Int.J.Curr.Microbiol.App.Sci (2022) *11*(10): 158-167

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 10 (2022)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2022.1110.019

Influence of Storage Time on the Physicochemical, Microbiological and Sensory Characteristics of Dried Mango Slices (*Mangifera indica* L. Var Kent) Produced in Côte d'Ivoire

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Keywords

Mangifera indica, Storage time, Dried slices, Quality parameters, Polyethylene plastic, Côte d'Ivoire

Article Info

Received: 02 September 2022
Accepted: 28 September 2022
Available Online: 10 October 2022

ABSTRACT

The objective of this study was to determine the impact of storage time on biochemical, microbiological and sensory parameters of dried mango slices (*Mangifera indica* L. var Kent) produced in Côte d'Ivoire. Batches of 100 g of dried mango slices wrapped in polyethylene plastic and packed in cartons were stored for 9 months at 25°C for quarterly monitoring (T_0, T_3, T_6 and T_9) of analytical parameters. Storage time (T_0 to T_9) induced significant losses (P <0.05) of 37.14% of titratable acidity, of 5.62% vitamin A, 23.97% of vitamin C, 34.12% of oxalates and 8.13% of phytates in dried mango slices. A significant increase (P<0.05) in flavonoids (13.81±0.10 to 16.20±0.2 mg/100g), polyphenols (14.02±0.10 to 16.41±0.01 mg/100g), moisture (11.13±0.94 to 16.15±1.91 g/100g), β-carotene (1.83±0.03 to 2. 09±0.02 mg/100g), total sugars (34.42±5.70 to 102.68±0.09 g/100g), reducing sugars (54.56±4.85 to 190.04±0.22 g/100g), and minerals were also observed from T_0 to T_9. Total aerobic mesophilic flora varied from 1.48±0.10 x 10^3 CFU/g (T_0) to 1.55±0.36 x 10^6 CFU/g (T_9), an increase of 4.73%. Only mango slices dried stored at T_3 were appreciated by panelists. Mangoes slices dried up to 3 months of storage have the best physicochemical, microbiological and sensory properties.

Introduction

Mango, the fruit of the mango tree (*Mangifera indica* L. var Kent), ranks fifth in world fruit production after citrus, grapes, bananas and apples (Martine, 1993). It is produced in abundance in Côte d'Ivoire and is the 3rd largest fruit exported by the country behind bananas and pineapples (Pugnet, 2018). With an estimated production of more than 100,000 tons per year, the country ranks 1st in

Africa among mango exporting countries and 3rd in the world for the European market after Brazil (65,000 t) and Peru (29,000 t) Gerbaud (2007).There are several varieties of mangoes. However, the Amelie variety is increasingly abandoned in favor of colored varieties such as Kent, Keitt, Zill, Palmer and Smith which are very appreciated by Europeans (Loeillet, 1998). In Côte d'Ivoire, the mango harvest period is relatively short and lasts between 3 and 4 months of the year depending on the region. Due to its perishable nature, mango faces a serious problem of post-harvest conservation, resulting in huge losses of about 80% worldwide (Kansci *et al.,* 2003). These post-harvest losses are estimated at between 30,000 t and 40,000 t/year for a production of over 100,000 t/year in Côte d'Ivoire (FIRCA, 2011). These losses are mainly due to factors such as the seasonality of the fruit (March, April, May and June) and the high yield (FIRCA, 2011). To mitigate these losses, several technologies have been developed, including drying technology, which would be a timely way to enhance the value of this fruit with limited shelf life (Candelaria *et al.,* 1994; Sagar *et al.,* 1996). This practice is used in many countries in the West African sub-region, including Burkina Faso, Côte d'Ivoire and Mali, using gas or hybrid dryers (Kameni *et al.,* 2003).

In Côte d'Ivoire, dried mango slices are produced by small processing units scattered in the north of the country. These units produce dried mango slivers that are sold locally or exported to European markets, which are the main buyers (Labaky, 2021). The dried mango slices produced is bagged, stored and delivered to customers as needed, exposing the product to several factors and modes of spoilage. According to Kebe (2009), good hygiene and manufacturing practices for the proper preservation of dried mango slivers depend on several factors that are not always controlled. Thus, in a market agriculture, the survival of dried mango as a commercial product depends on its nutritional, gustatory and sanitary qualities and its good conservation at room temperature (Kameni *et al.,* 2003). In Côte d'Ivoire, no study has yet been conducted on the marketability of mango slices produced. To participate in the search for ways to improve the quality of dried mango slices, the objective of this work was to determine the impact of storage time on the biochemical, microbiological and sensory parameters of dried mango slices (*Mangifera indica* L. var Kent) produced in Côte d'Ivoire.

Materials and Methods

The study material consisted of dried mango slices (*Mangifera indica* L. var Kent) produced by a production unit of a cooperative structure of Korhogo in northern Côte d'Ivoire.

Sampling and sample processing

A 9 kg batch 90 samples of 100 g of dried mango slices pretreated with meta-bisulfite and freshly packed in thermo-welded polyethylene plastic films) from 9 days of production equidistant of two days (3 times / week) was collected in storage room (30°C) of the cooperative unit production. Samples were collected at a rate of 3 kg per day (30 batches of 100 g) or 1 kg (10 batches of 100 g) per cycle of 8 h of group work in the day as clusters (Magnani, 2001). All these samples were packed in clean boxes and were packed in clean cartons for physicochemical, microbiological and sensory analyses each quarter for 9 months of storage (T_0, T_3, T_6 and T_9) in laboratory.

Physicochemical analysis

Direct determination

Titratable acidity, moisture, total carbohydrate, lipids, proteins and oxalate contents were determined according to AOAC (1990). Reducing sugars and total sugars were determined respectively by Bertrand (1955) and phenol-sulfuric (Dubois *et al.,* 1956 ; CEE-BIPEA, 1976) methods. Phenolic compounds were extracted with methanol (Singleton *et al.,* 1999) and their determination was done according to McDonald *et al.,* (2001). The determination of flavonoids from extracts of dried mango slices was done by the aluminum chloride calorimetric method (Chang *et al.,* 2004). Ascorbic acid was extracted with a metaphosphoric acid/acetic acid solution and assayed with 2,6-dichlorophenol indophenol calibrated with standard vitamin C of known concentration (Poncracz *et al.,* 1971). The minerals calcium (Ca), potassium (K), magnesium (Mg) and sodium (Na) were determined according to the protocol of Brule *et al.,* (1974). The determination of total fiber in dried mango samples was determined as described by Multon (1991).

Determination by HPLC

Vitamin A was determined according to the method of jedlicka *et al.,* (1992). To 1.0 g of dried mango sample, 10 mL of a 10% KOH solution in methanol-water (1 : 1, v/v) was added. To avoid the oxidation process during saponification, 0.025 g of ascorbic acid was added. The mixture was then refluxed in a water bath at 70 °C for 30 min.

The mixture was then cooled and extracted with 3 x 5 mL of hexane. The hexane phases were combined and dried over anhydrous sodium sulfate and evaporated to dryness.

The residue obtained (about 0.3 g) was taken up in methanol (10 mL) for analysis. The β-carotene content was determined according to the method of Mercadante *et al.,* (1997). For this purpose, extraction is performed using an equimolar mixture of ethyl ether and petroleum ether (1/1, V/V) on dried mango slices powders delipidated with KOH solution (10%).

The injection is performed isocratically using a WatersTM717 plus Auto sampler. The mobile phase (acetone-petroleum ether 30%) is pumped at a speed of 1 mL/min. using a Waters 510 HPLC Pump. The column used is a KS-2546-C18.5 column.

The β-carotene molecules are revealed using a WatersTM 996 plus Photodiode Array Dedector detector and the data automatically analyzed by an integrated Millennium 2010 Option PPA software. The β carotene contents of dried mango slices powders are calculated using a standard β carotene standard.

Phytates quantification was determined according to the method of Mercadante *et al.,* (1997). A 0.5 g dried mango slices powder test sample was shaken in the presence of 20 mL of 0.5 M hydrochloric acid for 3 h at room temperature. The mixture is centrifuged at 15,000 rpm for 15 min. From the supernatant liquid, 10 mL is taken, placed in a 250 mL round flask and evaporated to dryness under vacuum at a temperature not exceeding 40°C. The dry extract obtained is taken up with 15 mL, then 10 mL, then 5 mL of 0.025 N hydrochloric acid, and progressively loaded onto the anion exchange resin. The elution flow rate is maintained at 15 drops/min by means of a peristaltic pump. The eluate is not kept. The phytates are then eluted by 7 times 4 mL of 2.0 N hydrochloric acid in a 250 mL round flask with a flow rate of 15 drops/min.

Microbiological analysis

Preparation of the stock solution

It consisted of aseptically removing 25g of the sample mainly at T_0, T_3, T_6 and T_9, and placing them in a sterile plastic Stomacher bag by adding 225 mL of buffered peptone water (BPW). This mixture was then ground with the grinder for 1-3 min and then allowed to stand for 30 min to allow for revivification. The dilution stock solution (10^{-1}) was made up as follows according to the standard (ISO 6887-1: 2017).

Preparation of decimal dilutions

From the stock solution, dilutions in test tubes were made to facilitate enumeration. Thus, to prepare the 10^{-1} dilution, 1 mL of the stock suspension was taken in a sterile manner and mixed with 9 mL of buffered peptone water (BPW) contained in a sterile test tube. Then, 1 mL of the 10^{-1} dilution was taken and homogenized in 9 mL of buffered peptone water to obtain the 10^{-2} dilution. By the same technique, dilutions 10^{-3} to 10^{-6} were performed. The preparation of the decimal dilutions was performed according to the standard (ISO 6887-1: 2017).

Enumeration and research of germs

They were carried out according to horizontal methods (AFNOR, 1999). The following groups of germs were enumerated: total aerobic mesophilic flora (TAMF); yeasts and molds; *E. coli* and Salmonella ssp.

Sensory analysis

A hedonic test was used to assess the level of appreciation of organoleptic characteristics following the method described byStone and Sidel (2004). Thirty (30) panelists were asked to rate the level of appreciation of the descriptors of the dried mango slices on a 7-point unipolar scale ranging from 1 (dislike extremely) to 7 (like extremely). The descriptors analyzed were color, flavour, taste, texture, shape, and overall acceptability (Kumar & Shukla, 2017).

Statistical analyses

The statistical analysis is performed by the XLSTAT 2016.02.27444 software. The variability of the studied parameters represent the average of 3 trials. An analysis of variance (ANOVA) was performed and the significance of the differences between the dried mango slice samples is determined at the risk of error $\alpha = 0.05$ according to the Tukey test.

Results and Discussion

Physicochemical characteristics of dried mango slices during storage

Macronutrients and titratable acidity

The mean values of macronutrient contents of dried mango slices inTable 1 showed a significant increase of 45.10% in moisture content during storage with the data ranged from 11.13±0.94 g/ 100 g at T_0 to 16.15±0.04 g/ 100 g at T_9.Total and reducing sugars increased respectively from 34.42±0.06 g/100 g to 102.68±0.09 and from 54.56±0.13 to 190.04±0.22 g/100g from the first month (T_0) to the 9th month (T_9) of storage. However, a decrease of 37.14% of titratable acidity is observed in dried mango slices for contents ranged from 70±0.00 g/100 g to 44±0.00 meq.g/100g of samples at T_9. Lipids and total fibers contents increased from T_0 to T_3 and then stabilized until T_9 (1.33±0.30 and 9.0±0.50 g/100g) respectively. In contrast, total glucids decreased from T_0 to T_3 and then stabilized at T_9 (78.58±0.82 g/100g). No significant difference observed in proteins during the 9 months of storage.

The objective of this study was to evaluate the impact of storage time on the biochemical composition, microbial loads and acceptability of dried mango (*Mangifera indica* L. var Kent) slices produced in Côte d'Ivoire. Data showed that the moisture of dried mango slices increased from 11.13±0.94 to 16.15±1.91 g/100g, i.e. an increase of 45.10% during storage (T_0 to T_9). This increase in moisture content of dried mango slices could be due to moisture transfer between packaging and storage conditions as reported by Ouattara *et al.,* (2017). This transfer of humidity is also due to the quality of packaging used for dried mango slices which provokes microorganisms development and organoleptic depreciation as found by results. The increase of 45.10% of moisture in dried mango slices is higher than those ranged from 15% to 35% as reported by UNECE DDP-25 (2013) in marketable quality standard of dried mango slices.

The increase in moisture in dried mango slices leads to hydrolysis of sugars and consequently an increase in reducing sugars content from (54.56±4.85 to 190.04±0.22 g/100 g) and total sugars from (34.42±5.70 to 102.68±0.09 g/100 g) during the 9 monts of storage as reported by the study. This increase of sugars in in dried mango slices could induce available substrate for microorganisms development as mentioned previously. These findings are in agreement with those of Piacere

(2020) who showed that more foods contain sugars, faster it will degrade. The development of microorganisms could be accelerate by the decrease (37.14%) of titratable acidity in dried mango slices during storage from T_0, to T_9. According to Belem *et al.,* (2017), total acidity provides information on the acidic character of the product and contributes to the sanitary quality of food by limiting the development of spoilage and/or pathogenic microorganisms.

Vitamins

The vitamins contents (Table 2) of dried mango slices in storage showed values of 1.93±0.01 mg/100 g for β-carotene at the 3rd month of storage and increase significantly (8.29%) to 2.09±0.02 mg/100 g of samples at the 9th month of storage. Vitamins A and C content decreased significantly for 5.62% (146.24±0.05 µg/100 g to 138.01±0.13 µg/100 g) and 23.97% (28.36±0.36 mg/100 g to 21.56±0.06 mg/100 g) respectively from T_0 to T_9. The increase in β-carotene in dried mango slices during 9 months of storage (1.83±0.03 to 2.09±0.02 mg/100 g) was also reported by Djantou (2006). Data in this study are lower than those reported by Djantou (2006) which ranged from 61.67±0.19 mg/100 g to 65.34±0.04 mg/100 g by using of Dehydration Immersion Impregnation (D2I) treatment. The increase of β carotene would also be related to storage conditions as supported by Bafteh (2012). These researchers mentioned that β carotene is destroyed by light and heat. The decrease of vitamin A which is derived from β-carotene and vitamin C in dried mango slices during the 9 months of this storage conditions is related to their thermo-sensitivity as reported by (Rojas and Gerschenson, 2000). However, vitamin C contents of the study are lower than those of sliced and osmotically dehydrated with the values of 62.44±2.87 mg/100 gand 89.35±4.66 mg/100 gas reported by Djantou (2006) and Saliha *et al.,* (2005) respectively.

Minerals composition

Depending on the storage time (T_0, T_3, T_6 and T_9), Ca, K, Mg and Na in samples increased significantly ($P < 0.05$) to reach their peak at the 6thmonth of storage and then decreased at the 9thmonth of storage. The peaks were 24.20±0.10 mg/100 g; 863±0.11 µg/100 g; 88.2±0.10 µg/100 g and 16.05±0.05 mg/100g of samples respectively for Ca, K, Mg and Na (Table 3).

The significant increase in calcium (22.25±0.05 to 24.20±0.10 mg/100 g), potassium (860.5±0.07 to 863.00±0.11 µg/100 g), magnesium (86.6±0.07 to 88.2±0.10 µg/100 g) and sodium (14.00±0.09 to 16.05±0.05 mg/100 g) during the 6 first months of storage in this study was also reported by Djantou (2006). However, data of these authors with 650.54±49.41 µg/100 g (K), 57.65±5.59 µg/100 g (Mg), 30.12±4.67 mg/100 g (Ca) and 13.19±0.82 mg/100 g (Na) are higher than those of ours findings. This difference is related to the diffusion phenomena caused by D2I as previously described.

Secondary metabolites

Flavonoids and polyphenols contents increased during storage (T_0 to T_9) from 13.81 ± 0.10 meq.g/ g and 14.02 ± 0.10 mg/ g to 16.20±0.20 mg/ g and 16.41±0.01 mg/g respectively (Table 4) while oxalates and phytates showed a decrease of 34.12% (21.6±0.02 mg/100 g to 14.23±0.03 mg/100 g) and 8.13% (92.3±0.08 mg/100 g to 84.8±0.06 mg/100 g).

The significant increase ($P<0.05$) of secondary metabolites such as total flavonoids and total polyphenols in dried mango slices during the 9 months of storage could be due to the release of bound phenolic compounds as reported by several authors (Bartolome and Gomez-Cordoves, 1999). The decrease of oxalates and phytates contents in dried mango slices are lower than thresholds of 200 to 500 mg / 100 g recommended by Person (1976) for oxalates and 250 to 500 mg / 100 g recommended by Bushway *et al.,* (1998). This decrease is related to the action of oxalic and phytic acids that form insoluble complexes with minerals, which limits their bioavailability (Omoruyi *et al.,* 2007).

Table.1 Variation of biochemical composition in dried mango slices samples during storage

	Storage time (months) of dried mango slices			
	T_0	T_3	T_6	T_9
Moisture (g/100g)	11.13±0.94[c]	14.55±0.30[b]	15.70±0.20[a]	16.15±0.04[a]
Total sugars (g/100 g)	34.42 ±0.06[d]	50,47±0.07[c]	82.15±0.02[b]	102,68±0.09[a]
Reducing sugars g/100 g)	54.56±0.13[d]	84.65±0.02[c]	164.53±0,05[b]	190.04±0.22[a]
Titratable acidity (meq.g /100 g)	70.00±0.00[a]	61.00±1.73[b]	53.00±0.00[c]	44.00±0.00[d]
Proteins (g/100 g)	2.09±0.03[a]	2.16±0.09[a]	2.29±0.20[a]	2.34±0.16[a]
Lipids (g/100 g)	0.86±0.11[b]	1.06±1.02[a]	1.26±0.30[a]	1.33±0.30[a]
Total glucids (g/100 g)	83.39±1.54[a]	80.30±1.09[a]	79.22±0.98[b]	78.58±0.82[b]
Total fibers (g/100 g)	8.90±0.04[b]	9.00±0.50[a]	9.10±0.34[a]	9.0.00±0.50[a]
Total ash (g/100 g)	2.53±0.30[a]	1.93±0.41[b]	1.53±0.02[b]	1.60 ±0.03[b]
Energy (kcal/100 g)	337.09±0.6[a]	337.14±1.19[a]	337.30±1.42[a]	336.61±0.83[a]

Values in the same line with different superscripts are statistically different at P<0.05 by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage.

Table.2 Variation of vitamins in dried mango slices samples during storage

	Storage time (months) of dried mango slices			
	T_0	T_3	T_6	T_9
β caroten (mg/100 g)	1.83±0.03[b]	1.93±0.01[b]	2.00±0.01[a]	2.09±0.02[a]
Vitamin A (µg/100 g)	146.24±0.05[a]	143.15±0.07[b]	140.94±0.06[c]	138.01±0.13[d]
Vitamin C (mg/100 g)	28.36±0.36[a]	25.25±0.06[b]	23.47±0.05[c]	21.56±0.06[d]

Values in the same line with different superscripts are statistically different at P<0.05 by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage.

Table.3 Variation of mineral in dried mango slices samples during storage

	Storage time (months) of dried mango slices			
	T_0	T_3	T_6	T_9
Ca (mg/100 g)	22.25±0.05[c]	23.20±0.10[b]	24.20±0.10[a]	23.70±0.10[b]
K (µg/100 g)	860.50±0.07[c]	861.40±0.10[b]	863.00±0.11[a]	861.85±0.05[b]
Mg (µg/100 g)	86.60±0.07[c]	87.60±0.02[b]	88.20±0.10[a]	87.45±0.05[b]
Na (mg/100 g)	14.00±0.09[c]	15.80±0.10[b]	16.05±0.05[a]	15.45±0.05[b]

Values in the same line with different superscripts are statistically different at P<0.05 by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage.

Table.4 Variation of secondary metabolites in dried mango slices samples during storage

	Storage time (months) of dried mango slices			
	T_0	T_3	T_6	T_9
Total flavonoids (meq.g/ g)	13.81 ± 0.10^{d}	14.94 ± 0.06^{c}	15.12 ± 0.02^{b}	16.20 ± 0.20^{a}
Total polyphenols (mg/g)	14.02 ± 0.10^{c}	15.45 ± 0.05^{b}	15.88 ± 0.06^{b}	16.41 ± 0.01^{a}
Oxalates (mg/100 g)	21.60 ± 0.02^{a}	19.80 ± 0.10^{b}	16.65 ± 0.05^{c}	14.23 ± 0.03^{d}
Phytates (mg/100g)	92.30 ± 0.08^{a}	89.80 ± 0.12^{b}	86.60 ± 0.06^{c}	84.80 ± 0.06^{d}

Values in the same line with different superscripts are statistically different at $P<0.05$ by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage.

Table.5 Variation of microbial loads in dried mango slices samples during storage

	TAMF	Moulds	*E. coli*	Salmonella spp
T_0	$1.48\pm0.10 \times 10^{3d}$	Abs	Abs	Abs
T_3	$4.95\pm0.035 \times 10^{4c}$	< 15	Abs	Abs
T_6	$7.79\pm0.19 \times 10^{5b}$	$1.45\pm0.36 \times 10^{1b}$	Abs	Abs
T_9	$1.55\pm0.36 \times 10^{6a}$	$1.60\pm0.14 \times 10^{2a}$	Abs	Abs
Microbiological guidelines and standards (CFU/g) : (2019)	$\leq 1 \times 10^4$	$\leq 1 \times 10^5$	$\leq 1 \times 10^3$	not specified

Values in the same column with different superscripts are statistically different at $P<0.05$ by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage. TAMF : total mesophilic aerobic flora. Abs : absent.

Table.6 Variation of sensory parameters of dried mango slices samples

	Scores of sensory descriptors of dried mango slices samples			
	T_0	T_3	T_6	T_9
Color	6.13 ± 0.72^{a}	6.03 ± 0.83^{a}	5.26 ± 1.33^{b}	4.86 ± 1.54^{c}
Flavour	5.58 ± 1.00^{a}	5.53 ± 0.95^{a}	5.63 ± 0.98^{a}	5.36 ± 1.32^{a}
Taste	5.68 ± 1.08^{a}	5.86 ± 0.80^{a}	5.96 ± 0.79^{a}	4.80 ± 1.79^{b}
Texture	5.89 ± 0.95^{a}	5.46 ± 1.58^{a}	4.13 ± 1.70^{b}	4.03 ± 1.72^{b}
Shape	5.20 ± 1.44^{a}	5.03 ± 1.30^{a}	$5.06 \pm 1,36^{a}$	4.70 ± 1.61^{b}
Overall acceptability	5.56 ± 0.81^{a}	5.58 ± 0.76^{a}	4.66 ± 1.10^{b}	3.90 ± 1.46^{c}

Values in the same line with different superscripts are statistically different at $P<0.05$ by Tuckey test. T_0: time before storage; T_3: 3 months of storage; T_6: 6 months of storage and T_9:9 months of storage.

Microbiological characteristics of dried mango slices during storage

Data showed a significant increase of 4.73% for Total aerobic mesophilic flora (TAMF) ($1.48\pm0.10 \times 10^3$ to $1.55\pm0.36 \times 10^6$CFU/ g) and and 10.34% of mould ($1.45\pm0.36 \times 10^1$ to $1.6\pm0.14 \times 10^2$CFU/ g) during storage (T_0 to T_9). No *E. coli* and *Salmonella* spp were enumerated during the 9 months of storage (Table 5).

At 6 months of storage, the increase of humidity induced high value of total aerobic mesophilic flora loads up to 7.79±0.19 x 10^5 CFU/ g which is above those of the 2019 Guidelines and Standards for the Interpretation of Microbiological Analytical Results (≤ 1 x 10^4 CFU/ g). The increase of microbial load during storage was also reported by Dereje & Abera (2020) in sun-dried and rack-dried mango samples with the values ranged from 3.5 × 10^1 to 9.6 × 10^3 CFU/ g and 2.6 × 10^1 to 7.5 × 10^3 CFU/ g during the storage periods. According to Metivier (2015), moisture is favorable for the development of total mesophilic aerobic flora. So, this high value of total mesophilic aerobic flora load in dried mango is due to good manufacturing practice problem.

Sensory characteristics of dried mango slices during storage

Descriptors recorded in Table 6 such as color, flavor, taste, texture and shape showed a significant difference from T_0 to T_9. But for acceptability, dried mango slices stored up to 3 months with a score of 5.58±0.76 had good overall acceptability than those of 6 months (4.66±1.10) and 9 months (3.9±1.46).

The color, flavour, taste, texture and shape of dried mango slices showed a significant decrease ($P < 0.05$) between samples storaged at 3 months compared to those of 9 months. These decrease could be attributed to the increase of moisture link to packaging and storage conditions as reported by Ouattara *et al.,* (2017). Indeed, the use polyethylene to package dried mango slices at 25°C can only ensure their shelf-life up to 3 months (5.58±0.76) compared to acceptability of those stored at 6 months (4.66±1.10) and 9 months (3.9±1.46). These results are consistent with the work done by Dereje and Abera (2020) in which pretreatments and drying methods had the potential to extend the shelf-life of dried mango slices up to three months. Literature showed that package is susceptible to gas transfer including O_2 to food, CO_2 to outside of the package, and the passage of volatile compounds from outside to food (Severi *et al.,* 2011). Peychès-Bach (2009) also demonstrated that polyethylene packaging has lower resistance (barrier property) to moisture vapor. These data are corroborated by Fellows (2011) who reported that the stability of dried products depends on the moisture in the air and the type of product especially products that absorb moisture from the air such as dried fruits (mango, pineapple and dried vegetables).

This study showed that storing time of dried mango slices pre-treated with meta-bisulfite and then wrapped in polyethylene plastic film at 25°C is three months. The biochemical, microbiological and sensory characteristics of dried mango slices decrease after three months of storage. For a better suitainability and market quality of the dried mango slices produced in Côte d'Ivoire, the production units need to improve the packaging of their products and apply HACCP plan.

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How to cite this article:

Kouamé Elie Fokouo, Kouakou Nestor Kouassi, Marc Adou, Yao Denis N'dri, Kablan Tano and N'Guessan Georges Amani. 2022. Influence of Storage Time on the Physicochemical, Microbiological and Sensory Characteristics of Dried Mango Slices (*Mangifera indica* L. Var Kent) Produced in Côte d'Ivoire. *Int.J.Curr.Microbiol.App.Sci.* 11(10): 158-167. doi: https://doi.org/10.20546/ijcmas.2022.1110.019