Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 1030-1033
Received: 23-08-2020
Accepted: 06-10-2020

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Standardization of process for preparation of osmo-dried guava slices cv. *Lalit* and *Shweta*

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Abstract
Technology for utilization of guava fruits for preparation of dried slices was optimized by osmotic dehydration technique. The guava fruits of cultivar *Lalit* and *Shweta* were selected for preparation of dried slices. Out of different pre-treatments, 6mm slice thicknesses and the use of 0.2% KMS+0.5% $CaCl_2$ guava were found most suitable with respect to moisture loss, drying time and sensory characteristics for further development of osmo-dried fruit slices. The slices were then kept in different osmotic solutions *viz*, 50^0B, 60^0B and 70^0B for 24 hour and dried in a cabinet drier at $55^0 \pm 5\ ^0$C to constant moisture content. The osmo-dried slices were found to contain 18.44 - 21.75% moisture content, 57.84 - 78.86^0 B TSS, 0.10 - 0.24% titratable acidity, 33.72 - 37.10% reducing sugar and 45.25- 51.82% total sugar.

Keywords: Guava, osmotic dehydaration, KMS, $CaCl_2$

Introduction
Guava (*Psidium guajava* L.) also known as 'apple of tropics' (Mehta *et al*., 2018) [19] and 'poor man's apple (Tripathy *et al*., 2016) [29] belonging to the family Myrtaceae is one of the commercial fruits of tropical as well as subtropical regions. Guava fruits contains 74–87% moisture, 13–26% dry matter, 0.5–1% ash, 0.4–0.7% fat and 0.6–1.5% protein (Bashir and Abu-Goukh, 2002) [1]. It is a rich source of vitamin C (260mg/100gm) (Menzel, 1985), pectin (1.8%) (Dhingra *et al*., 1983) [4] and vitamin A (250IU/100gm) (Dhillon *et al.*, 1987) [3] and contains high amount of dietery fibre. Besides, it also have appreciable quantities of niacin, thiamine, riboflavin, calcium, phosphorus and carotene. Keeping in view the availability of guava fruits for a limited period in the market (Mehta *et al*., 2018) [19] and high perishability (Kshetrimayum *et al*., 2015) [9], it becomes imperative to utilize these guava for value addition. However, the fruits mostly consumed fresh but can also be processed into various products like jam, jelly, toffee and squash (Hernanan *et al*., 1980; Singh and Dhawan, 1983) [7, 23]. There are several techniques of processing available for fruits and vegetable to increase the shelf life like freezing, drying, canning (Kushwaha *et al*., 2018) [14]. Among these, drying is one of the common and old method to preserve and extend the shelf life of guava (Patel *et al.*, 2016) [21]. This is based on the removal of water contained in the fruits or vegetables tissues (Kumar and Vikram, 2017) [10]. But drying at high temperatures and long times may cause damage in the nutritive and sensory characteristics, affecting flavor, color, and nutrients of dried food (Lin *et al*., 1998; Lenart, 1996) [16, 15]. Thus, osmotic dehydration is technological alternative to reduce the postharvest losses (Teles, 2006) [27]. It improves the economics of dehydration processes for extension of sustainability of drying. It is a useful technique for the production of safe, stable, nutritious, tasty, economical and concentrated food obtained by placing the solid food, whole or in pieces in sugar or salt aqueous solution of high osmotic pressure (Fito *et al*., 2001) [6]. Osmotic dehydration have been used in many fruits such asbanana fruit (Thippanna, 2005; Fernandes *et al*., 2005; Taiwo and Adeyemi, 2009) [28, 5, 26], papaya fruit (Kumar *et al.*, 2019) [14], guava fruit (Kannan and Thirumaran, 2001; Kumari *et al.*, 2018; Kushwaha *etal.*, 2018) [8, 13, 14], mango (Varany Anond *etal*., 2000; Patricia *et al*., 2008) [30, 22] and pineapple (Rahman and Lamb, 1990; Nazaneen *et al*., 2015) [23, 20]. No systematic work has been reported on osmotic drying of guava cultivar Lalit. The present investigations were undertaken to standardise the process for preparation of osmotically dried guava slices for increasing the consumption of this product among the consumers.

Material and Methods
The fruits of guava cv. *Lalit* and *Shweta* were used for preparation of slices. A known weight of thoroughly washed fruits was cut into 6mm slice thickness and seeds were removed. The slices of guava fruit were pretreated with 0.2% KMS+ 0.5% $CaCl_2$. Sugar syrup of three concentrations *viz*, 50^0 B, 60^0 B and 70^0 B was prepared.

Prepared guava slices were dipped in 50, 60 and70° Brix sugar syrup solution in the ratio of 1:2 fruit to syrup and allowed to continue osmosis for 24 hours at room temperature (12-24 °C). After taking samples for analysis, known weight of osmo-dried slices of guava were spread thinly on stainless steel trays which were kept in a cabinet tray drier for dehydration. Guava slices were thoroughly air dried at 55±5 °C temperature till the fruits reached the desired moisture content and product quality.

Analysis

Physico-chemical analysis of guava fruits and osmo-dried slices was conducted by using standard analytical procedures (Ranganna, 2014) [24]. Total Soluble Solid (TSS) contents of fresh guava fruit and osmo-dried slices was determined by hand refractometer. Sugars were estimated by Lane and Eyon method as given by Ranganna (2014) [24]. The pH of the guava was determined with the help of automatic pH meter (Deluxe pH meter model 101).Acidity was determined by titrating the aliquots against a standardized 0.1 N NaOH solution to a pink end point using phenolphthalein as an indicator (Ranganna 2014) [24]. Total pectin content of guava was determined by Care and Hayne's method as described by Ranganna (2014) [24]. For sensory scoring, the dried slices were served for evaluation by a panel of 7–9 semi-trained judges for various quality attributes *viz*., color, taste, texture and overall acceptability on 9 point hedonic scale. Data pertaining to sensory evaluation of fruit slices were analyzed according to Randomized Block Design (RBD) as described by Mahony (1985) [18] while, the data on chemical characteristics of fruit slices were analyzed statistically by following Completely Randomized Design (CRD) according to Cochran and Cox (1967) [2].

Results and Discussion

Physico chemical characteristics of fruits

A perusal of data in Table 1 reveals that the mean length, diameter and weight of guava fruit cultivar Lalit and Shweta varied from 5.76±0.16 cm to 6.41±0.17 cm, 5.91±0.09 cm to 6.83±0.19 cm and 115.74±6.64 g to 132.18±2.64 g, respectively. The data shown in Table 1 indicated that average total soluble solids in fresh guava fruits of cultivar Lalit and Shweta ranged between 11.38±0.280B to 12.08±0.340B, titratable acidity varied from 0.72±0.01 per cent to 0.63±0.05 per cent, respectively. A perusal of data in Table 1 indicated that pH value of fresh guava fruits cultivar *Lalit* and *Shweta* as 5.24±0.17 and 5.44±0.21, respectively. The content of total sugars and reducing sugars in fresh guava fruits cultivar Lalit and Shweta ranged between 8.56±0.25 to 5.10±0.10 per cent and 8.61±0.25 to 5.38±0.19 per cent and pectin content in fresh guava fruits were 1.40±0.01 per cent and 1.23±0.03 per cent, respectively.

Table 1: Physico-chemical characteristics of Fresh Guava fruits cv Lalitand Shweta

S. No.	Parameter	Varieties	
		Lalit	Shweta
		Mean±SE*	Mean ±SE*
Physical characteristics			
1	Length (cm)	5.76± 0.16	6.41±0.17
2	Diameter (cm)	5.91±0.09	6.83±0.19
3	Weight (g)	115.74±6.64	132.18±2.64
Chemical characteristics			
4	TSS (^{0}B)	11.38±0.28	12.08±0.34
5	Titratable Acidity (% as CA)	0.72±0.01	0.63±0.05
6	pH	5.24±0.17	5.44±0.21
7	Reducing sugars (%)	5.10±0.10	5.38±0.19
8	Total Sugars (%)	8.56±0.25	8.61±0.25
9	Pectin	1.40±0.01	1.23±0.03

*Means of 3 replicates

Physico-chemical characteristics of Osmo-dried slices

The data on physico-chemical characteristics of Osmo- dried guava fruit slices is presented in Table 2 and Table 3.

Moisture content

Among different osmotic treatments, the mean maximum moisture content (21.75 per cent) was recorded in 50^{0}B and minimum moisture content (18.44 per cent) in 70^{0}B (Table2). Between both cultivars, maximum moisture content 20.25 per cent in guava slices was found in Shweta and minimum moisture content 20.11 per cent was found in Lalit. Kumar and Vikram (2017) [10] have reported slightly higher moisture content 23.88 per cent- 29.40 per cent in dehydrated guava slices prepared from cultivar Allahabad Safeda. However, Madan and Dhawan (2005) [17] reported slightly lower moisture content ranging from 14.2 per cent 21.0 per cent in carrot candy.

Total Soluble Solids

The maximum total soluble solid (78.86^0 B) were recorded in 70^{0}B and minimum (57.84^{0}B) in 50^{0}B (Table2). Among cultivars, higher total soluble solids (68.530B) were found in guava slices prepared from Lalit as compared to Shweta (66.64^{0}B). Nazaneen *et al.* (2015) [20] recorded the TSS of dehydrated pineapple cubes ranging from 75.35- 55.89^0 B.

Titratable Acidity

The maximum titratable acidity (0.24 per cent) was recorded in 50^{0}B and minimum in 70^{0}B (0.10 per cent)(Table2). Among cultivars, more titratable acidity 0.17 per cent was found in guava slices prepared from Lalit as compared to Shweta (0.16 per cent). Similar values have been reported by Kumar and Vikram (2017) [10].

Reducing sugar

Among the different osmotic treatments the maximum reducing sugar (37.10 per cent) was recorded in 70^{0}B and minimum reducing sugar (33.72 per cent) was recorded in 50^{0}B (Table 3). Between both cultivars, maximum reducing sugar 35.62 per cent in guava slices was found in Lalit and minimum reducing sugar 34.79 per cent was found in Shweta. Kumar *et al.* (2008) [11] observed the reducing sugar content of osmo-vac dehydrated mango slices which varied from 35.25 per cent to 38.13 per cent.

Total Sugar

The maximum total sugar (51.82 per cent) was recorded in 70^0B and minimum total sugar (45.25 per cent) was recorded in 50^0B (Table 3). Between both cultivars, maximum total sugar 49.04 per cent in guava slices was found in Lalit and minimum total sugar 47.37 per cent was found in Shweta. Kumar *et al.* (2008) [11] observed the total sugar content of osmotic dehydrated guava slices which varied from 33 per cent to 60 per cent.

Table 2: Effect of different osmotic treatments on the moisture content, total soluble solids and titratable acidity of osmotically dehydrated guava slices of cultivars Lalit and Shweta

Parameters	Moisture content (%)			Total Soluble Solid (^{0}B)			Titratable Acidity (%)		
Treatment	Lalit	Shweta	Mean	Lalit	Shweta	Mean	Lalit	Shweta	Mean
50^0B	21.53	21.75	21.64	58.90	57.84	58.37	0.24	0.23	0.24
60^0B	20.38	20.29	20.33	67.84	65.52	66.68	0.14	0.15	0.14
70^0B	18.44	18.70	18.57	78.86	76.57	77.71	0.11	0.10	0.11
Mean	20.11	20.25		68.53	66.64		0.17	0.16	
$CD_{0.05}$ Variety (V)=NS Treatment (T)=0.48 V X T=NS				Variety (V)= 0.23 Treatment (T)= 0.28 V X T = NS			Variety (V)= NS Treatment (T) = 0.03 V X T = NS		

Table 3: Effect of different osmotic treatment on reducing sugar in osmotically dehydrated guava slices cultivar Lalit and Shweta

Parameters	Reducing sugar (%)			Total sugar (%)		
Treatment	Lalit	Shweta	Mean	Lalit	Shweta	Mean
50^0B	34.25	33.72	33.98	47.15	45.25	46.28
60^0B	35.52	34.10	34.67	48.15	46.25	47.21
70^0B	37.10	36.55	36.82	51.82	50.62	51.22
Mean	35.62	34.79		49.04	47.37	
$CD_{0.05}$ Variety (V) = 0.05 Treatment (T) = 0.06 V X T = NS				Variety (V) = 0.08 Treatment (T) = 0.10 V X T = 0.14		

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