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Research Article

Conversion of Khadrwai Dates from Khulal to Tamar through Various Practices

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Abstract

Dates have been an important basic food for several cultures all over the world and they are still consumed widely over thousands of year. The aim of our study was to protect khadrwai dates from monsoon season and minimize post-harvest losses. For this purpose, some bunches were wrapped with polythene plastic sheet, some covered in sacks and others remained open on date palm. Date samples were collected during Khalal, Rutab and Tamar stage by weekly intervals. Chemical and physical characteristics were determined using published procedures. Result showed firmness was more in polythene plastic dates about 4.733, 4.46 and 1.6 during every stage and other conditions have less firmness. Brix % gradually increases during all stages. At full ripening stage, brix % was near about 30 - 40%. Color changes during ripening from light yellow at Khalal to golden brown at Rutab stage and then converted to dark brown color at Tamar stage. Moisture content was decrease with the passage of time. At Tamar stage, moisture content was about 15 % which was beneficial for long term storage. The highest losses on date palm were observed in sack dates due to shrinkage of size and bitter taste. Monsoon season less effected on opened date palm. Polythene plastic condition is best for maximum production and minimum losses on date palm.

Keywords: Khudrwai Dates; Khalal Stage; Tamar Stage; Protection; Spoilage

Introduction

Pakistan is blessed with vast agriculture resources. In Pakistan date palm is an important cash crop. It is believed that dates were cultivated about 8000 years ago in Iraq. There are 200 varieties of dates like Ambera, Barhi, Deglet noor, Halawy, Hayani, Iteema, Kalmi, Khadrawy, Khola, Khudri, Khadrwai, Khola, Khudri, Mabroom, Maktoom, Medjool, Migraf, Safawi, Sukkari, Thoory, Warehouse and Zahidi [1]. Khudrawi Date is a single seed-ed berry with a pericarp and fabulous endocarp. Khadrwai dates are sweet and soft. They change color from orange brown to light brown with medium to broad oblong size. They are considered among the best dates both in texture and flavor. Mid-season khadrwai dates are ripe [2]. Dates Medjool is a healthy fruit. Most people find the dates to be dried fruit. The Medjool dates are usually picked, washed, sorted and packed from the date palm [3].

Depending on the sugar concentration i.e. sweetness, climate condition and market demands, the dates can be harvested at Khalal level [4]. Date fruit can be eaten at the Rutab stage but the fruit typically matures fully on the tree and is harvested at the Tamar stage. The climber must ascend unassisted to harvest the khudrwai dates, taking with him a rope that will support him when he reaches the top. Then bunches then cut down and lowered to the table. The dates are considered high-energy food with sugar and fiber, however, and are therefore good for people [5]. When the dates are left on the palm the will turn into Tamar stage at which they have the least amount of moisture and they are self-preserving [6,7].

Khudrwai dates are eaten in various processed ways, fresh or dried. In the ripe stage ('Rutab' stage) they are also eaten freshly picked. This stage has a soft texture and is crisp to flavorful. Dates are consumed in some cultivars at the point of physiological matu-

rity (the 'Khalal' stage). The stage in Khalal is colorful and crunchy. Many dates are eaten at a fully mature stage ('Tamar' stage). And flesh is dry in this stage. The date at this stage is distinguished by very low moisture content and is suitable to be consumed out of season for long-term storage. Losses occur at harvesting time [8].

Dates were a part of human diet having high levels of carbohydrates, minerals and vitamins, besides they also contain protein and fats are in small quantities. We have about 79.94g carbohydrates, 5% vitamin A, 10% niacin, 16% pantothenic acid and 19% pyridoxine, 11% iron, 13% manganese, 13% magnesium, 40% copper [9]. There is a relationship between sweetness and amount of sugar which increase gradually during maturation [5]. As both a staple and a dessert fruit they have great significance. They all are commonly eaten during the month of Ramadan. Consumption is also strong during Christmas time. The dates found their way into sweets, chocolates, bakery goods, preservatives, sauces and cereals for breakfast. Dates intake has many intestinal disorders, lets you gain weight, increases energy levels and enhances [10]. Dates possess important radical scavenging activity due to the presence of non-enzymatic antioxidants (phenolic, flavonoid and ascorbic acid) and enzymatic antioxidants (catalase, peroxidase and superoxide dismutase), compounds known to have health benefits [11,12]. Dates are created with various medicinally essential nutrients for the ailment of any disease. The khudrawi date palm has been known as the 'tree of life' because of its high amount of nutritional value and its long existence. Date fruit was found to be helpful in glycemic and lipid regulation of diabetic patients and was also reported as having antioxidant and anti-mutagenic properties [13].

Date characterizations based on various ways. The fruit flesh wright, flesh thickness and pit weight were used in physical characterization. Many of the studies have used chemical characterization to test their carbohydrates, minerals, vitamins and proteins. Firstly, it relies on physical properties which are then open to chemicals. The date's chemical and physical characteristics influenced their mechanical and rheological properties, which is a firmness and quality indicator. Features of size and shape are most commonly used in the sorting and sizing of dates [14].

To our knowledge, there is minor report on the khudrwai dates under different conditions for more growth. The goal of this research was to study the fruit quality properties of khudrwai dates at each stage of maturity affected by which condition. And determine which condition is appropriate for use as a practical post-harvest treatment to improve its rate of production.

Pakistan is one of the main growers of dates. It follows Egypt, Saudi Arabia, Iran and U.A.E in the list of top date producing countries with 10% share of global production. Dates are grown in all four provinces of Pakistan. Important dates producing provinces are Sindh (Khairpur and Sukkur), Balochistan (Makran and Panjgoor), Khyber Pakhtunkhwa (D. I. Khan) and Punjab at Jhang, Muzafargarh, Bahawalpur and D. G. Khan [14].

Pakistan is an ideal place for date cultivations and productions of dates in Pakistan during the last 4 years are given in table 1.

The area under cultivation and production in Punjab about last 4 years are given in table 2.

Year	Area (hectares)	Production (tons)
2014 - 2015	91145	537204
2015 - 2016	97107	467756
2016 - 2017	60644	438989
2017 - 2018	98415	540606

Table 1: Cultivation and production of date fruits in Pakistan.

Year	Area (hectares)	Production (tons)
2014 - 2015	5781	44041
2015 - 2016	5783	42931
2016 - 2017	5776	43548
2017 - 2018	4930	37792

Table 2: Cultivation and production of date fruits in Punjab.

Source: Government of Pakistan, Ministry of Food, Agriculture and Livestock, Islamabad.

Materials and Methods

Date samples

The experiments were performed by collecting Khudrwai dates samples in three conditions (open, polythene plastic sheets and sacks) at three separate maturity stages (Rutab, Khalal and Tamar) to characterize the rainy season ripening process and rate of production from Agriculture Ayub Research Faisalabad. Some of the sampling dates were sorted, cleaned for physical and chemical analysis, at each maturation stage. Then each sample was packed in plastic polystyrene box and stored at temperature of 25°C and humidity of 75 percent.

Chemical and physical analysis of date samples

Moisture content, firmness, color and brix were analyzed at different stages of all three types of khudrwai dates at 25°C storage.

Weight loss

At each stage the Khudrwai dates of each condition were used for measurement. The dates were separately taken to the laboratory and weighed by a weighing balance, one by one. The findings reported have been expressed as a percentage of weight loss over initial value [5].

Moisture content

Samples were analyzed for moisture according to AOAC method. This method depends on measuring the mass of water in a known mass of sample before and after the water. 5g of each sample drying in an oven at 105°C for at least 18 hrs.

Where W1 = Weight (g) of sample before drying and W2 = Weight (g) of sample after drying. To achieve an exact calculation of the moisture content, all water molecules initially contained in the product must be separated without altering the mass of the date samples [13,15].

Firmness

A texture analyzer was used to determine firmness. Comparably, thicknesses were taken two readings per khudrwai condition. Check firmness at room temperature of about 25°C with cylindrical puncture probe with a diameter of 7 mm. The probe's passing speed and all test puncture depth were 0.2 mm/sec and 2 mm respectively. Maximum force was reported as indication of firmness during the punching process [16].

Total soluble solids (Brix %)

Date flesh of each condition was taken at each point of the Khala, Rutab, and Tamar and grinded by pestle in a mortar at room temperature of 25°C. Juice was obtained by pressing muslin cloth over the pulp. For the determination of TSS a hand refractometer has been used. A drop of solution was poured into the inner face of the refractometer cover and firmly presses the cover against the glass prism. Then, the percentage of solid was read. Result were expressed as percent of total soluble solid (Brix %) in juice at 25°C [5].

Color

The color of date samples was evaluated using a modified method. Pictures of the date samples were taken in a fully closed white cardboard box using a digital camera. During photography the option flash was kept off. The gap from camera to box bottom was 30 cm. For all samples the relative location of the camera and the sample is kept the same. Color was calculated inside the software's "Lab" mode. The color measurement tests were performed in triplicate [16].

Results and Discussion

Dates of khudrwai variety at each maturity stage were treated. The treatments were performed on date palm by applying different conditions (Opened, wrapped in polythene plastic sheets and in sacks) on the dates. Different tests were also performed for physical and chemical analysis after harvesting at each maturity stage to determine which condition was good for high productivity.

Weight loss

Samples of khudrwai dates at different conditions on each maturity stage were observed. For determination the quantity of dates, weighing balance was used. Open dates at Khalal stage was 55 kg and after conversion into Tamar stage the weight was 45 kg. Therefore, during conversion, the observed total weight loss was 10 kg which was about 19%. In open condition dates take much time to become ripe to convert from Khalal to Tamar stage. They were maximum in number and thin in size as compared to others polythene plastic dates and bag dates. Weight of polythene plastic sheeted dates at Khalal stage was 21 kg and at Tamar stage was 19 kg. Weight loss with polythene plastic sheet was 10%. A significant difference was observed that Polythene dates were ripen frequently and 90% Tamar dates were produced. Like open dates they were also thin in size. Tamar stage is a fully ripened stage and at this stage weight loss was controlled. In sack, weight of dates at Khalal stage was 9 kg and after the conversion into Tamar stage weight was 3 kg. Observed weight losses were 6.66% and produce 33.3% of Tamar dates. The result regarding weight losses are in table 3. They were very thick in size. Figure 1 shows the percentage of gain and loss of khudrwai during conversion of Khalal stage to Tamar stage by applying (Opened, wrapped in polythene plastic sheets and in sacks) conditions. In sack, maximum production losses were observed due to improper respiration process. Weight loss is a physiological event caused by loss of water from the fruit surface to the surrounding atmosphere and loss of carbon on formation of CO_2 during respiration [17].

Date Palm Conditions	Weight at Khalal stage (kg)	Weight at Tamar stage (kg)	Loss (kg)	% weight losses (%)
Opened	55	45	10	19
Polythene plastic sheeted	21	19	2	10
sacked	9	3	6	66.6

Table 3: Weight loss of date fruit during different condition on date palm.

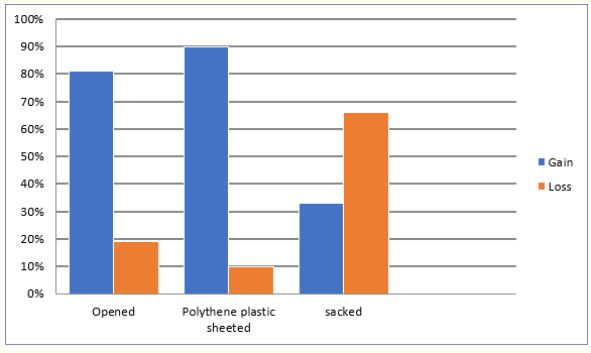

Figure 1: The percentage of gain and loss of khudrwai during conversion of Khalal stage to Tamar stage by applying various conditions.

Moisture content

Moisture is a good parameter for food spoilage and acceptability, the moisture content of the three stages of dates (Khalal, Rutab, Tamar) in different conditions were investigated. In open dates, at Khalal stage moisture content is 54%. At Rutab stage 33% and at Tamar stage 15%. In polythene plastic dates moisture was 57% at Khalal stage and at Rutab stage it was 35%. At Tamar stage moisture was 14% in polythene plastic conditioned dates. In sack dates moisture content was 51% at Khalal stage. At Rutab and Tamar stage it was 32% and 16% in sack dates respectively. The results regarding moisture content are in table 4. From Khalal to Rutab stage moisture content was decrease. At this stage the dates will be non-perishable and can be store for longer period of time and can also be prevented from microbial attack yeast and mold. The high moisture content will facilitate spoilage of dates and low moisture content will leads to dry dates and they are not acceptable to consumer. Moisture content is dependent upon climate conditions, harvesting period and drying conditions [5,18].

Date Palm conditions	Khalal	Rutab	Tamar
Opened	54	33	15
Polythene plastic sheeted	57	35	14
Sacked	51	32	16

Table 4: Moisture content of date fruit during different condition on date palm.

Firmness

Firmness is one the main quality parameter in sensory acceptance of the date's fruits by the consumer. Texture Analyzer instrument was used for the evaluation of texture quantitatively. Firmness is calculated as maximum force required form the texture test (N). In open dates initial firmness was 3.81N in khudrwai dates at Khalal stage. At Rutab and Tamar stage firmness was 4.24N and 1N respectively. Khalal fruits that lost their hard and crisp texture have lower quality and price. In polythene plastic sheeted date's firmness was 4.73N at Khalal stage. At Rutab and Tamar stage firmness was 4.46N and 1.6N respectively. At Khalal stage of sack dates, firmness was 4.37N. At Rutab stage firmness was 5.14N and at Tamar stage was 0.9N in sack dates. The result regarding firmness are in table 5. Firmness loss could also be linked to the action of softening promoting enzyme such as polygalacturonase [19]. The higher water temperature caused disturbance in cell structure and membrane damage in fruit samples which was the source of decrease in fruit firmness [17].

Date Palm conditions	Khalal	Rutab	Tamar
Opened	3.81	4.24	1
Polythene plastic sheeted	4.73	4.46	1.6
Sacked	4.37	3.14	0.9

Table 5: Firmness of date fruit during different condition on date palm.

Brix

Brix (total soluble sugars TSS) were measured using refractometer. TSS is the main quality factors effecting taste and flavor. In open dates at Khalal stage 17.9% brix was observed. At Rutab and Tamar stage brix was 23.1% and 35.3% respectively. In polythene plastic sheeted dates, brix was 16.3% at Khalal stage. Then dates are changed into Tamar stage from Rutab stage. At Rutab stage brix was 23.4% and at Tamar stage brix was 41.7%. In sack dates at Khalal stage brix was 14%. At Rutab stage, brix was 23.4% and at Tamar stage brix was 31.5% The result regarding brix are in table 6. Result shows that TTS% increase progressively towards Tamar stage. Date ripening was in associated with an increase in total fruit soluble solids, which appears linked in increase to cell wall hydrolyzing enzyme during ripening. However, decline in moisture con-

tent and increase in sugar contents renders date extremely resistant to fungal spoilage after harvest. That's why, polythene plastic wrapped date showed much better result and increase shelf life. From the polythene dates were protected from the monsoon, Moisture and sugar content all were in controlled condition [18].

Date Palm conditions	Khalal	Rutab	Tamar
Opened	17.9	23.1	35.3
Polythene plastic sheeted	16.3	23.4	41.7
Sacked	14.0	23.4	31.5

Table 6: Brix of date fruit during different condition on date palm.

Color

The color of date plays vital role in the marketing value and quality index. Color variations were related to ripening process. The color of open khudrwai dates was observed. At initial stage (Khalal stage) the color was light yellow and at Rutab stage color was golden brown of open dates. After weekly interval at Tamar stage the color becomes dark brown. Polythene plastic sheet dates have light yellow color at Khalal stage and at Rutab stage golden brown color appears. At Tamar stage dark brown color was observed. In sack dates, color changes were also observed. At Khalal stage the color was light yellow and at Rutab and Tamar stage it turns into golden brown and dark brown color respectively. The result regarding color are in table 7. At elevated temperature, the main factors responsible for the darkening of dates are oxidative browning of phenolic compounds and sugar browning [16].

Date Palm conditions	Khalal	Rutab	Tamar
Opened	Light yellow	Golden brown	Dark brown
Polythene plastic sheeted	Light yellow	Golden brown	Dark brown
Sacked	Light yellow	Golden brown	Dark brown

Table 7: Color of date fruit during different condition on date palm.

Conclusion

The existing study revealed that the khudrwai dates in polythene plastic condition on date palm is best for maintaining production and quality rate. This condition showed result at each maturity stage (Khalal, Rutab and Tamar), involves weight losses, TSS, moisture content, color and firmness according to the demands. While the interaction of opened and sack dates decrease the production rate and increase the losses rate. These losses might be due to monsoon. Khudrwai dates of Polythene plastic sheet have thin size and good taste while on the other hand opened and sacks dates have reduction in size with the passage of time and have bitter taste. Due to the shrinkage of size more weight losses occur. It is especially important to developed polythene plastic condition during development of stages for best quality; minimize postharvest losses and protection against monsoon.

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