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Assessment Microbiological and Physicochemical Quality of Figs Dried in Adrar Region, Algeria

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Abstract

The figs are considered one of the fruits of paradise due to their great nutritional value that brings health back to the citizen, including protection from malnutrition. However, the consumption of the inhabitants of Adrar state for this fruit is very little and that is the lack of abundance in the market during the season, in addition to the rapid spoilage of this delicate fruit in case It was transported from the north due to the difficult delivery conditions, including the period and method of transportation to the province. Therefore, the solar drying team studied the preservation of this material through the solar drying method in order to preserve and store it for consumption throughout the year. In this study, the fresh figs were screened for the drying process using indirect solar, after that, the microbiological and physicochemical properties was tested in order to evaluate the nutritive value and hygienic quality of dried figs. The results revealed the presence of mesophilic aerobic total bacteria and coliform total, as well as the absence of *Salmonella Typhi*, *Staphylococcus aureus*, *Clostridium perfringens*, and certain yeast colonies. The pH value, activity water, dray matter, and ash assay findings were (0.41), (7.5%), (5.71%), and (5.71%), respectively, which do not impact the final quality of the dried goods and are satisfactory to the standards required by Algerian commercial legislation.

Keywords: Dried Figs, assessment, Microbiological quality, Physiochemical quality, Adrar.

1. Introduction

Solar drying is a method used for the purpose of drying agricultural products, which are widely spread, for the purpose of achieving Physico-chemical stability of the product by removing part reducing the moisture content, allowing safe storage for a longer amount of time, obtaining a new product with novel qualitative traits as well as a distinct nutritional and economic worth [1]. Also, the drying is contributing to a major reduction in weight and volume, minimizing

packaging, storage, and transportation costs, refer to the sorption isotherms investigation used to determinate the kinetics drying [2].

Many dried items, including figs, grapes (raisins), apricots, and plums (prunes), are consumed in Algeria as such, blended with other meals, or as components in the making of cakes and dishes, including couscous.[3].

The figs (*Ficus carica, Moraceae*) originated in Western Asia and spread to the Mediterranean where it's well- adapted to climates and soils of this region, it is one of the most rich fruits nutritionally , due to having major sources carbohydrates and others sources, including Vitamins A, B1, B2, C and minerals [4] .

On the other hand, figs are distinguished by their high perishability due to the susceptibility to microbiological spoiling, including mesophilic bacteria and even psychrophilic bacteria, when placed in cold storage settings at 4°C, resulting in nutritional component losses. [2].

The main micro-organisms spoilage are mostly composed of molds such as *Botrytis cinerea*, *Monilinia laxa*, *Alternaria alternata*, *Fusarium moniliforme*, *Rhizopus stolonifer*, *Aspergilus niger*, *Cladosporium herbarum*, and *Phytophora palmivora* and subsequently mycotoxin production, Additionally other microbial groups including mesophilic aerobic, lactic acid bacteria (LAB), *Staphylococcus spp.*, *Enterobacteriaceae spp.*, *Pseudomonas spp.*, and *Acetobacter spp* have been as a part of the microbial population in ripe fruits figs, which can cause fruit decay and health hazard and economic loss due to effects productivity [3].

As a result, drying solar is regarded as one of the new technologies used to reduce drying time and improve product safety. The packing in the vacuum thus allows for a reduction in metabolic activity and even microbial multiplication [5].

The Turkey is considerate one of the most countries to produce the figs dried products and biggest exporter on the world, in 2003, the turkey exported the total production of 28000 to 42000 tons with income of 8,064,000 USD. In contrary, a little production on dried figs were produced in Algeria [6].

Therefore, dried figs have a great economic value. Thus, the goal of this study was to examine the microbiological and physiochemical quality features of dried figs obtained by sun-drying and to inhibit or even abolish presumptive fungus multiplication, resulting in a product with adequate sensory and safety properties.

2. Materials and methods

2.1 Plant Material

The fresh figs were selected (handpicked) at the commercial ripening stage based on the homogeneous in color, size firmness and skin color without visual defects early in the morning, in immediately, the selected figs were transferred to the laboratory under cold conditions for preparing to indirect solar drying process [7].

2.2 Sample preparation and drying conditions

About 300 g of fresh fig were spread uniformly in a single layer in the sample tray, then introduced in a chamber of dryer solar. After that, the experiments were started at 80.00 a.m. to 20.000 p.m in continually and stopped during the night. The measure of moisture was carried each at 1-h intervals using the balance (OHAUS). The process was stopped when obtained the suitable weight and moisture level (fig1). The dried samples were packed in under the vacuum method and stored at ambient temperature (fig2) [6].

2.3 Microbiological analysis

Three independent replicates of 10 g of figs, after drying were kept in ice boxes transported to the laboratory of drying solar URER/MS Adrar, Algeria. Dried Figs were homogenized in 90 ml of sterile saline water of 0.1% (P/V) using stomacher mill. Obtained samples were fold diluted in 1/10, than 0.1ml, and plated on specific media. The mesophilic aerobic bacteria were done on PCA agar and incubated at 30°C for 48h. The enumeration of total coliforms were done on plate of VRBG agar and incubated at 30°C for total coliforms and at 44°C for faecal coliforms during 48 h.Yeasts and moulds were counted on OGA agar and incubated at 25°C for 4 days. For appropriate counting, we considered only the plate with 30 to 300 colony-forming unite (CFUs), expressing with log CFU-1 as a result [8].

2.4 Physicochemical parameters

2.4.1 Determination of Moisture and water activity

Moisture loss was measured during the drying process, which is computed using the following equation:

$$\text{Moisture (\%)} = (\text{Wo} - \text{Wf/Wo}) \times 100$$

Where Wo denotes the fresh fruit's original wetness and Wf denotes the final weight after drying.

During the drying process, water activity was also measured using a Hygrolab AW 500 analyser [9].

2.4.2 Determination of ash content

The figs (5g) are calcined in a muffle furnace at 550°C until a pale ash with a consistent weight is obtained [10]. The following formula calculates the proportion of organic substance MO:

$$MO\% = (Mi - Mr)/Mr.100$$

MO%: Organic matter.

Mi: initial mass of the sample (g)

Mr: final mass of the sample after drying (g).

The ash content (Tc) is calculated by following equation:

$$Tc = 100\text{-}MO\%$$

2.4.3 Determination of dried matter

The dry matter is determined on a sample of 10 ml of figs by drying in an oven at a temperature of 105 ° C until a constant weight is obtained [11].

2.4.4 Determination of pH

The pH of the raw whey is determined by a direct reading using a pH meter (PHS-38W Microprocessor) previously calibrated [12].

3. Results and discussion

The results shows the presence of diverse microorganisms in the samples E1 (fresh figs) and E2 (dried figs) with a varying microbial charge. Although, the bacteria, yeast and molds were decreased after the drying process. The mesophilic aerobic bacteria (MAB) in fresh figs presented highest value reached counts of 4.3 log CFU/g and decreased to (3.4 log CFU/g) in dried figs. on the contrary, the yeasts and molds reported lowest value reached 2.3 log CFU/g in the fresh figs and decreased to 1.2 log CFU/g of dried figs, Regarding the *Salmonella Typhi* and *Staphylococcus areus* were not detected to both samples fresh and dried figs [13].

The drying method reduced the microbial population, in agreement with the effects reported by M.C. Villalobos., 2016 [14], the effectiveness of this method depends on the temperature, the time of application and the initial microbiological load on the fruits. Nevertheless, the drying is not always enough to inhibit spore bacteria and molds, as observed in our study [9].

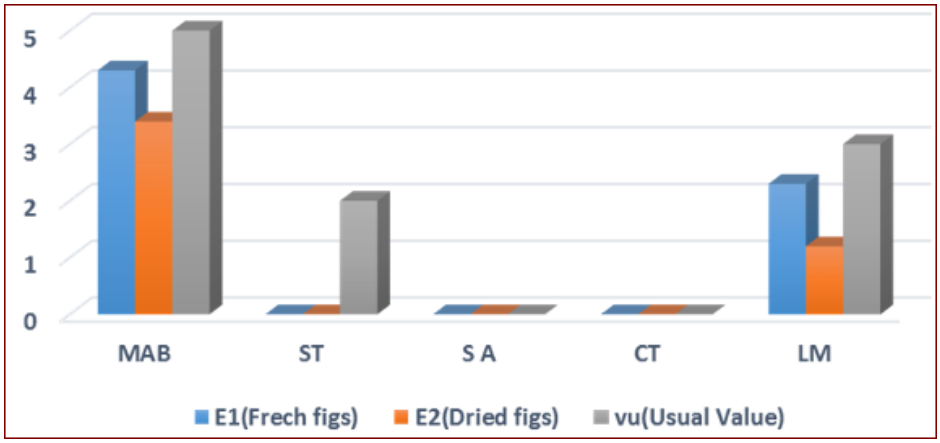
Table 1 summarizes the key physicochemical features of dried figs. The dry matter content of the dried figs is lower with a value of 7.50%, which means that the solar drying evaporates the most quantity of water figs with a value equal to 0.68 of water activity (A_w), 21, 51% of moisture content, and 5.71% for assay of ash, This demonstrates that the interruption of the enzymatic process nearly completely inhibits the growth of microorganisms [13]. The pH is

relatively low pH4.1, which is advantageous. Indeed, at this pH level, the rate and variety of microorganisms that cannot develop on the product, such as *Salmonella* and *Clostridium*, *Staphylococcus aureus*, are significantly decreased [15].

Figure 1. Trays loaded the dried figs

Figure 2. Dried figs packed under vacuum

Figure 3. Microbiological analyzes of figs before and after solar drying



MAB: Mesophilic aerobic Bacteria, St: *Staphylococcus areus*, ST: *salmonella Typhi*, CT: *Clostridium perfringens*, LM: yeast and models

Table 1: Physicochemical analyzes of dried figs

Parameters	Value
Moisture content	21,51%
Dried matter	7.50 %
pH	4.10
Water activity	0,68 %
Assay of ash	5.71%

4. Conclusion

The application of Solar drying in the conservation of agroalimentaire products, the figs as such, it's allowed a reduction or eradicate of the perissability in this sensitive product, and the availability at moment during the year, additionally to the suitable season of harvest. At the level of security and health, the drying process allowed us to obtain final products with suitable microbiological characteristics without any affected on consumer humans.as well, the obtained products had a greater homogeneity in their quality characteristics of physicochemical and value nutritive compared to the fresh products.

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