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Research Article

PHYSICOCHEMICAL PROPERTIES AND SENSORY EVALUATION OF MIXED FRUIT JUICE (ORANGE, WATERMELON, AND TANGERINE) USING DATE SYRUP AS A SWEETENER

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ABSTRACT

Objective: The main objective of this study was to evaluate physicochemical and sensory properties of mixed fruit juice produced from blends of orange, watermelon, and tangerine using date fruit syrup as a sweetener.

Methods: Sweet orange and tangerine were sorted, peeled, squeezed to extract juice and sieved while watermelon was washed, peeled deseeded, blended and sieved to obtained watermelon juice. The orange, tangerine, and watermelon juice were blended in ratios of 50:25:25, 25:50:25, 25:25:50 and 33.33:33.33:33.33 v/v OWT means Orange: Watermelon: Tangerine designated as O_{50}WT, transform (OW_{50}T), OWT_{50} and OWT, respectively. Twenty milliliter (20 ml) of date fruit syrup was added into different proportion of mixed fruit juice pasteurized at 85°C for 15 minutes and filled into bottle. Samples were evaluated for physicochemical properties and consumer's acceptability.

Results: The addition of date fruit syrup significantly increased pH from 4.05 to 4.15, total soluble solid 9.50 to 10.50 °Brix, vitamin C 1.46 to 1.79 mg/100 g, and calcium from 2.55 to 4.77 mg/100 g. Sensory evaluation revealed that sample O_{50}WT (50% orange, 25% watermelon, and 25% tangerine) was the most preferred in term of flavor (6.40), taste (7.40) and overall acceptability (7.40) while sample OWT was least accepted.

Conclusion: It is concluded that addition of date fruit syrup in mixed fruit juice improved the quality and sensory attributes of mixed fruit juice.

Keywords: Mixed fruit juice, Date fruit syrup, Physicochemical properties, Sensory attributes.

INTRODUCTION

Mixed fruit juices are liquid, non-alcoholic drink produced from the blends of fresh fruit juice such as orange, tangerine, banana, watermelon, and pineapple among others [1]. In Nigeria, there is an availability of suitable fruits which could be exploited for juice making such as passion fruit, watermelon, pineapple, banana, and orange among others. These fruits are highly perishable nature Fish *et al*. [2]. Large quantities of the fruit are traditionally and commercially processed into the different products such as wine, fruit juice, soft drink, carbonated beverages, and alcoholic drinks which help to prevent post-harvest loss. Fruit and vegetable supply more than 90%of vitamin C in human diet Erentuk *et al*. [3].

Orange and tangerine belong to citrus family. Orange (*Citrus sinensis*) from Rutaceae family while tangerine (*citrus tangerine*) is smaller and less round than common orange. Tangerine resembles orange but it is smaller and sweeter than orange Pittman and Davis [4]. Tangerine and orange are rich in vitamin C powerful natural antioxidant, folate, dietary fiber, and bioactive compound like carotenoid and flavonoids that prevent cancer and degenerative diseases Ejaz *et al.* [5].

Watermelon (*Citrullus lanatus*) is a fruit which belongs to the family of Cucurbitaceae and contain about 95% water. The fruit is round with reddish mesocarp having a lot of seeds. There are various species with different colored endocarp, for example, red flesh, yellow flesh, and orange flesh. It contains vitamins B_1 and B_6, potassium, calcium, iron, zinc and magnesium Teraka and Khaled [6] in addition to vitamin A and C which are generally common to all fruits and vegetables Abdelwahab *et al.* [7]. Watermelon (*Cochliobolus lunatus)* is rich in carotenoids some of which include lycopene, phytofluene, phytoene, beta-carotene, lutein and neurospnene. Lycopene makes up the majority of the carotenoids in the watermelon.

Date fruit (*Phoenix dactylifera L.*) is a monocotyledon within the palm tree family and it found mostly in the North Africa and East region Baliga *et al.* [8]. Date fruit is used to produced dare syrup that contains easily digestible (70%) mainly glucose, fructose, sucrose, a good source of mineral, dietary fiber, and contain less amount of protein and fat Aleid *et al.* [9]. Date fruit is directly consumed or used as an ingredient in some food formulation such as ice cream product, drinks, confectionery, bakery product, jam, and margarine. Date syrup serve as natural sweetener in juice production could be address the problem of overconsumption of white sugar in linked to diabetes mellitus, obesity, dental carries and other nutritional disorder in consumers Dziezak [10]. Date syrup can be converted to white sugar by applying various decolorization process Wolf *et al.* [11]). Orange and tangerine are well known for their distinctive flavor, taste and aroma as well as multiple health benefit associated them while watermelon is famous for its delightful color and water content. Blending of these three fruits using date syrup as a sweetener will increase their utilization, give a unique taste and improve nutritional composition of new product, create varieties and more value is added to the product. The objective of this work was to determine the physicochemical and sensory properties of mixed fruit juice using date syrup as a sweetener.

METHODS

Procurement of raw materials

Sweet orange, watermelon, tangerine, and date fruits were purchased from Nkwo Igbo-ukwu market in Aguata Local Government Area, Anambra state, Nigeria.

Preparation of date syrup

About 200 g of date fruits (200 g) were sorted out to remove the bad one, washed, soaked for 2 hrs in 2 l of water, deseeded, blended and sieved to obtained date juice. The extracted juice was poured into a clean pot and heated on a hot plate for 1 hr to obtained date syrup. Fig 1 below shows the flow chart for production of date syrup.

Preparation of mixed fruit juice

Sweet orange and tangerine were sorted for wholesomeness, washed in clean water to remove contaminants reduced microbial load. They were peeled, squeezed to extract the juice, sieved to obtained orange, and tangerine juice. Watermelon was washed, peeled, deseeded, blended and sieved to obtained watermelon juice. Juices extracted

from the three fruits, blended in different proportion to obtain the orange, watermelon and tangerine mixed fruit juices. 20 ml was added into different proportion of mixed fruit juices. They were pasteurized for 85°C for 15 minutes, and juices were filled into bottles and kept in refrigeration for analyses.

Physicochemical properties

The pH was determined using a pH meter as described by the AOAC [12] method. 5 ml of sample was measured into the beaker and glass electrode was inserted inside the beaker and the reading was taken.

Determination of titratable acidity

Determination of titratable acidity of the mixed fruit juice was carried out in accordance with the method described by AOAC [12]. 10 ml of the mixed fruit juice was diluted to 250 ml using distilled water and titrated with standardized 0.1 N sodium hydroxide (NaOH) solution using 0.3 ml phenolphthalein for each 100 ml solution being titrated indicator to a pink end point, which persisted for 30 seconds. This was expressed in terms of NaOH/100 ml of the sample. The flow chart for production of mixed fruit juice with addition of date syrup is shown in fig 2.

Determination of vitamin C

The 2,6 dichlorophenol titrimetric method as described by AOAC [12] was used. 2 ml of the sample was extracted by homogenizing sample in acetic acid solution. The standard solution was prepared by dissolving 50 mg of ascorbic acid in 100 ml of water. The solution was filtered to get a clear solution. Then, 10 ml of the filtrate was added into a flask in which 2.5 ml acetone had been added. This was titrated with indophenols solution (dye 2,6, dichlorophenol indophenols) to a faint pink color which persisted for 115 seconds. The standard was treated identically.

Calculation

mg ascorbic acid/ml = C × V × DF/WT

Where; C = mg ascorbic acid ml dye; V = volume of dye used for titrate of diluted sample;
DF = Dilution factor; WT = volume of sample in ml

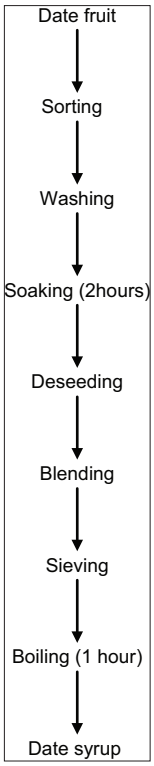

Fig. 1: Flow chart for production of date syrup

Determination of mineral content

Mineral analysis was determined using method described by Shahid *et al.* [13]. 2 ml of the sample was weighed and subjected to dry ashing for 5 hrs in well-cleaned porcelain crucibles at 550°C. The resultant ash was dissolved in 5 ml of $HNO_3/HCl/H_2O$ (1:2:3) and heated gently on a hot plate until brown fumes disappeared. 5 ml of deionized H_2O was added and heated until a colorless solution was obtained. The solution on each crucible was filtered into 100 ml volumetric flask and the volume made up to 100 ml with deionized water. The individual mineral element was determined from the solution. Calcium was determined using flame photometer (Perkin-Elmer model 52A) while iron was determined using atomic absorption spectrophotometer (Buck Scientific model 210 VGP).

Determination of total soluble solid (TSS)

Mixed fruit juice was analyzed for TSS using a digital refractometer the machine was standardized using purified water before taking readings. It is express as °Brix.

Sensory evaluation

About 10 untrained panelists were used to evaluation of mixed fruit juices sweetened with date syrup on a 9-point hedonic scale (where 9= extremely like and dislike extremely). The samples were scored for color, flavor, mouth feel, taste, and overall acceptability.

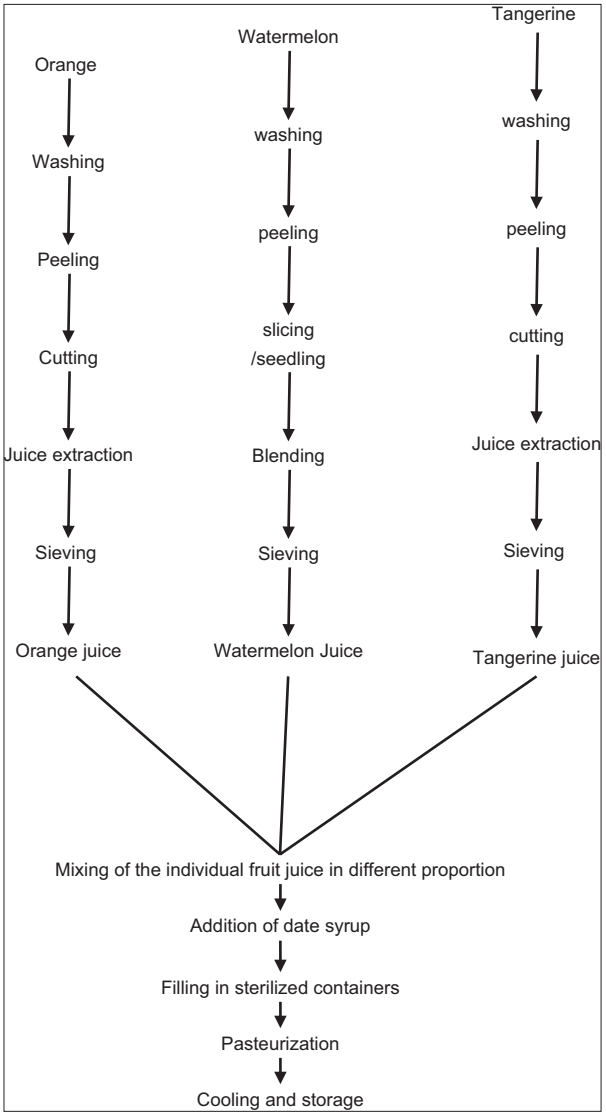

Fig. 2: Flow chart for production of mixed fruit with addition of date syrup

Table 1: Physicochemical properties of mixed fruit juice using date syrup as a sweetener

Samples	$O_{50}WT$	$OW_{50}T$	OWT_{50}	OWT
pH	4.05^{a}±0.02	4.15^{a}±0.10	4.09^{a}±0.40	3.71^{b}±0.20
Total acidity (as % citric acid)	0.91^{b}±0.01	0.42^{c}±0.20	0.42^{c}±0.10	1.26^{a}±0.02
TTS^{0}Brix	10.50^{a}±1.00	9.50^{bc}±0.20	9.70^{a}±0.30	8.50^{c}±0.10
Vitamin C mg/100 g	1.46^{a}±0.10	1.79^{a}±0.40	1.55^{b}±0.10	1.22^{c}±0.02
Calcium mg/100 g	3.89^{b}±0.10	4.48^{a}±0.10	2.55^{c}±0.10	1.90^{d}±0.10
Iron mg/100 g	0.017^{c}±0.01	0.038^{b}±0.00	0.038^{b}±0.00	0.046^{a}±0.01

Mean followed by the same row with the same superscript letters were not significantly different ($p<0.05$). $^{a, b, c}$ Key: $O_{50}WT$=50% orange: 25% watermelon: 25% tangerine+20 ml date syrup $OW_{50}T$=25% orange: 50% watermelon: 25% tangerine+20 ml date syrup OWT_{50}=25% orange: 25% watermelon: 50% tangerine+20 ml date syrup OWT=33.33% orange: 33.33% watermelon: 33.33% tangerine

Table 2: Sensory evaluation properties of mixed fruit juice

Samples	$O_{50}WT$	$OW_{50}T$	OWT_{50}	OWT
Colour	7.20^{b}±0.10	8.10^{ab}±1.00	5.70^{c}±1.00	8.70^{a}±0.05
Flavor	6.40^{a}±1.00	6.20^{a}±1.00	5.70^{a}±0.10	5.70^{a}±0.10
Taste	7.40^{a}±0.10	6.40^{b}±1.00	5.50^{b}±0.20	3.20^{c}±0.02
Mouthfeel	6.20^{b}±1.00	6.60^{b}±0.20	5.50^{a}±0.20	8.00^{a}±1.00
Overall acceptability	7.40^{a}±0.10	6.70^{a}±0.20	6.60^{a}±0.40	5.40^{b}±1.00

Mean followed by the same row with the same superscript letters were not significantly different ($p<0.05$). ^{a,b,c} Key: $O_{50}WT$=50% orange: 25% watermelon: 25% tangerine+20 ml date syrup $OW_{50}T$=25% orange: 50% watermelon: 25% tangerine+20 ml date syrup OWT_{50}=25% orange: 25% watermelon: 50% tangerine+20 ml date syrup OWT=33.33% orange: 33.33% watermelon: 33.33% tangerine

Statistical analysis

The data were subjected to analysis of variance using the statistical package for Social Sciences Version 17.0. Duncan's multiple range test was used to compare the treatment mean. Statistical significance was accepted at ($p<0.05$).

RESULTS AND DISCUSSIONS

Physicochemical properties of mixed fruit juice

The physicochemical parameters of mixed fruit juice sweetened with date syrup determined are presented in Table 1. From the table, the pH value of the mixed fruit juice sweetened with date syrup was significantly ($p<0.05$) difference from that without addition of date syrup. The pH value of mixed fruit juice added date syrup ranged from 4.05 to 4.15. Similar result was reported by Fatemeh *et al*, Ardail *et al.* [14] in pH of orange juice sweetened with date syrup. Sample orthogonal wavelet transform is not abbreviation of OWT (33.3% orange: 33.3% watermelon: 33,3% tangerine) transform (OWT) (control) had the lowest pH value of 3.71. The high pH value of samples $O_{50}WT$, $OW_{50}T$ and OWT_{50} may be due to incorporation of date syrup in mixed fruit juice. The pH is a measure of the degree of acidity or Alkalinity of a product. The pH value of 3 to 4 may give juice a good potential of inhibiting the growth of pathogenic bacterial (Jay [15]; Hatcher *et al.* [16]).

Total acidity of mixed fruit juice sweetened with date syrup (0.42-0.91% citric acid) was lower than the sample without addition of date syrup (1.26% citric acid). The difference may be as a result of addition effect. Ghana standard Board [17] also reported that non-alcoholic beverage should have acidity between 0.50% and 1.90% calculated as anhydrous citric acid. Values obtained in this study are fairly within the range. Samples added date syrup had less acidity this may be reason for their sweetness. Total acidity is a measure of total acid present in juice.

TSS of samples varied significantly and values ranged from 8.50 to 10.50 °Brix. samples contain date syrup had higher total solid than the control sample the relatively high sugar content of samples $O_{50}WT$, $OW_{50}T$ and OWT_{50} could be due to the fact date fruit is a natural sweetener which contains high level of simple sugar inherent in date fruit which might have contributed to higher Brix level. It is observed that TSS observed in the present compares with TSS reported by Onyekwelu and Elochukwu [18] and Fatemeh *et al* Ardail *et al*. [14] for citrus juice and orange juice sweetened with date syrup respectively. Ghana standard Board specifies that non-alcoholic beverage shall have a refractive value of not less than 8°Brix. Degree brix of commonly used fruit range from 9 to 150 Adedeji and Oluwalana [19].

Sample $OW_{50}T$ had the highest calcium content while control sample had the lowest calcium content. This may be probable due to blending proportion and addition effect. Teraka and Khaled [6] and Aleid *et al.* [9] reported that watermelon and date fruit are a good source of calcium.

The samples contain date syrup had the lower iron content ($OW_{50}T$= 0.038 mg/100 g, OWT_{50} = 0.038 mg/100 g) than the control sample (OWT= 0.046 mg/100 g). The iron content of samples added date syrup significantly ($p<0.05$) decreased from 0.017 to 0.038 mg/100 g. Iron is an essential macronutrient for almost all the organisms. It is sufficient to meet the daily required intake value for human beings which varies from 7 to 8 mg/day depending on age and sex.

Sensory properties of mixed fruit juice

Table 2 shows the mean sensory scores of mixed fruit juice. There were significant ($p<0.05$) differences in color, taste, mouth feel and overall acceptability among the samples. Sample $O_{50}WT$ (50% orange: 25% watermelon: 25% tangerine) had the highest mean score in flavor (6.40), taste (7.40) and overall acceptability (7.40) while sample OWT (33.33% orange: 33.33% watermelon: 33.33% tangerine) had the lowest mean score in flavor (5.60), taste (3.20) and overall acceptability (5.40). Sample OWT was most preferred in term of color. This may be due to color of date syrup (dark brown) which affects the panelists' acceptability. There were no significant ($p>0.05$) differences in the flavor of the samples. Inclusion of date syrup in mixed fruit juice did not affect the flavor of the samples.

CONCLUSION

Mixed fruit juices were produced from blends of orange, watermelon and tangerine using date syrup as a sweetener. Samples incorporated with date syrup had higher pH value, TSS, vitamin C and calcium content than control sample. Sample $O_{50}WT$ had higher mean scores in taste, flavor, and overall acceptability than sample OWT. Therefore, addition date syrup increase consumers acceptability of mixed fruit juice. The addition of date fruit syrup in mixed fruit juice improved its quality and sensory attributes.

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