

Studies on ripening of dates from rutab stage to ripe dehydrated dates

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Abstract: The traditional dehydration processing of dates is rated as unhygienic and the product quality remains poor. Keeping in view the need for improved dehydration techniques, present study has been designed for producing quality dates with enhanced shelf life. The oven drying and solar dehydration technologies have been used in the study to convert rutab stage dates into table dates and compared with those processed through traditional sun drying method. The processed dates were subjected to physicochemical analysis and microbiological studies during six months shelf life storage. The oven drying ripening procedure resulted in dates with improved physicochemical and sensory characters. The microbial load of these dates also remained within acceptable limits.

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INTRODUCTION

Date (*Phoenix dactylifera*) is well known for its nutritional contents. It contains 1.9% protein, 70.6% carbohydrates, 2.5% fat, 1.2% minerals and 10% fiber¹. The dates are considered as prime fruit for their nutritional and therapeutic value. These have great use as nutritional treat during Islamic holy month of Ramadan. The fruit has been recommended in folk remedies for the treatment of various infectious diseases and cancer as it contains sufficient quantity of minerals and vitamins that help to prevent diseases². The dates are also a good substitute for refined sugar; researchers found that the consumption of dates might be of benefit in glycaemic and lipid control of diabetic patients³. It has been also identified that dates are having antioxidant and antimutagenic properties and were also found effective to reduce heart diseases⁴. Pakistan is the fifth largest date producer in the world, with cultivated area of 82 thousand hectares and annual production of 496.6 thousand tons⁵. The Aseel, Dhakki and Begum Jangi varieties are considered as the best of all date varieties grown in Pakistan.

It is required to convert the unripe dates into value added product through a dehydration technique. During conventional sun drying of dates, the unhygienic environmental conditions contaminate the dates with bird droppings and insect infestation. Moreover there is a great chance of fungal growth under high humid conditions. *Coliforms* and *Faecal coliforms* are frequently present in traditionally dried dates. The spoilage starts quickly under the influence of unfavorable climatic conditions. It results in a definite wastage of valuable consumable date fruits and minimizes the export potential of the produce. To curtail these losses, the traditional methods of date processing are

being replaced by improved techniques. Today, on the global level as well, the production, utilization and industrialization of dates are continuously improving⁶.

Keeping in view the growing importance of hygienically processed quality dates, The oven drying and solar dehydration technologies have been used in the study to convert rutab stage dates into table dates and compared with those processed through traditional sun drying method. In order to achieve this objective, the Aseel variety dates have been utilized which contains 75-80% sugars. The dates obtained from improved processing techniques and traditional methods were analyzed for their sensory, biochemical and microbiological attributes to evaluate the comparative changes occurred in processed dates.

MATERIALS AND METHODS

The dates (*Phoenix dactylifera* L. variety: Aseel) about 100 kg were procured from district Khairpur (Sindh) and transported to the laboratory.

Processing of dates

The received dates were properly cleaned and sorted out; approximately 945-960g of dates were separated from the batch which were very hard, immature, deformed and infested. The cleaned dates were then divided into three equal parts (33 kg each), out of which one portion was separated for processing in electric cabinet oven dryer; another for solar dryer and the third portion for traditional sun drying. The processes involved conversion of dates of Aseel variety (Rutab stage) into table dates in specified time interval.

One of the portions of dates was placed in electric cabinet oven dryer at 60°C for 22-24 hrs with hot blower circulating air inside the oven dryer. After completion of drying process; dates were

placed in a cold room at temperature 4-5°C. and packed in card box packets (each with a net weight of one kg of dates) after 3-4 hours of cooling. The processed dates were then subjected to sensory, biochemical, microbiological analysis and shelf life studies.

Similarly another portion of dates was placed in solar dryer of which the internal temperature raised up to 65-75°C due to black body radiation effect inside the dryer while outer temperature of the atmosphere was recorded about 35-45°C. This type of process usually takes about 2-3 days for drying. After dehydration; dates were placed for cooling at approximately 4-5°C. for 3-4 hours then packed in card box packets having a net weight of 1 kg and were subjected to sensory, biochemical and microbiological analysis and shelf life studies.

The remaining portion of dates was placed on mats in open atmosphere following traditional sun drying method, at 35-45°C. This type of drying process takes about 6-7 days for the maturation and drying of dates. After completion of drying process; dates were kept at 4-5°C for about 3-4 hours for cooling then they were packed in card box packets with 1 kg of net weight each and subjected for sensory, biochemical and microbiological analysis and shelf life studies.

Sensory evaluation

The sensory evaluation of dates was performed by a trained panel consisting of 15 assessors ranging from 20 to 45 years of age. Panelists were asked to evaluate the dehydrated dates obtained from three different processes for their color, flavor, texture, shape, damage, infestation and acceptability at 9-points hedonic score⁷. The score for each parameter was calculated as an average score awarded by the panel members. An overall quality score was also calculated and was evaluated on monthly basis up to six months.

Chemical analysis

The unprocessed dates (*Rutab* stage) and processed dates (traditional sun drying, electric cabinet oven drying and solar drying methods) were analysed for pH, acidity and total sugars⁸ and moisture⁹

Microbiological analysis

Both unprocessed and processed dates were examined for the comparison among differences recorded in order to get the real picture regarding to their microbiological status. Both unprocessed and processed dates were investigated for total aerobic count (TAC), total yeast count (TYC), total mould

count (TMC), total *coliforms* (TCC) and *Faecal coliforms*¹⁰.

RESULTS AND DISCUSSION

The dates (Aseel) were processed through different drying methods i.e. sun drying, oven drying and solar dehydration technology and the comparative physico-chemical analysis for both processed and unprocessed dates has been given in Table 1. Chemical characteristics of dates are considered of great importance in assessing the quality of produce. The high moisture content facilitates the spoilage and very low moisture content leads to dryness of fruit which remains unacceptable for consumers¹¹. Table 1 reveals higher moisture content in unprocessed fruit (41.8%) whereas it is at appropriately low level in the processed dates i.e. ranging from 14.9 to 18.4%. It is important to note that the ratio of moisture content is related to sugar content, since dates with low moisture content contained high sugar level and vice versa¹². Acid content tends to go down during maturation but in warm conditions and high humidity during maturity and harvesting time, acidity may increase. However during the course of this study the acidity does not changed significantly and was observed as 0.23 to 0.26%. Similarly pH was also affected insignificantly by the processing methods.

The change in color, flavor, texture and overall acceptability characteristics for processed dates during six months storage are presented in Figures 1-4. It has been observed that the oven dried processed dates are having a shelf life of more than six months when packed in a moisture vapor-proof packing material and stored under suitable storage conditions. The products are having considerably good natural flavor of dates with no off color and texture observed. The overall acceptability for dates processed by oven drying method was rated highest (8) on 9-point hedonic scale followed by solar drying method⁷. The score for traditionally dried dates⁵ was found poor.

The results for total aerobic count (TAC) are indicted in Table 2 shows high count (but within the normal range) in unprocessed and traditional sun dried dates but low count was observed in dates processed by solar and oven drying methods. The standard value for TAC has been prescribed as <10⁶cfu/g in fruit products¹³. High microbial count may reflect the quality issues and possible poor temperature control¹⁴. There is a positive correlation

between low aerobic plate count and longer shelf life of a fruit, thus it is required to avoid high microbial levels. Yeasts may cause spoilage at slightly lower levels (10^6 - 10^7 cfu/g) and grow slowly than bacteria¹⁵.

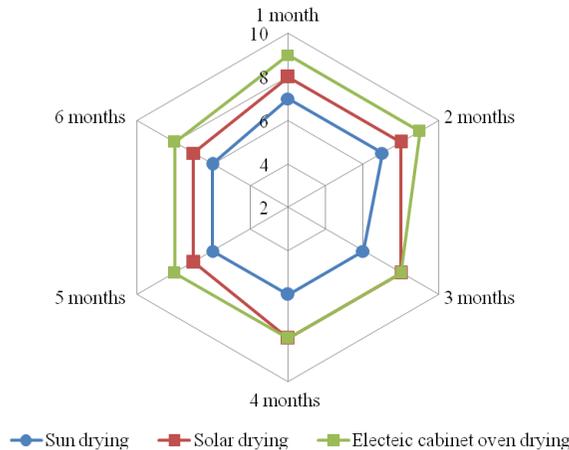


Figure 1: Effect of drying methods on dates color during six months storage.

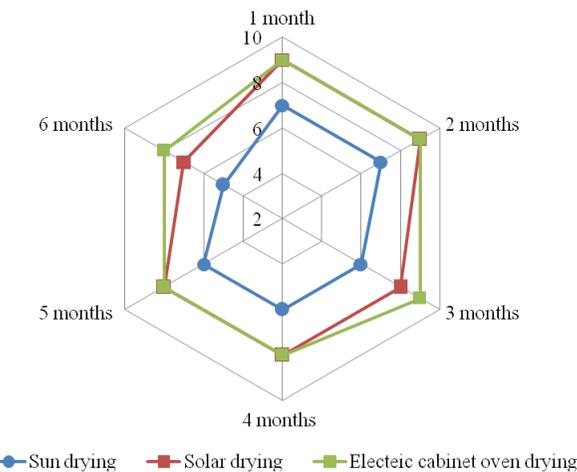


Figure 2: Effect of drying methods on dates flavor during six months storage.

The yeasts and moulds were generally present in both unprocessed and traditional sun dried dates but reduced significantly in electric cabinet dryer dates and solar dried dates. Heating is the most effective and accessible way of killing microorganisms and the rate of killing is directly proportional to the rate of increase of heating temperature¹⁶.

Table 2 shows the absence of *Faecal coliforms* in electric cabinet drying and solar drying processing techniques whereas it was found present in traditionally processed dates. Due to frequent

presence of *Coliforms* and *Faecal coliforms*, spoilage starts with the unfavorable climatic condition and results in wastage of valuable product hence minimizing export potential. During processing, the electric oven offers complete protection from dirt, dust and infestation. Apart from this, processing temperature controls the mould and yeast growth.

The quality of sun-dried product remains inconsistent, resulting in the exceedingly high economical losses for growers. It has been estimated that these losses exceed than 40% of the crop yield. Such high amount of food wastage adversely affects the input of food flow besides causing heavy damages to grower's economy and country at large.

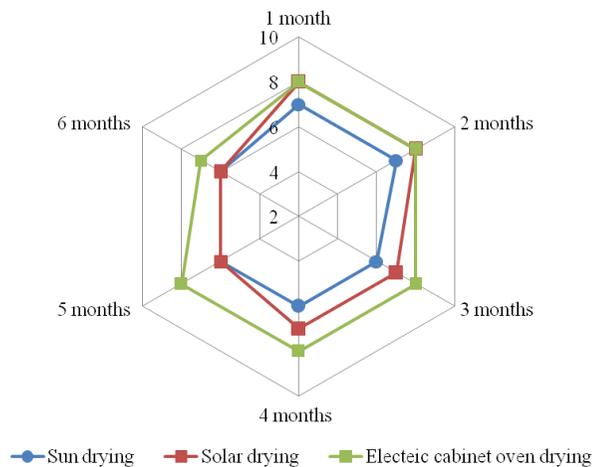


Figure 3: Effect of drying methods on dates texture during six months storage.

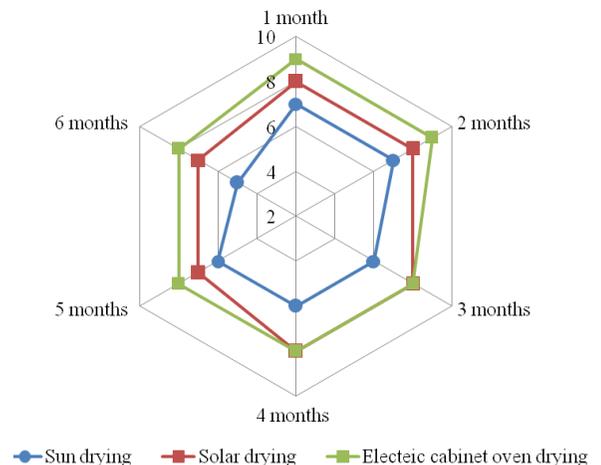


Figure 3: Effect of drying methods on dates acceptability during six months storage.

Table 1: Physico-chemical analysis of processed and unprocessed dates.

Parameters	Unprocessed Dates (Rutab)	Processed Dates		
		Sun Drying	Electric Oven Drying	Solar Drying
pH	5.8	5.9	6.1	6.0
Acidity (%)	0.23	0.25	0.26	0.24
Moisture (%)	41.8	18.4	16.2	14.9
Total Sugar (%)	38.1	65.2	60.3	61.2

Table 2: Comparative microbiological analysis of unprocessed and processed dates.

Sample Description	TAC CFU/g	TYC CFU/g	TMC CFU/g	TCC/g	FC
Unprocessed Dates	1.3×10^5	6.2×10^4	1.1×10^4	Up to 1100	Generally Present
Traditional Sun Dried Dates	5.5×10^4	3.0×10^3	2.1×10^3	Up to 1150	Generally Present
Electric Cabinet Dryer Dates	2.9×10^2	2.9×10^3	1.1×10^3	< 3	Absent
Solar Dried Dates	3.2×10^3	1.4×10^3	8.0×10^2	< 3	Absent

TAC: Total Aerobic Count, TYC: Total Yeast Count, TMC: Total Mould Count, TCC: Total Coliforms Count
FC: Fecal Coliforms Count

CONCLUSION

The oven drying technology for obtaining high quality dates with a desired level of moisture content, freedom from infestation, spoilage bacteria and moulds has been found ideal for prolonged shelf life. The conversion of raw dates into table dates occurred in 2-3 days and 20-22 hrs in solar and electric dehydrators respectively, with a delicious taste and excellent texture. Through adopting controlled curing and ripening procedures, dates being lost during processing will remain available to the consumers.

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