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Research Article

Comaprative Study for Three Mangoes (*Mangifera Indica*) Varieties (Hindia, Bizra and Gulbator) in South Kordofan and Blue Nile State of Sudan

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Abstract

The study was conducted to study physicochemical components and organoleptic properties of three Sudanese varieties viz. Hindia, Bizra and Gulbatoor analysed in Food Department, IRCC, and Sudan. The samples obtained from two localities of Sudan; Blue Nile state (BN) and South Kordofan state (SK) of Sudan. The samples were subjected to physicochemical analysis according to SSMO of Sudan, Codex alimentarius standard, AOAC, FAO methods and Larmond sensory evaluation method. The samples were prepared; juice was made and analyzed according to recommendations and specifications to investigate whole weight of the mangoes, total soluble solids % (TSS%), Percent of pulp to fruit (PPF), pH, acidity, Total sugar % (TS%), Crude fibre% (CF%), pulp colour (red and yellow) and organoleptic properities (Org. properties). The results showed that Hindia Mango from (BN) (5.3) was significantly higher in pH than (SK) (4.3). TSS% was highest significantly (24%) in (SK) than (BN) (13%). Colours: red (4.5) yellow (45.7) were significantly highest in (BN) followed by (SK) (4.4) and (19.9) respectively. PPF was (61%) in (BN) followed by (SK) (59%). Acidity (0.0042) and TS% (4.2%) in (BN) were significantly different compared to (SK) (0.0014) and (3.17%) respectively. CF% was significantly (0.63%) in (SK) compared to (BN) (0.61%). Org. properties; colour was signicantly (7.0) in (BN) compare to (SK) (6.0), while taste and the flavour were the same (7.0) in both (BN) and (SK). Bizra mango pH is significantly highest in (SK) (4.5) than in (BN) (4.49). TSS% was significantly highest (23%) in (SK) compared to (BN) (15%). Colours of pulp, red (6.2) and yellow (42.6) were highst significantly in (BN) compare to (SK) (4.9) and (12.9) respectively. PPF was (59%) in (SK) compared to (BN) (43%) with significant difference. Acidity was significantly higest (0.007) in (BN) compare to (0.0021) in (K). TS% (4.3%) CF% (0.53%) were highest in (BN) compared with (SK) (2.33%) and (0.23%) respectively. Org. proprieties; colour (6.0), taste (7.0) and Flavour (7.0) were the same in both (BN) and (SK). Gulbatoor variety pH from (BN) was significantly highest (4.96) compared to (SK) (4.1). TSS% (18%) and PPF (58%) were significantly highest in (SK) compared to (BN) (17%) and (51%) respectively. Colours: both red (2.6) and yellow (39.8) were highest significantly in (BN) comapred to (SK) (0.4) and (13) respectively. Acidity (0.004), TS% (4.5%) and CF% (0.33%) were significantly highest in (BN) compared to (0.0021), (4.04%) and (0.16%) in (SK). Org. proprieties; colour, taste and flavour were the same in the samples (7.6), (7.8) and (6.2) respectively.

Keywords: Mango; Physical; Chemical; Organoleptic Properties; Sudanese Mango Varieties

Introduction

Mangos (*Mangifera indica*) one of the most important and widely cultivated fruits of the tropical world. Many hundreds of named mango cultivars exist. The yellow to orange fruit is juicy, distinctively spicy, and a rich source of vitamins A, C, and D. Mango fruit varies in shape, colour, and size from ovoid to long, from vividly red and yellow to dull green, and from plum- to melon-size [1]. Of the three parts of the mango, pulp is the part most utilized for human consumption [1]. The pulp content is the edible portion of mangoes and is given much importance during evaluation [1]. The composition of mango pulp varies from location of cultivation, variety and stage of maturity. The major constituents of the pulp are water, carbohydrates, organic acids, fats, minerals, pigments, tannins, vitamins and flavour compounds [1]. The characteristics odour that appeared in the fruits during ripening is

components of ester and carbonyl types [1]. Mango is now recognized as one of the best fruits due to its excellent flavour, attractive fragrance, and beautiful shades of colour, delicious taste and high nutritive value [2]. Among the main constituents of this fruit, carbohydrate and acid contribute a great deal to the food value of the fruit. Awareness in respect of improved mango production is lacking. As Shafique findings sugar ranges between (0.591-162.50) sucrose, glucose and fructose constitute the bulk of carbohydrate [1]. And physical charcters (colour, flavour and taste) varies between Excellent, Good and Fair and most of the soluble solid in mango pulp. It is rich source of β-carotene [3]. The difference in odour among the varieties is due to variation in flavoring components. More than hundred volatile components have been identified, major ones being terpenes although several other hydrocarbons, esters and alcohol were also present in ripe mango fruit [4]. Mango pulp is not generally consumed directly rather used as fillings for pastries, jams, sauces, fruit juices and drinks [5]. Essentially a prime table fruit, mango pulp is perfectly suited for conversion to juices, nectars, drinks, jams, fruit cheese or to be had by itself or with cream as a superb dessert. It can also be used to make the most delicious ice cream and yoghurt. Thin slices, seasoned with turmeric, are dried, and sometimes powdered, and used to impart an acid flavour to chutneys, vegetables and soup. Green or ripe mangoes may be used to make relish [6]. Physico-chemical characteristics of preserved mango pulp are TSS (Brix) (18.60) Acidity (0.69) and pH (3.81), while sensory characteristics of preserved mango pulp are Colour (7.25), Flavour (7.25) and Taste (7.00) [7]. Many mangoes varieties were cultivated in different Sudan states, the main production was concentrated in south Kordofan, Blue Nile, Sennar, River Nile, Northern state, Kassala, Gezira and Khartoum states. But the analytical studies required more investigations; to meat the demand of mangoes pulp for food industry and export the surplus.

In view of the above aspects, the present study has been undertaken to throw light on some of the constituents of mango with a view to apprehending the fruit as a supplementary food having a good calorific value as well as to select the varieties for plantation with a hope to be a member of the mango exporting countries [1].

The aim of this study was to investigate the physical, chemical and organoleptic properties mango pulp of three Sudanese varieties namely; Hindia, Bizra and Gulbatoor mango varieties brought from two Sudanese states namely, Blue Nile and south Kordofan states.

Materials and Methods

Experimental design

The experiment was laid out in complete randomized design with three treatments namely; Hindia (t1), Bizra (t1) and Gullbator (t1); replicated twice.

Source of materials

The samples of mangoes were obtained from Kordofan and Blue Nile states were carried in paper bags.

Procurement of the materials

The varieties were selected and ripened fruit, uniform in size, colour and weight was obtained from the local market of the two states. The fruit was thoroughly washed to remove dirt, dust, pesticide residues and microflora on the surface of the fruit.

Peeling and cutting and blending:

Ten samples from each variety were taken, cleaned, cut into slices and blended. The juice was filtered through of 0.11cm in diameter.

Methods:

Physical Analysis

pH: The pH was measured using pH 211, microprocessor, pH meter, Hanna instruments, made by Romania according to SSMO [8].

Total Soluble Solids (TSS): The TSS was practiced using hand refractometer, Beelgham and Sainless Ltd, London, 40 – 85% sugar refractometer, according to the Codex alimentarius standard [9].

Colours: The colour was determined using Lovibond Tintiometer type D, made by tintometer LTD, made by the color laboratory, Salisbury, England.

Chemical analysis:

Acidity: Acidity was done according to the AOAC [10]. Calculated as 0.1 ml of alkali (NaOH) to 100 ml of Juice [11].

Sugar content: Sugar content was done according to SSMO [8].

Fibre content: Fibre content was measured according to the AOAC [10].

Organoleptic analysis

Organoleptic properties such as colour, flavor and taste were done using panel taster using panel taster. The average of the score was considered taking Marks 1-10. Ready to serve drinks (pulp 8%, acid 0.2% and sugar 16 Brix) were prepared from each sample of mango pulp. They were presented to a panel of judges for sensory evaluation for colour, taste and flavour using an hedonic scale in accordance with the method described by [12]. The panel members were selected on the basis of their ability to discriminate and scale a broad range of different attributes of mango and mango products. An orientation program was organized for the panel members to brief them the objective of the study. The drink samples were brought to the sensory analysis lab and were served to the panelists. The judges were provided with prescribed ques-

tionnaires to record their observation. The information contained on the performa was 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much; 1 = Dislike extremely. The panelists expectorated the drinks and rinsed mouth using distilled water between samples. Sensory testing was made in the panel room completely free of food/chemical odour, unnecessary sound and mixing of daylight.

Statistical analysis

Data were statistically analyzed, using analysis of variance [13]. And the values are presented as means (SD±).

Results and Discussion

Physical properties, chemical properties and organoleptic properities of Hindia mangoes variety in three Sudanese states; Kordofan and Blue Nile states; were shown in table (1). The results showed that Hindia Mango from (BN) (5.3) was significantly higher in pH than (SK) (4.3). TSS% was highest significantly (24%) in (SK) than (BN) (13%). Colours: red (4.5) yellow (45.7) were significantly highest in (BN) followed by (SK) (4.4) and (19.9) respectively and all of which above the minimum level (13.5) of TSS recommended by Codex Stan 247. [14]. PPF was (61%) in (BN) followed by (SK) (59%). Acidity (0.0042) and TS% (4.2%) in (BN) were significantly different compared to (SK) (0.0014) and (3.17%) respectively. CF% was significantly (0.63%) in (SK) compared to (BN) (0.61%). The chemical properties such as acidity were very low compared to Saeed, et al. who found that acidity of mango was (0.69) [7]. Org.

Specification	SD	Blue Nile state	Kordofan state
Physical properities:			
pH	4.3	5.3	0.707107
Total Soluble Solids %	24	13	7.778175
Percent of pulp to fruit	59	61	1.414214
Colour (lovibond reading):			
Red	4.4	4.5	0.070711
Yellow	19.9	45.7	18.24335
Chemical properities:			
Acidity	0.0014	0.003	0.001131
Total sugar %	3.17	4.2	0.72832
Crude fibre %	0.61	0.63	0.014142
Organoleptic evaluation (Average score):			
Colour	6.0	7.0	0.707107
Taste	7.0	7.0	0
Flavour	7.0	7.0	0

Table 1: Average chemical, physical and organoleptic analysis of Hindia mango variety in three states, Kordofan, North state and Blue Nile state.

properties; colour was signicantly (7.0) in (BN) compare to (SK) (6.0), while taste and the flavour were the same (7.0) in both (BN) and (SK). All sensory characteristics of mango pulp were relatively matching with Saeed, et al. who mentioned that mangoes colour is (7.25), flavour (7.25) and taste (7.00) [7]; except the taste and flavour of Nothern state and colour of Kordofan samples were lesser than what mentioned by Saeed, et al. [7]. These vatiation between the two localities (states) is due to that mango varieties may as a result of cultural practices, soils, microclimatic changes. Physical properties, chemical properties and organoleptic properities of Bizra mangoes variety in two Sudanese states; Kordofan, North and Blue Nile states were illustrated in table 2. Bizra mango pH significantly highest in (SK) (4.5) than in (BN) (4.49). TSS% was significantly highest (23%) in (SK) compared to (BN) (15%). All of the total soluble solids above the minimum level (13.5) recommended by Codex Stan 247. [14].Colours of pulp, red (6.2) and yellow (42.6) were highst significantly in (BN) compare to (SK) (4.9) and (12.9) respectively. PPF was (59%) in (SK) compared to (BN) (43%) with significant.

Specification	SD	Blue Nile state	Kordofan state
Physical properities:			
pH	4.5	4.49	0.007071
Total Soluble Solids %	23	15	5.656854
Percent of pulp to fruit	59	43	11.31371
Colour (lovibond reading):			
Red	4.9	6.2	0.919239
Yellow	12.9	42.6	21.00107
Chemical properities:			
Acidity	0.0021	0.007	0.003465
Total sugar %	2.33	4.3	1.393
Crude fibre %	0.23	0.53	0.212132
Organoleptic evaluation (Average score):			
Colour	6.0	6.0	0
Taste	7.0	7.0	0
Flavour	7.0	7.0	0

Table 2: Average chemical, physical and organoleptic analysis of Bizra mango variety in three states, Kordofan, North state and Blue Nile state.

Difference: Acidity was significantly higest (0.007) in (BN) compare to (0.0021) in (K). TS% (4.3%) CF% (0.53%) were highest in

(BN) compared with (SK) (2.33%) and (0.23%) respectively, but the chemical properties such as acidity were significantly difference in Kordofan state than Blue Nile; it is very low compared to Saeed, et al. [7] who found that acidity of mango was (0.69) [7].. Org. proprieties; colour (6.0), taste (7.0) and Flavour (7.0) were the same in both (BN) and (SK), except colour all sensory characters were resemble Saeed, et al. [7]. Physical properties, chemical properties and organoleptic properities of Gulbator mangoes variety in two Sudanese localities; Kordofan, North and Blue Nile states were explained in table (3). Gulbatoor variety pH from (BN) was significantly highest (4.96) compared to (SK) (4.1). TSS% (18%) and PPF (58%) were significantly highest in (SK) compared to (BN) (17%) and (51%) respectively, but all of which above the minimum level (13.5) recommended by Codex Stan 247. [12]. Colours: both red (2.6) and yellow (39.8) were highest significantly in (BN) comapred to (SK) (0.4) and (13) respectively. Acidity (0.004), TS% (4.5%) and CF% (0.33%) were significantly highest in (BN) compared to (0.0021), (4.04%) and (0.16%) in (SK) that it is very low acidity compared to Saeed, et al. who found that acidity of mango was (0.69) [7]. Crude fibre percentage was the same in Blue Nile and Northern state with significantly difference with Kordofan state.

Specification	SD	Blue Nile state	Kordofan state
Physical properities:			
pH	4.1	4.96	0.608112
Total Soluble Solids %	18	17	0.707107
Percent of pulp to fruit	58	51	4.949747
Colour (lovibond reading):			
Red	0.4	2.6	1.555635
Yellow	39.8	13	18.95046
Chemical properities:			
Acidity	0.0021	0.004	0.001344
Total sugar %	4.04	4.5	0.325269
Crude fibre %	0.16	0.33	0.120208
Organoleptic evaluation (Average score):			
Colour	7.6	7.6	0
Taste	7.8	7.8	0
Flavour	6.2	6.2	0

Table 3: Average chemical, physical and organoleptic analysis of Gulbator mango variety in three states, Kordofan, North state and Blue Nile state.

Org. proprieties; colour, taste and flavour were the same in the samples (7.6), (7.8) and (6.2) respectively, except the flavour all the sensory characters are higher than what obtained by Saeed, et al. [7]. The variation between the three varieties in the three localities may be due to microclimate, cultural practices, soil type etc.

Conclusions:

We can conclude the following:

1. Hindia Mango from (BN) was significantly higher than (SK) in pH, red and yellow Colours, PPF, Acidity and TS%. In contrast South Kodofan ones was highest significantly (BN) in TSS% and CF%, while Org. properties were the same in both (BN) and (SK).
2. Bizra mango obtained from (SK) significantly highest in pH, TSS%, PPF than Blue Nile ones. Colours of pulp, Acidity, TS%, CF% were highest in (BN) compared with (SK), while Org. proprietieswere the same in both (BN) and (SK).
3. Gulbatoor variety pH, Colours, Acidity, TS% and CF% from (BN) was significantly highest compared to (SK). TSS% and PPF were significantly highest in (SK) compared to (BN). Org. proprieties were the same.

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