Analysis of the impact of climate change and storage methods on the quality of olive oil in Libya

Badereddin Algataa

Ph.D. Candidate

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Abstract: More pronounced climate change is a major challenge for the human population and the world economy. The increasing concentration of gases that create the greenhouse effect in the atmosphere is one of the causes of global warming. Climate change is influenced by both natural processes and human activity, in parallel with technological development. Climate change affects the cultivation of agricultural crops, of which the focus is on olives in this research. Olives are an important plant that many nations have adopted for food and as an oil in nutrition. Libya is one of these countries. The olive harvest in Libya begins in December and ends in March. The subject of this research is the analysis and analysis of the impact of climate change on the quality and quantity of olive oil produced in Libya. A physical-chemical analysis of olive oil produced in Libya was performed, and the obtained results were compared with the limit, standard values. In Libya, as well as in other olive growing countries, there is a need for research into the effects of climate change and their impact on the quantities and quality of olives and olive oil.

Key Words: Olives, Libya, climate, challenge, natural.

Introduction

The development of irrigation systems and other improvements in agricultural practice in Libya should contribute to increasing the yield of olives, the quality and quantity of olive oil, and economic development similar to those in Tunisia or Morocco. However, the observed trend of declining water resources and precipitation in the first part and projections for the second half of the 21st century do not allow increasing the distribution of water resources. Future irrigation systems in Libya will need to be sustainable and more wisely using water resources. Olive oil is mostly obtained in Libya in a traditional way, and olive trees are of good quality. Weather conditions have to a lesser extent influenced the quality of the oil, while the poorer conditions of storage, ie storage of olive oil, had a much greater impact. In this area, there is a huge area for improving olive growing in Libya. After examining the effect of time and storage, we can conclude: the impact of the storage of olive oil in Libya on the quality of olive oil is greater than the impact of climate change. Elevated temperatures and the presence of light in storage rooms are inadequate conditions that adversely affect the quality of olive oil. Climate change is the biggest and most serious challenge for the planet, humanity and the world economy. Numerous scientific studies and research have proven that a high concentration of greenhouse gases (GHGs) is responsible for global warming. Climate change is conditioned by natural processes and anthropogenic activity, which in parallel with technological and industrial development has become a dominant factor. Climate change, which is conducted by anthropogenic action (deforestation, irrigation, burning of fossil fuels, waste generation, etc.) affect all aspects of the environment and thus affect the quality of air, soil and water.

The analysis of olive oil

The degree of quality of olive oil is first and foremost influenced by acidity, which is thought to not exceed 0.8%. The content of free fatty acids in olive oil varies depending on the time of harvest, weather and climatic conditions, as well as the category of oil (extra virgin, virgin, olive oil, <0.8, <2 and> 2% , respectively). The composition and content of fatty acids are important for the quality and stability of olive oil. A higher oleic acid content is desirable due to its positive effects on human health. During maturation, its content changes as well as palmitic (decreases) and linoleic (increases) acids. A higher content of poly-unsaturated fatty acids is beneficial from a nutritional point of view but has the effect of reducing the stability of the oil. Extra virgin oil contains the highest percentage of triglycerides 98-99%, while the accompanying components are minimized. Triglycerides generally contain mono-unsaturated (oleic about 73%), less saturated (stearic and palmintic 17%) and more polyunsaturated fatty acids (linoleic and linoleic about 10%). Triglycerides are a soap component of olive oil, while the non-soap component is tocopherols (vitamin E), carotenoids, sterols, chlorophyll, phenolic compounds, phospholipids, etc.

The analysis of free fatty acids in olive oil is usually done using GC-FID (Gas Chromatography Flame Ionization Detection), since this technique has been proposed as the official method (Regulation (EEC) N8 2568/91, Annex X). However, other analytical methods have been developed for this purpose, such as HPLC, CEC (Capillary Electro Chromatography), or NMR (Nuclear Magnetic Resonance). Many efforts have been made to develop instrumental methods that can identify the components responsible for the organoleptic characteristics (taste and odor) of olive oils, as well as to eliminate subjectivity and other disadvantages that come from sensory evaluation in tasting panels. Traditionally, volatile compounds have been determined by GC / -MS (Gas Chromatography - Mass Spectrometry, coupled with mass spectrometry. Later, another approach was proposed for the determination of volatiles, based on the use of sensor arrays (electronic "nose"), which was able to evaluate the basic volatiles produced by oil. In some cases, the results obtained by electronic nose are compared with those obtained by other methods. On the other hand, GC is also used in the combination of sensor arrays.

The quality of extra virgin olive oil (EVOO) depends on the process that begins with the maturing of the olives and ends with storage. Therefore, it is necessary to take into account not only agronomic practices, raw materials, harvest, technology of storage and harvesting of fruits, but also other factors. The presence of air (oxygen), light and temperature changes are responsible for the deterioration of the process in EVOO as a result of oxidative and hydrolysis reactions. The shelf life of EVOO is estimated at 12-18 months. When stored properly in well-sealed packages, EVOO can withstand two years of storage, while maintaining its properties unchanged.

Oxidation is responsible for the deterioration of olive oil quality, counteracted by the antioxidant activity determined by the presence of polyphenolic compounds and tocopherols that increase the shelf life of the oil. The major oxidation-susceptible fraction is lipid degradation, which produces the production of carbonyl and aldehyde compounds, which leads to the development of poor aromas and, ultimately, to "oxidative degradability".

Auto-oxidation further contributes to olive oil degradation processes. This occurs even in the absence of light, when, initially, oxygen absorption leads to the formation of hydroperoxide. When olive oil is exposed to light, photo-oxidation is caused by natural photosensitizers, such as chlorophyll, which react with oxygen. Therefore, the storage conditions of olive oil are of primary importance, because the oil is produced for a limited period of time, it is consumed throughout the year. In fact, in order to maintain oils that have "extra virgin" or "virgin" oils, lipid oxidation products must not exceed the maximum limit values.

Olive oil quality research in Libya

Olive (Olea europaea) is a perennial evergreen plant that has been associated with humans since ancient times, which has been relied on as a source for the production of oils for human and domestic consumption. The expansion of olive growing along the coast of Libya and in some mountain areas, such as the Akhdar and Nefusa mountains, was possible due to climatic conditions favorable for its growth. However, with the increasing climate change in recent years, there has been variation in the production of olive oil in Libya. Olive cultivation is conditioned by climatic factors, of which the most important are temperature, regime and rainfall. Libya grows olives in areas characterized by rainy winters and dry summers with average annual temperatures ranging from 15 ° C to 20 ° C. Today, there are about 10 million olive trees in Libya that have so far provided for good production and meeting domestic needs. There are three local olive varieties (Andoran, Worsley and Karzai) as well as non-local Mistozah, Achamlala and Sfakien varieties from nearby Tunisia, followed by different Italian varieties, such as Manzanillo and Sevillano. Olives in Libya are an important fruit-considered plant that has been adopted by Libyans for use as a nutritional oil. The harvest of olives in Libya lasts more than four months, beginning in December and ending in March. The subject of this research is to analyze and consider the impact of climate change on the quality and quantity of olive oil produced in Libya, as well as packaging and storage impact. In addition, the results will suggest measures to mitigate the impact of climate change, which could contribute to a better quality of olive oil produced in this country. There is no doubt that consumers primarily evaluate foods according to their appearance (color, texture and so on), so this first assessment will influence their choice. This is partly because food color in general is often associated with their stage of maturity, the presence of contaminants or micro-organisms, the conditions of industrial processing, and more. On the other hand, there are associations with colors that correspond to foods, which are mainly obtained through learning and play an important role in consumer choice. The packaging method can directly affect the quality of olive oil by protecting the product from two major factors that cause the oil to deteriorate due to oxidation: oxygen and light. Moreover, it is crucial to avoid contact with inappropriate materials, such as metal vessels, that can initiate oxidative decomposition reactions, which affect the shelf life of the oil. For this reason, metal vessels that offer the benefit of full protection from light, oxygen and water vapor are now made of chromium-based steel instead of aluminum or aluminum alloys. The inside of the pan is coated with resins that protect the metal surface from corrosion. Although glass is a good barrier against moisture and gases, transparent bottles can lead to photo-oxidation. Commercial edible oils require direct light protection, so glass with additives and low light transmittance is used in the UV range. In addition to the type of packaging, storage temperature plays an important role. Pristouri et al. (2010) noted in their study that the shelf life of the oil is extended if the oil is contained in dark colored packaging stored in the dark at temperatures lower than 22°C.

Results of research

Tarhuna is a Libyan city, 65 kilometers southeast of Tripoli, in Murkub district. The city is named after the Berber tribe. Tarhuna County is an area of northwestern Libya where olives have been cultivated for centuries, and because of this fact, olive oil samples were selected and tested in the study. This research aimed to evaluate the effects of packaging and storage conditions on the quality of EVOO. The oils obtained have been tested from different types of olives (mainly Italian Enduri and local Hamudi and Gargashi), which come from the 2017/18 vintage. years. Since the storage period is very critical for the oxidation processes, we think that this moment is one of the most appropriate for assessing the suitability of the packaging and the storage temperature to slow the oxidation of EVOO, and for this reason we have studied the effects of storage mode and temperature on the quality of EVOO by observing changes in its chemical characteristics. The second objective of this study is to help producers in Libya identify the effects of short-term storage in flexible vessels often used for oil storage. It is best to store olive oil (EVOO) in containers that are impermeable, made of chemically inert materials such as glass or stainless steel, dark in color (opaque) to limit light absorption. An oil test was performed over a period of three months to determine the impact that the storage period and material of the storage vessels have on the quality of the EVOO. Oil obtained from different types of olives, after 30, 60 and 90 days of storage, were tested in two types of packaging. The oil was stored in two types of storage containers, that is, plastic containers of 15 liters capacity and plastic metalized bags of 5 liters capacity. It should be noted that there are some important limitations of this study because the storage conditions for olive oil were not ideal (storage temperature variable). We monitored three parameters in the samples that affect the quality of the oil: peroxide value, saturated fatty acid content and total phenol content.

In industrial processing, olives are selected by variety and, in many cases, origin: olives harvested from the plant and olives harvested from the ground. The sample is taken to determine the weight and then the fruits are stored together waiting for the processing to begin. The extraction process runs smoothly and the machines stop only for cleaning and maintenance operations. This type of extraction process optimizes mixing volume and reduces time by continuously adding decanters and consequently increasing factory performance. Adjusting the processing time and temperature with this system is a very easy operation, due to the product homogeneity and process continuity. The kneading times are programmed during the preparation phase by setting the mixing section with respect to the flow rate of the decanter and standard temperatures to achieve the proper temperature during the mixing process.

The first test of oil degradation in a warehouse is to measure the level of increase in peroxide value. The acceptable level of peroxide is less than 20 meq / kg of oxygen. In this study, after three months, the maximum allowable values in all samples were exceeded. Low-density polyethylene was the least resistant to oxidation, while metallized bags showed better resistance to oxidation. Peroxide value is a measure of primary oxidation of olive oil. Initial PV for both types of olive oil tested was within the permitted range (PV <20 meq / kg). The peroxide value was determined by the method of the International Union of Applied Chemistry, 2-501 (IUPAC 1992).

The oil (weighing 2.50 g) was dissolved in a mixture of acetic acid and chloroform in a ratio of 3: 2. To this solution was added 1 ml of saturated potassium iodide (KJ) (70 g KJ / 40ml water) and stirred for 1 minute. . The solution was then placed in a dark place for 5 minutes. Water (75 ml) was added followed by 2 drops of starch solution (2.5 g of starch / 100 ml of water). The solution was triturated with previously standardized 0.01 N sodium thiosulphate (Na2S2O3). The titrate volume was recorded and the peroxide value calculated and displayed as the meq of active oxygen / kg of oil.

The quality of EVOO is differently affected by temperature and storage because of the oxidative changes that occur in the oil. At the end of the three-month test period, no oil sample showed significant changes in the visual descriptors of clarity, green and yellow reflections, and the underlying positive sensory notes of bitterness were retained. The oil stored at 28°C showed an intensification of the oxidative processes leading to a significant presence of a flaky aroma.

Conclusion

Storage at a lower temperature can be a good way of storing to slow down the breakdown of oil during storage. It has been observed that despite the use of oil in which oxidative processes existed, the subsequent oxidation kinetics appeared to be very different when the experimental parameters (temperature and packing mode) changed. This fact suggests that storage conditions can prevent or at least slow down oxidation processes. It is known that oil in Libya is often stored in inadequate rooms at room or elevated temperatures, often exposed to light. Oil producers and traders in Libya are advised to store the oil in dark rooms at 16-18 ° C. According to the results of this research, there is a need in Libya for research into the effects of climate change and their impact on the quantities and quality of olives and olive oil. The use of water for the irrigation of olive orchards must be well planned to achieve maximum olive yield and good quality olive oil with minimal water consumption, which Libya is increasingly lacking. Global warming and increasing carbon dioxide levels will have the greatest impact on increasing the population of insects and pests that can threaten olive groves. It is therefore necessary to keep the orchards under constant control to determine the time, type and amount of insecticide to be applied. In line with climate change, olive harvesting time should be redefined to ensure a balance between high yield and quality of the final product. New olive breeding studies should focus on the behavior of

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olive genotypes in relation to climate change. Olive resistance to diseases or quality of table olives at elevated temperatures should be used as dominant criteria for the selection of new olive varieties. After examining the effects of weather and storage, we can conclude: the impact of the storage of olive oil in Libya on the quality of olive oil is greater than the impact of climate change. Elevated temperature and the presence of light in storage rooms are inadequate conditions that adversely affect the quality of olive oil.

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