy Dina[1]

[1]Department of Food Technology and Nutritional Science, Faculty of Life Science, Mawlana Bhashani Science and Technology University, Santosh, Bangladesh
[2]Department of Biological Sciences, Graduate School of Science, Tokyo Metropolitan University, Hachioji, Japan
[3]Department of Chemistry and Biochemistry, The University of Texas at Arlington, Arlington, USA
Email: *sajib.ftns2010@gmail.com, *esrafilmbstu@gmail.com

How to cite this paper: Akter, N., Reza, M.S.A., Esrafil, M., Amin, M.A., Akter, S., Reza, N.M., Nasim, M.N.H. and Dina, P.R. (2023) Nutritional, Textural, Sensory Properties and Storage Stability Evaluation of Newly Formulated Strawberry Bar. *Food and Nutrition Sciences*, **14**, 287-299.
https://doi.org/10.4236/fns.2023.144019

Received: January 15, 2023
Accepted: April 9, 2023
Published: April 12, 2023

Abstract

An analytical study was conducted to develop a strawberry bar and analysis of the nutritional quality and storage stability of a newly formulated strawberry bar. In proximate analysis moisture, ash, pH, acidity, vitamin C, total phenolic content, and antioxidant of strawberry pulp were found 82%, 0.5%, 2.57, 1.38%, 49 mg/100g, 0.33%, 75.17% whereas, in the strawberry bar, it was found 18%, 0.71%, 2.10, 1.10%, 22 mg/100g, 0.14%, 56.13% respectively. For textural properties analysis, the textural profile of the strawberry bar such as hardness, factorability, viscosity, cohesiveness, adhesiveness, springiness, gumminess, chewiness, probe diameter, threshold, filtering range of strawberry bar was found 5.538×10^4 N/m, 0.000 N/m^2, 1.687×10^4 N/m^2, 0.6636, 2.908×10^3 J/m^3, 0.8664, 3.675×10^4 N/m^2, 3.184×10^4 N/m^2, 20.000 mm, 5 N, 0.4 N respectively whereas the maximum level was 17.4 N at 29.628 seconds and the minimum level was −5.3 N at 30.166 seconds. The sensory evaluation of the strawberry bar was conducted based on nine-point hedonic scales. The sensory evaluation results indicated that the appearance of the strawberry bar was liked very much and the taste, texture, color, aroma, and overall acceptability of the strawberry bar were liked moderately by panelists. In microbiological analysis, the Total Viable Count (TVC) and Total Coliform Count (TCC) of the strawberry bar were found safe levels for up to third days. But on the sixth day, the TCC of the strawberry bar was not found and the TVC of the strawberry bar was found 17×10^4 cfu/g respectively which is higher than the permitted value (Gulf Standard: 10^5 cfu/g). From the microbial point of view, the newly formulated strawberry bar was safe to consume for up to 3 days but not for 6 days.

Keywords

Strawberry Pulp, Strawberry Bar, Antioxidant, Sensory Evaluation, Texture, Gallic Acid

1. Introduction

Strawberry is a highly-priced fruit all over the world. Over six hundred various occurred which differ in taste, texture, and size. However, the "garden" diversities of strawberries with which most of us are familiar today are known as *Fragaria ananassa*. *Fragarin chiloensis* and *Fragarin verginiana* were the ancestors of all the present strawberry cultivars [1]. Mature fruit must be consumed early after winning. Fruit, while the transfer to the market long as there are prospects for the deterioration of fruit during distribution. Strawberries may also be fermented into wine or liqueur (such as Italian fragoli) [2]. Strawberries also contain phenols and flavonoids as compared to other berry fruit. According to Food and Agriculture Organization (FAO), the world production of strawberries has exceeded 4 million tons, of which the United States funds 28 percent [2]. The eatable portion of strawberry is the succulent thalamus of the flower which includes a receptacle with numerous achenes. Strawberry fruits are not only gorgeous for their delicious taste and fresh aroma, but also for their nutritional values and antioxidant properties [3]. This is partly allied to the presence of health-promoting ingredients in plant products. Their benefits are exerted by utilizing various complementary mechanisms that involve several bioactive compounds such as tannins, flavonoids, and phenolic acids [4]. Strawberries are known to be a rich source of polyphenols, such as Ellagitannins (ETs) [5]. The qualitative and quantitative structure of ETs in strawberries has not been thoroughly set to date. Ellagitannins and their metabolites hold some health-promoting qualities, including antiviral, antibacterial, antioxidant, antimutagenic, and anticarcinogenic properties [6]. Polyphenols play an important role as signaling molecules involved in the accent of signal pathways, thereby affecting cellular function and gene expression, in addition to their direct properties on the digestive system [7]. However, the *Fragaria xananassa* hybrid cross that makes up most of the strawberry farming around the world is not breaking through in Khagrachhari just yet. Aromas have huge, firm fruit that has great flavor, good color, and a bright sheen [8]. One serving of strawberries covers approximately 33 Kcal, is an excellent source of vitamin C, a good source of manganese, and provides several other vitamins and dietary fiber minerals in lesser quantities [9].

Strawberry is one of the most important commercial fruit crops and a rich source of nutrients such as antioxidants, vitamins, dietary fiber, and other different types of nutritive elements. Strawberries can not be stored for a long time due to being highly perishable [10]. In this regard, an analytical study was conducted to develop a strawberry bar and analysis of the nutritional quality, textural

and sensory properties, and storage stability of the newly formulated strawberry bar.

2. Materials and Methods

An analytical study was conducted based on the development and evaluation of the nutritional quality and storage stability of the strawberry bar.

2.1. Raw Materials and Equipment

For the development of the strawberry bar strawberry was collected from the Dhaka supermarket and other ingredients were collected from the local market. Various types of chemicals were used: Hydrochloric acid (MercKGaA), Sodium Hydroxide, Sulfuric Acid, Petroleum ether (APS F), Petroleum benzene (Merck), Alcohol (Merck), Diethyl ether (Merck), Ether, Warm Distilled water. The equipment used for this experiment: Beaker, weighing balance (WTB 200), Spatula, Plate, Bowl, Glass rod, Electric Heater, Grinder, Crucible, Conical flask, Thimbol, Condenser, Separatory Funnel., Pipette, tube, desiccator, filter paper (double rings 102), oven (JSON-050), soxhlet apparatus (LASSCO), OVEN (TOSHIN RGT-MW28L2), Muffle furnace (JSMF-45T), Scissors.

2.2. Processing of Strawberry Pulp and Corn Flour

The fresh mature free from objectionable strawberry was poured into cold water and washes the whole strawberry and remove from the budding fruit. After removing water from the fruits, cut into pieces with a stainless steel knife. Combine strawberries and water in a deep pan and boil for 7 to 8 minutes. Cool and blend in a mixer till smooth. The blended strawberry pulp was kept in a deep container and preserved in a refrigerator at −18˚C. Corn was collected from the local market. Only the fine and healthy corn was selected from the sample and washed in distilled water and the washed water was drained out. Then washed wheat was dried in an oven drier for 45 minutes at 105˚C then it was dried in a vacuum drier. After drying it was ground to make a fine powder.

2.3. Processing of China Grass

China grass was cut into small pieces. Small pieces of china grass are taken into a beaker and added weighing amount of water. Then the beaker is placed into the hot plate and heated for 15 minutes for melting.

2.4. Processing of Strawberry Bar

Strawberry pulp is weighed and taken into a bowl. Total Soluble Solid (TSS) was measured by hand refractometer and pH is measured by pH meter. The strawberry pulp was then mixed with the weighted amount of sugar salt and pectin and water was added to the pulp. Properly mixed the pulp. The mixed pulp was then placed into the cooking chamber and the pulp was heated in a slow process. The pulp was heated at 50˚C - 60˚C for 5 minutes and a weighted amount of

corn flour was added to the pulp. The mixture was stirred gently during heating. The TSS of the product was measured by Adde Refractometer. When the mixed TSS reached 65˚Brix China grass was added and after 5 minutes citric acid was added to the mixture. The total mixture was boiled for about 20 minutes. After boiling the mixture, the mixture was kept on pour on steel trays with parchment paper for drying. Then, dried in a hot air oven drier at 75˚C for 10 hours. The product is kept for cooling until reaches room temperature. Cut the product into pieces at 2.5 × 5.0 cm. Then the product is stored in a dry and cool place.

2.5. Proximate Analysis

2.5.1. Determination of Moisture Content

Moisture is always present in food shifts. Estimation of moisture is done simply by heating at 105˚C for 3 - 4 hours in the oven and is cooled in a desiccator to absorb moisture. The process is repeated several times until the constant weight is shown by the sample.

2.5.2. Determination of Ash Content

About 5 - 10 g of the sample is weighed accurately into a porcelain previously pre-weighed crucible. The sample was burned at 600˚C so that all the ingredients should burn except the minerals.

2.5.3. Determination of Fat Percentage

The total fat content of food is commonly determined by organic solvent extraction methods followed by Parvez *et al.* [11]. The accuracy of these methods greatly depends on the solubility of the lipids in the solvent used. The lipid content of food determined by extraction with one solvent may be quite different from the content determined with another solvent of different polarity.

2.5.4. Determination of Vitamin C

The amount of vitamin C in each sample was estimated using the standard method [12]. Chemical 2,6-dichlorophenolindophenol is reduced to a colourless form by ascorbic acid. The reaction is specific for ascorbic acid at pH 1 to 3.5. The dye is blue in an alkaline solution and red in acid. 10 ml of standard vitamin C solution is taken in a conical flask and titrated with the dye solution. Four to six grams of tuber dry powder are taken and homogenized well with 3% metaphosphoric acids and filtered through a double layer of muslin cloth. The filter was centrifuged at 3000 rpm for 10 minutes and the supernatant was titrated with 2,6-dichlorophenolindophenol solution. The amount of vitamin C present in the extract was determined by comparing it with the titration result of a standard vitamin C solution.

2.6. Estimation of pH

A Sension TM+ pH 31, pH meter is used for the determination of pH. After checking the pH meter and making sure the pH meter has worked well, the pH meter is set in a dry place. Then calibrate the meter containing a buffer solution

of pH 4, pH 7, and pH 10. Whenever readings are taken correctly, ensure that the meter is working correctly. After rinsing in distilled water, place in the sample solution to be tested, then take the reading correctly. All determinations were performed in triplicate.

2.7. Estimation of Titrable Acidity

Titration is a chemical process used in ascertaining the amount of constituent substance in a sample e.g. acids, by using a standard counter-active reagent, e.g. an alkali (NaOH). All determinations were performed in triplicate.

2.8. Determination of Total Phenolic Content (TPC)

TPC was measured following the method described by Mahmud *et al.* [13]. A standard Gallic acid curve was constructed by preparing the dilutions of (0.1, 0.5, 1.0, 2.5, and 5 mg/ml) in methanol from the standard solution of Gallic acid. 100 µl of each of these dilutions was mixed with 500 µl of water and then with 100 µl of Folin-Ciocalteu reagent and allowed to stand for 6 minutes. Then 1 ml of 7% sodium carbonate and 500 µl of distilled water were added to the reaction mixture. The absorbance was recorded after 90 minutes at 760 nm spectrometrically. The same procedure was repeated with the pure hot water extracts of all three formulations. The total phenolic content of the extract was calculated as Gallic acid equivalents (mg GAE/g). All the experiments were performed in triplicate.

Table 1 indicates the mean absorbance of various concentrations of Gallic acid and Figure 1 indicates that the standard Gallic acid curve and regression equation were used to calculate the total phenolic content of the extracts.

2.9. Microbial Analysis

Total Viable Count (TVC), Total Coliform Count (TCC), and microbiological tests were conducted for the samples. For the total viable count of the strawberry bar, we used Nutrient agar media. Estimation of the bacterial load was performed by the previous method [14]. For the total coliform count of the Strawberry bar, we used MacConkey Agar media. Estimation of the total coliform count was performed by standard methods. Isolates were then identified according to Bergey's manual of determinative bacteriology and the manual for the identification of medical bacteria.

Table 1. The absorbance of gallic acid (a standard phenolic compound) at 765 nm.

Concentration (mg/ml)	Avg. absorbance at 765 nm
0.1	0.397
0.5	1.763
1	3.207
2.5	4.016
5.0	4.115

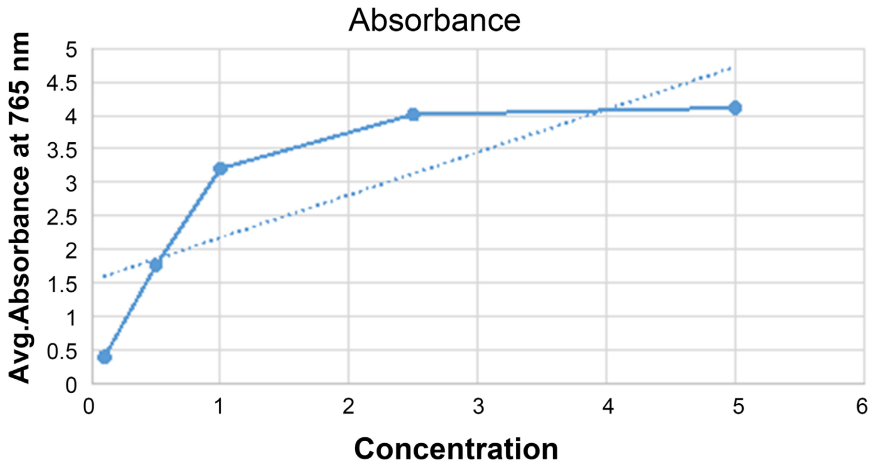

Figure 1. Gallic acid calibration curve (a standard phenolic compound).

2.9.1. Preparation of Sample

One gram tomato sample was diluted with 9 ml of sterile buffered peptone water and mixed well (10^{-1} dilution). Serial dilutions were prepared and the spread plate technique was used on solid media. Serial dilutions of samples were made up to 10^{3} with sterile buffered peptone water. 0.1 ml of each dilution was evenly spread on the Macconkey agar medium and incubated. Plates were screened for the presence of discrete colonies after the incubation period and the total numbers of coliform were estimated as colony-forming units per gram (cfu/g).

2.9.2. Incubation and Identification of Coliform

After the solidification of agar, the plates were inverted and placed in an incubator operated at 37˚C for 24 - 48 hours. After incubation, the plates were taken out from the incubator and dark red colonies were counted with at least a diameter of 0.5 mm. The number of colonies was multiplied by the dilution and the count of coliform organisms per gram of sample was recorded and selected based on color and characteristics.

2.10. Organoleptic or Sensory Analysis

Various methods have been used to measure food preferences the most common method is a questionnaire generated of foods or food categories in which a hedonic scale is used to rate the degree of liking, a hedonic scale in an organoleptic quality rating scale where the judges express his degree of likings. A 9-point balanced scale was used. Overall tests were conducted by using 9 points hedonic scale [12]. This test had been used by experts and panelists, but it was felt to be more effectively applied. The 15 untrained panelists were teachers and students of the food technology and nutritional science department of MBSTU, Bangladesh panel participated in this organoleptic test. In hedonic scale response, i.e state of like and dislike are measured on a rating scale. The essential features of the hedonic scale were its assumption of a continuum of preferences and the direct way it defined the categories of response in terms of like and dislikes points given by the sensory panel based on the likings and disliking were analyzed.

2.11. Determination of Textural Properties of the Strawberry Bar

The textural profile analysis of strawberry bar samples (2 × 2 × 2 cm) from the midsection of the bar was performed using a texture analyzer (TA-XT Plus, Stable Micro System Ltd, Surrey, UK) with a 36 mm diameter cylindrical probe, 50% compressing, and a test speed of 1.0 mm/sec. The crust of the bar sample was removed in bar texture determination. A double cycle was programmed and the texture profile was determined using Texture Expert 1.05 software (Stable Microsystems). Another parameter was defined as: pre-test speed 2.0 mm/sec, post-test speed 2.0 mm/sec, and trigger force 5 g. the texture parameter recorded were the hardness, fracturability, viscosity, cohesiveness, adhesiveness, springiness, gumminess, chewiness, probe diameter, threshold, and filtering range of the Strawberry bar.

2.12. Statistical Analysis

The data were analyzed using SPSS for windows V.20 and presented as Mean ± SD (standard deviation). Each value was derived from the average of three observations and the mean value was reported.

3. Results

The study was conducted to develop and evaluate of nutritional quality, texture, sensory, and shelf life of the strawberry bar. The findings of the study were described in the following tables and figures.

3.1. Compositional Value of Strawberry Pulp

The extracted pulp was processed for preparing the strawberry bar and properly packed in appropriate containers/jars. Then the sample was kept for microbiological and shelf-life studies. The composition of the fresh strawberry pulps analysis was done in the following components such as (moisture, ash, pH, acidity, vitamin C, antioxidant, and total phenolic content).

Table 2 represents the compositional analysis of fresh strawberry pulp. In the present study, the amount of moisture, ash, pH, acidity, vitamin C, and antioxidant of strawberry pulp were about 82%, 0.5%, 2.57, 1.38, 49 mg/100g, 3.27, and 75.17% respectively.

Table 2. Composition of fresh strawberry pulp.

Component	Amount
Moisture	82%
Ash	0.5%
pH	2.57
Acidity	1.38%
Vitamin C	49 mg/100gm
Antioxidant	75.17%
Total phenolic content	0.33

Figure 2 shows that the amount of moisture, ash, fat, antioxidant, and acidity in the strawberry bar was about 18%, 0.71%, 6.31%, 56.13%, and 1.10% respectively.

3.2. Microbial Analysis of Strawberry Bar

From Figure 3, we can see that the TVC count after 1st day of the strawberry bar in 3rd diluted sample was about 3×10^4 cfu/g which was satisfactory. After 3rd day the total bacterial load was found in the strawberry bar at about 4×10^4 cfu/g which was marginal. After 6th day the maximum bacterial load found in the strawberry bar was 17×10^4 cfu/g where an acceptable level up to 1×10^5 cfu/g by Gulf Standard (Table 3).

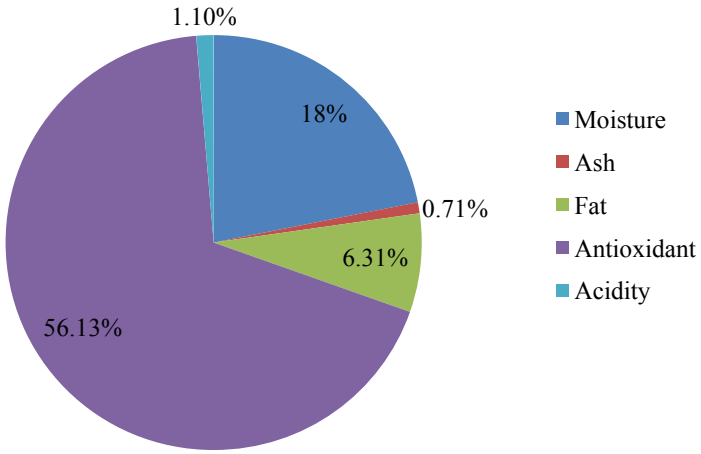

Figure 2. Proximate composition of the strawberry bar.

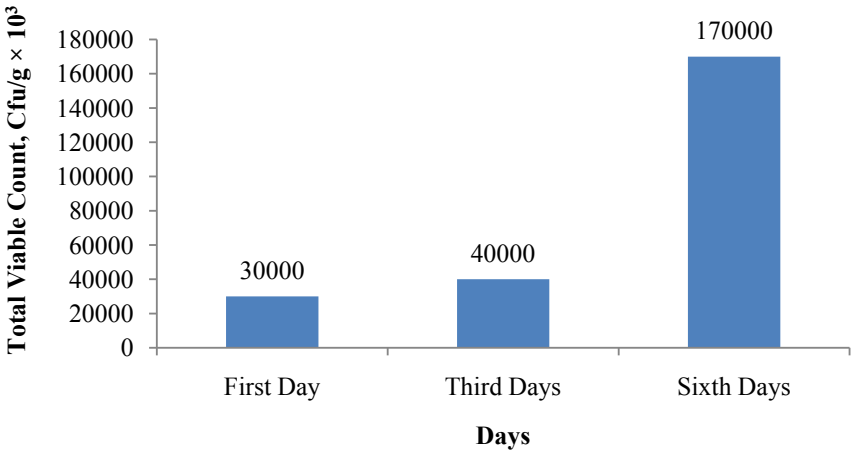

Figure 3. Total viable count of strawberry bar.

Table 3. Gulf standard for microbial count.

Parameter	Total viable count	Total coli form count
Maximum count anticipated	10^4	<10
Maximum count permitted	10^5	<100

Table 4 indicates the TCC of the Strawberry bar on the 1st, 3rd, and 6th days. The total coliform count of the strawberry bar after the 1st, 3rd day and 6th days was nil.

3.3. Sensory Evaluation of Strawberry Bar

The acceptability of the strawberry bar was evaluated by the Hedonic rating test. About 20 panelists were selected from the student, teachers, and employees of the Department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Tangail. The panelists were requested to assign an appropriate score for the general appearance, color, flavor, texture, and overall acceptability of the strawberry bar. The amount of total volatile compounds, total acidity, total sugar content (degrees Brix), and fruit firmness were used to characterize the degree of color, flavor, and texture. Test penal results are shown in Figure 4.

Figure 4 represents the sensory evaluation of the strawberry bar based on the Nine Hedonic Scale where the appearance was liked very much and taste, texture, color, aroma, and overall acceptability were liked moderately by panelists.

3.4. Textural Analysis

Table 5 represents the texture profile of the strawberry bar where hardness, fracturability, viscosity, cohesiveness, adhesiveness, springiness, gumminess, chewiness, probe diameter, threshold, and filtering range strawberry bar were about 5.538×10^4 N/m^2, 0.000 N/m^2, 1.687×10^4 N/m^2, 0.6636, 2.908×10^3 J/m^3, 0.8664,

Table 4. Total Coliform Count (TCC) of strawberry bar.

Samples	Days		
Strawberry bar	1st Day	3rd Day	6th Day
Total coliform count (cfu/g)	Nil	Nil	Nil

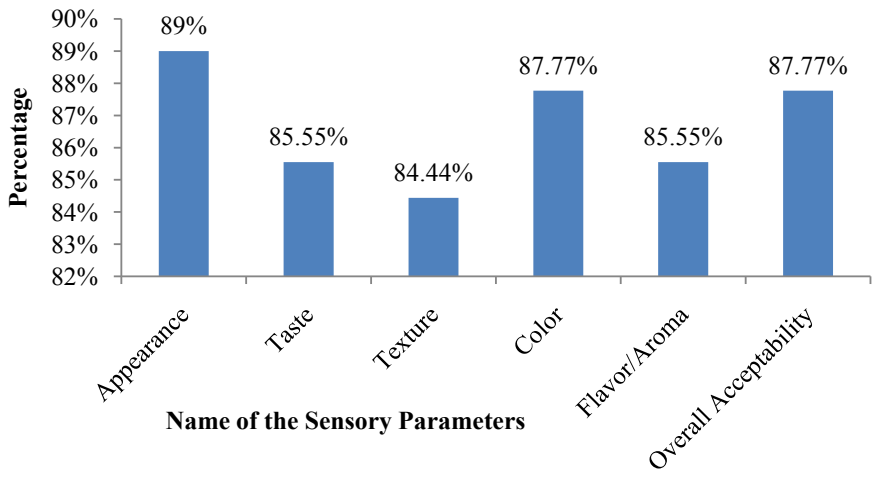

Figure 4. Sensory evaluation of prepared strawberry bar.

Table 5. Texture profile of the strawberry bar.

Parameter	Texture Profile
Hardness	5.538×10^4 N/m^2
Fracturability	0.000 N/m^2
Viscosity	1.687×10^4 N/m^2
Cohesiveness	0.6636
Adhesiveness	2.908×10^3 j/m^3
Springiness	0.8664
Gumminess	3.675×10^4 N/m^2
Chewiness	3.184×10^4 N/m^2
Probe diameter	20.000 mm
Threshold	5 N
Filtering range	0.4 N

3.675×10^4 N/m^2, 3.184×10^4 N/m, 20.000 mm, 5 N, 0.4 N respectively. Whereas the maximum level was 17.4 N at 29.628 seconds and the minimum level was −5.3 N at 30.166 seconds.

4. Discussions

An analytical study was conducted to develop a strawberry bar and analysis of the nutritional quality and storage stability of the newly formulated strawberry bar. In proximate analysis moisture, ash, pH, acidity, vitamin C, total phenolic content, and antioxidant of strawberry pulp were found 82%, 0.5%, 2.57, 1.38%, 49 mg/100g, 0.33, 75.17% whereas, in the strawberry bar, it was found 18%, 0.71%, 2.10, 1.10%, 22 mg, 6.31%, 0.14, 56.13% respectively. The two main acid content of the strawberry are malic acid and citric acid, which decrease gradually over the storage period. This occurs as a result of CO_2 dissolving in water on the fruit, which produces carbonic acid and acidifies the fruit content. Acidity decreased throughout time, depending on how long it was stored. As the main substrates of respiratory metabolism, sugars, and acids are depleted causing corresponding changes in Titrable Acidity (TA) during storage. The pH of strawberries may be increased slightly during storage, corresponding to a decrease in TA. Caner [15] found that, after 12 days of storage, pH values of strawberries were significantly higher than 5 days. For textural properties analysis, the textural profile of strawberry bar such as Hardness, Fracturability, Viscosity, Cohesiveness, Adhesiveness, Springiness, Gumminess, Chewiness, Probe Diameter, Threshold, Filtering Range of Strawberry bar were found 5.538×10^4 N/m, 0.000 N/m^2, 1.687×104 N/m^2, 0.6636, 2.908×103 J/m^3, 0.8664, 3.675×10^4 N/m^2, 3.184×10^4 N/m^2, 20.000 mm, 5 N, 0.4 N respectively whereas the maximum level was 17.4 N at 29.628 second and minimum level was −5.3 N at 30.166 seconds. The sensory evaluation of the strawberry bar was conducted based on Nine Hedonic Scale. From the sensory evaluation, we found that the appearance

of the strawberry bar was liked very much and the taste, texture, color, aroma, and overall acceptability of the strawberry bar were liked moderately by panelists. The flavor of the strawberry bar may change with the storage time due to the changes in pH of the bar. The pH of the strawberry product may increase with the increase in the duration of the storage. Changes in pH influence the flavor of the product [15]. The use of various modified atmospheric packaging such as changes in gas compositions, including high oxygen, CO_2, and N_2 could be a good alternative to maintain fresh strawberry and strawberry products like bar nutritional and sensory qualities.

In microbiological analysis, the Total Viable Count (TVC) and Total Coliform Count (TCC) of the strawberry bar were found safe levels for up to third days. But on the sixth day, the TCC of the strawberry bar was not found and the TVC of the strawberry bar was found 17×10^4 cfu/g respectively which is higher than the permitted value (Gulf Standard 10^5 cfu/g). From the microbial point of view, the newly formulated strawberry bar was safe to consume for up to 3 days but not for 6 days.

5. Conclusion

Ready-to-eat fresh fruit has become an important area of potential growth presumably due, in part, to their freshness, low caloric content, and commodity to be used in the active promotion of fruits and vegetables as basic components of a healthy diet. The shelf life of fresh strawberries stored at low temperatures is usually less than 5 days, and this period is reduced when the product is minimally processed. Strawberry is one of the most important commercial fruit crops in the world and the new arrival fruit item in the aspect of Bangladesh. In this regard, an analytical study was conducted to develop a strawberry bar and analysis of the nutritional quality and storage stability of the newly formulated strawberry bar. In the proximate analysis of moisture, ash, pH, acidity, and vitamin C, from the microbial point of view, the newly formulated strawberry bar was safe to consume for up to three days but not for six days.

Acknowledgements

The authors thank themselves for conducting the research activity and preparing the manuscript with patience. The authors are highly grateful to the Department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh for providing the laboratory amenities.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] John, G.H., Kohavi, R. and Pfleger, K. (1994) Irrelevant Features and the Subset Se-

lection Problem. *Proceedings of the Eleventh International Conference*, Rutgers University, New Brunswick, 10-13 July 1994, 121-129.
https://doi.org/10.1016/B978-1-55860-335-6.50023-4

[2] Matsuo, H., Chiba, T., Nagamori, S., Nakayama, A., Domoto, H., Phetdee, K., *et al.* (2008) Mutations in Glucose Transporter 9 Gene SLC2A9 Cause Renal Hypouricemia. *The American Journal of Human Genetics*, **83**, 744-751.
https://doi.org/10.1016/j.ajhg.2008.11.001

[3] Giampieri, F., Tulipani, S., Alvarez-Suarez, J.M., Quiles, J.L., Mezzetti, B. and Battino, M. (2012) The Strawberry: Composition, Nutritional Quality and Impact on Human Health. *Nutrition*, **28**, 9-19. https://doi.org/10.1016/j.nut.2011.08.009

[4] Seeram, N.P., Lee, R., Scheuller, S. and Heber, D. (2006) Identification of Phenolic compounds in Strawberries by Liquid Chromatography Electrospray Ionization Mass Spectroscopy. *Food Chemistry*, **97**, 1-11.
https://doi.org/10.1016/j.foodchem.2005.02.047

[5] Sójka, M. and Król, B. (2009) Composition of Industrial Seedless Black Currant Pomace. *European Food Research and Technology*, **228**, 597-605.
https://doi.org/10.1007/s00217-008-0968-x

[6] Ishimoto, T., Nagano, O., Yae, T., Tamada, M., Motohara, T., Oshima, H., *et al.* (2011) CD44 Variant Regulates Redox Status in Cancer Cells by Stabilizing the xCT Subunit of System xc^- and Thereby Promotes Tumor Growth. *Cancer Cell*, **19**, 387-400.
https://doi.org/10.1016/j.ccr.2011.01.038

[7] Bullon, P., Morillo, J.M., Ramirez-Tortosa, M.C., Quiles, J.L., Newman, H.N. and Battino, M. (2009) Metabolic Syndrome and Periodontitis: Is Oxidative Stress a Common Link? *Journal of Dental Research*, **88**, 503-518.
https://doi.org/10.1177/0022034509337479

[8] Sperrin, M., Marshall, A.D., Higgins, V., Buchan, I.E. and Renehan, A.G. (2014) Slowing Down of Adult Body Mass Index Trend Increases in England: A Latent Class Analysis of Cross-Sectional Surveys (1992-2010). *International Journal of Obesity*, **38**, 818-824. https://doi.org/10.1038/ijo.2013.161

[9] Alvarez-Suarez, J.M., Giampieri, F. and Battino, M. (2013) Honey as a Source of Dietary Antioxidants: Structures, Bioavailability and Evidence of Protective Effects against Human Chronic Diseases. *Current Medicinal Chemistry*, **20**, 621-638.
https://doi.org/10.2174/092986713804999358

[10] Al-Khalifa, A.S. and Al-Arify, I.A. (1999) Physicochemical Characteristics and Pollen Spectrum of Some Saudi Honeys. *Food Chemistry*, **67**, 21-25.
https://doi.org/10.1016/S0308-8146(99)00096-5

[11] Parvez, M.S., Jashin, N., Yesmin, M.T., Reza, M.S.A. and Akter, N. (2020) Proximate, Phytochemical and Antioxidant Activity of Amla Powder and Amla Candy. *Journal of Environmental Science and Natural Resources*, **13**, 82-86.
https://doi.org/10.3329/jesnr.v13i1-2.60693

[12] Haque, A.M., Akter, S., Safeuzzaman, S., Akter, N., Mondal, S.C., Sultana, M.M. and Reza, M.S.A. (2016) Effect of Cabbage Powder on Physico-Chemical Properties of Biscuits. *IOSR Journal of Environmental Science, Toxicology and Food Technology* (*IOSR-JESTFT*), **10**, 33-38.

[13] Mahmud, M.R., Hossain, M.S., Shuvo, S.D., Reza, M.S.A. and Abedin, M.Z. (2020) Potentiality of Banana and Pumpkin Fruits Residues as a Cheap Source of Valuable Nutrients. *Journal of Environmental Science and Natural Resources*, **13**, 87-93.
https://doi.org/10.3329/jesnr.v13i1-2.60695

[14] Khaleque, M.A., Sarkar, C.K., Islam, M.A., Kobid, M., Nabi, A.H.M., Islam, M.N.,

Reza, M.S.A. and Uddin, M.A. (2020) Microbiological Analysis of Water Used for Pharmaceutical Product Preparation. *IOSR Journal of Pharmacy and Biological Sciences* (*IOSR-JPBS*), **15**, 7-10

[15] Caner, C. and Addy, M.S. (2009) Maintaining Quality of Fresh Strawberries through Various Modified Atmosphere Packaging. *Packaging Technology and Science*, **22**, 115-122. https://doi.org/10.1002/pts.831