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Effect of Different Temperature Regimes on Duration of Fruit Softening and Sensory Evaluation of *Dacryodes edulis*

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Abstract: The fruits of *Dacryodes edulis* are seasonal and the duration of fruit softening and sensory evaluation is unknown. The effect of different temperature regimes on 3 sizes of fruits were evaluated to asses the duration of fruit softening and sensory evaluation. The duration of fruit softened at 50, 75 and 100°C were 1.5±0.5 to 13.5±0.5 min were significantly the same (p = 0.05) and significantly different (p<0.05) from fruit softened at 0 and 25°C which took 900±100 to 1450±50 min to soften. The sensory evaluation was significantly best for fruits softened at 75°C, followed by 50°C. The large fruits performed better than medium and small fruits. The different temperature regimes had effect on duration of fruit softening and sensory evaluation. However, it is recommended that, fruits of *Dacryodes edulis*, which are intended for eating, should be softened at water temperature regimes of 50 to 75°C.

Key words: Temperature regime, fruit softening duration, sensory evaluation

INTRODUCTION

Dacryodes edulis G. Don. H. J. Lam commonly called African pear is an economic fruit in Southeastern Nigeria[1]. It is a widespread plant in the Gulf of Guinea[2]. The fruit is commonly used in the cross-boundary trade between Cameroon, Gabon and Nigeria[3].

The immature fruits are orange-red in colour and turn black at maturity, which are harvested[1] and eaten. The fruit vary greatly in colour and shape, pulp to seed size and price per kilogram of fresh pulp[4]. The fruit consists of seeds, which are surrounded by mesocarp, which is part of the fruit that is eaten. The mesocarp is rich in edible vegetable fats and oil[5], which can be used for the manufacture of soap, margarine, paints, cosmetics, resin, polish, wood vanish and skin cream[6].

Temperature is very important for softening African pear. Okolie and Obasi[7] observed that softening temperatures of fruit showed that softening of the pear pulp was negligible at room temperature of 10 to 28°C but was most effective in the range of 60 to 85°C. They further opined that heat softening of African pear pulp was due to introduction of endogenous cell wall degrading enzyme by heat.

The fruit is usually subjected to heat either in water or directly on hot ash to soften the pulp before eating with either cooked or roasted corn. The processing temperature often impacts on the colour and taste of the fruit, which could affect its market acceptability. However, there is a dearth of information on the optimum temperature regime that would enhance market acceptability. This study were therefore designed to assess the optimum temperature that would enhance market acceptability of the fruit subject to various temperature regimes during the softening process.

MATERIALS AND METHODS

The experiment was conducted in the Biology laboratory at the Delta State University, Asaba Campus, Asaba, between July and November 2004 and repeated between July and November 2005. Asaba is located at 06° 14' N and 06° 49 E of the equator.

Fruits of *Dacryodes edulis* of various sizes were sourced locally. The fruits were sorted as small (<20 g), medium (21-40 g) and large (>40 g) following the categorization by Okorie and Ndubuizu[8]. The fruit colour was rated before softening at different temperature regime.

A batch of 255 fruits replicated 3 times and subjected to the following temperature regimes of 0, 25, 50, 75 and 100°C in water bath, until the mesocarp softened. The duration of fruit softening was observed. The softened fruits were subjected to a test panel by a 15-meber untrained pnelist for simple sensory evaluation.

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A quality for rating scale recommended by Ihekoronye and Ngoddy[9] for untrained panel was used for the test parameters of colour, taste and texture. Attractiveness was used for colour, degree of softness was used for texture and taste was measured by degree of sweetness on a scale of 1 to 5. The data obtained here were subjected to analysis of variance and the means were separated using Standard Error and Duncan multiple Range Test.

RESULTS AND DISCUSSION

Softening duration: The duration of fruit softening declined with increase in the softening temperature. It was longest at 0°C of 1450±50 min and least at 100°C with a range of 1.5±0.5-3.5±0.5 min. With regards to fruit size, small fruits at different temperature regimes softened faster than the medium and large fruits Table 1.

The softening period were significantly low and comparable ($p = 0.05$) for 50, 100°C but were significantly different ($p<0.05$) from fruits softened at 25 and 0°C (Table 1). The duration of fruit softening declined with increase in temperature regimes. The softening period of 3.5±0.5-13.5±0.5 min for small, medium and large fruits for temperature regimes of 100, 75 and 50°C indicates that, in less than 14 min of hot water treatment, the fruit were softened and were ready for consumption or marketing. This observation agrees with the findings of Okolie and Obasi[7], who reported that, the most effective temperature for fruit softening is between 60-85°C.

Sensory evaluation: Sensory evaluation is a terminology; used to define the degree of excellence of a product, which includes appearance, nutritional contents, taste. Food is generally selected based on physical senses. These include smell, taste, touch, sight and even hearing[10].

Colour: The different sizes of the fruit, namely small, medium and large were rated black (5) before the softening process commenced at different temperature regimes. The colour of softened fruit had the best rating at 0°C and least rating at 100°C. The temperature of 0°C retained the colour of the fruits for all the fruit sizes.

There were differences in the colour of the fruits softened ($p<0.05$) at different temperature regimes. The fruit softened at 100°C was highly bleached irrespective of the fruit sizes (Table 2-4).

Taste: The taste of the fruit had the best rating for fruits softened at 75°C and was significantly better than fruit softened at other temperature regimes (Table 3). Also, the taste of a fruits generally increased with increase in the temperature regime up to 75 and declined at 100°C. for all the fruit sizes. Generally, there were no significant differences in taste between small, medium and large fruit sizes at all the temperature regimes (Table 3).

Texture: The texture rating of the softened fruits increased with increase in softening temperature up to 75 and subsequently declined at 100°C. Also there was no significant difference between the texture of fruits softened at 0 and 25°C but was significantly different

Table 1: Duration (minutes) of fruit softening under various temperature regimes of water

Temperature Regimes (°C)	Seed size: Large	Medium	Small	Mean
0	1450±50b	1450±50b	1450±50b	1450±50
25	1350±50b	1190±90b	900±100b	1147±80
50	13.5±1.5a	10.5±2.5a	6.5±1.5a	10.2±1.8
75	4.5±0.5a	4.5±0.5a	3.5±0.5a	4.2±0.5
100	3.5±0.5a	2.5±0.5a	1.5±0.5a	2.5±0.5
Mean	564.3±20.5	531.5±28.7	472.3±30.5	522.8±26.6

Table 2: Sensory evaluation panel scores for various sizes of softened pear subjected to varying temperature regimes (colour)

Temperature Regimes (°C)	Seed size: Large	Medium	Small	Mean
0	4.7±0.5c	4.6±0.5c	4.6±0.4c	4.6±0.47
25	4.5±0.5bc	4.3±0.4c	4.1±0.3bc	4.3±0.4
50	3.2±0.1b	3.4±0.1b	3.6±0.2b	3.4±0.13
75	2.4±0.3ab	2.5±0.2ab	2.6±0.2ab	2.5±0.23
100	1.2±0.06a	1.4±0.1a	1.8±0.08a	1.47±0.08
Mean	3.2±0.29	3.24±0.26	3.34±0.24	3.26±0.26

Values and means±SE for 15 observations (maximum score = 5, minimum score = 1) Different alphabets denotes significant difference ($p \leq 0.05$)

Table 3: Sensory evaluation panel scores for various sizes of softened pear subjected to varying temperature regimes (taste)

Temperature Regimes (°C)	Seed size: Large	Medium	Small	Mean
0	1.0±0.04a	1.2±0.06a	1.3±0.07a	1.17±0.06
25	1.0±0.04a	1.2±0.06a	1.3±0.07a	1.17±0.06
50	4.0±0.3bc	3.8±0.04b	3.7±0.03b	3.83±0.12
75	4.6±0.5c	4.7±0.5c	4.4±0.3c	4.57±0.43
100	3.9±0.4b	3.8±0.4b	3.8±0.2bc	3.83±0.33
Mean	3.04±0.26	3.02±0.21	2.96±0.13	3.01±0.2

Values and means±SE for 15 observations (maximum score = 5, minimum score = 1) Different alphabets denotes significant difference ($p \leq 0.05$)

Table 4: Sensory evaluation panel scores for various sizes of softened pear subjected to varying temperature regimes (texture)

Temperature Regimes (°C)	Seed size: Large	Medium	Small	Mean
0	1.6±0.2a	1.5±0.07a	1.5±0.05a	1.53±0.11
25	2.1±0.01a	2.1±0.04a	2.1±0.1a	2.1±0.05
50	4.2±0.4b	4.1±0.5b	4.1±0.04bc	4.1±0.31
75	4.7±0.4b	4.8±0.3b	4.6±0.4c	4.7±0.37
100	4.1±0.3b	4.1±0.2b	3.8±0.3b	4.0±0.27
Mean	3.34±0.26	3.32±0.22	3.22±0.18	3.29±0.22

Values and means±SE for 15 observations (maximum score = 5, minimum score = 1) Different alphabets denotes significant difference ($p \leq 0.05$)

($p<0.05$) with fruits softened at 50, 75 and 100°C (Table 4). The textures of various fruit sizes softened at the same temperature regimes, compared favourably ($p = 0.05$).

Generally the taste and textural ratings of the softened fruits were significantly best at temperature regime of 75°C.This was followed by fruits softened at 50°C. For colour rating, it was best at temperature regime of 0 and followed by that of 25°C irrespective of the fruit sizes. But the other sensory indicators are poor compared with its long duration in softening. Even though the duration of softening was lower at 100°C, the sensory indicators were generally depressed (Table 2-4). It would appear that the sensory evaluation of softened fruits was best appreciated at softening temperature regimes of 50-75°C. The softening duration for these temperature regimes were also within acceptable limits of about 4 to 10 min

CONCLUSION

The different temperature regimes had significant effect on duration of fruit softening and sensory evaluation. The study showed that *Dacryodes edulis* fruit subjected to 50-75°C of temperature regime softened between 3.5±0.5 to 13.5±0.5 min, were most appreciated but fruit softened at 75°C was significantly best. Also, the biggest fruit size (> 40g) had the best sensory evaluation. It is therefore recommended that fruits, which are intended for eating, should be softened at water temperature regime of between 50 to 75°C.

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