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Utilization of Sunflower Seeds in Tahina and Halawa Processing

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ABSTRACT

Sunflower seeds were cleaned, roasted, decorticated and ground to a smooth thick oily suspension (tahina). Chemical analysis showed that sunflower tahina-like butter contained higher ether extract (62·3%) than sesame tahina (55·3%). Sesame tahina was higher in ash and carbohydrate contents, while the protein content was similar in both. Microscopic examination of stained films indicated that the system in sunflower tahina was essentially a suspension of solid particles in a continuous oil phase (water in oil system). Oil separation in sunflower tahina was followed during storage at room temperature for 90 days. The addition of glycerol monostearate had a pronounced stabilizing action resulting in reducing oil separation from 11·8% to 6·25%. The peroxide value of sunflower tahina oil increased during storage, reaching a maximum value after 60 days' storage, then decreased. The oxidative stability of sunflower oil was increased with the addition of 0·02% butylated hydroxy anisole (BHA) and 0·02% butylated hydroxy toluene (BHT).

Organoleptic evaluation showed no significant differences between sunflower and sesame halawas in texture and flavor except that the color of sunflower halawa was distinctly darker. The chemical analysis emphasized the high caloric, as well as nutritive value, of sunflower halawa. The use of Egyptian sunflower seeds in tahina and halawa tahinia-making would reduce the importation of sesame seeds.

INTRODUCTION

Sesame (*Sesame indicum*), one of the oldest vegetable oil crops cultivated by man, is used on a wide scale in many forms as food (Altschul, 1958). In Egypt, the bulk of sesame seeds, both locally cultivated and imported, is used for tahina-making,* the chief use of which is in the production of halawa tahinia† or Sokareia (El-Taibany, 1970). However, tahina is also consumed in the form of a spread mixed with treacle or honey (Ilany-Feigenbaum, 1965) or mixed with cooked chick-peas to prepare a popular dish known as 'Hommos-b-tehineh' (El-Iraqi, 1976).

Halawa tahinia has a high nutritive value in addition to its pleasant nutty taste and availability throughout the year at reasonable prices. It is rich in oil and sugars and has a reasonably high protein content (El-Dokany, 1965).

Recently, the industrial production of halawa tahinia in Egypt has increased because of the ever-increasing demand. From the economic point of view, sesame is in short supply; to satisfy the increasing demand, Egypt imported 13,500 tons of sesame seeds costing 7·6 million $ (FAO, 1981). El-Shirbiny *et al.* (1963) studied the process for the production of peanut butter and its possible uses in halawa tahinia-making. They found that the texture of the peanut butter was too dry and unsuitable for mixing directly with the syrup used for halawa manufacture and addition of cotton seed oil to raise the oil content to 58% was necessary.

Sunflower (*Helianthus annuus*) is considered to be one of the most important oil crops. In Egypt, the cultivated area of sunflower has been increasing recently with an annual production of 14,000 tons of seeds (FAO, 1981). The price of sunflower seeds was 160$/ton, compared with 448$/ton for sesame seeds (*Annual Bulletin of the Institute of Agriculture Economics and Statistics*, 1979).

The work described in this paper was carried out in an attempt to utilize sunflower seeds in the production of both sunflower tahina and halawa and to study their quality characteristics.

MATERIALS AND METHODS

Sesame tahina and halawa tahinia were supplied by ICA, one of the plants of the Egyptian Company for Foods (Bisco Misr). Sunflower seeds,

* Tahina is a butter-like substance prepared from decorticated, roasted ground oil seeds.
† Halawa is a product of tahina, prepared by adding sugar and flavourings.

variety Majak, used for the preparation of tahina-like butter were obtained from El-Nobaria Agricultural Station, Damanhour Governorate.

Technological procedures

Preparation of sunflower tahina

Sunflower tahina was prepared on a laboratory scale as follows. Clean, dry sand was spread on the trays of open roasters and heated for about 10 min until it reached a temperature of 150–155 °C. An equal amount of sunflower seeds was then mixed with the hot sand, and the mixture was stirred during roasting, which was completed in 12 min. After roasting, the sunflower seeds–sand mixture was sifted in order to recover the roasted sunflower seeds. The cool roasted seeds were decorticated manually (the hull represented 27·8 % of the total seeds), and the roasted kernels thus obtained were ground, using a blender, to obtain a smooth thick oily suspension (sunflower tahina-like butter). This was then placed in plastic containers which were closed and stored at room temperature.

Preparation of halawa tahinia

A sugar solution (3:1, w/v) was heated in a steam jacketed cooker, fitted with strong rotating paddles for mixing the sugar solution. After complete dissolution of the sugar, citric acid (1 g per kg of sucrose) was added. Heating was continued until the temperature reached 150 °C which was maintained for 10 min. An extract of the bark of *Radix saponariae albae* was added (Ilany-Feigenbaum, 1965) prior to the end of cooking and was vigorously mixed with the hot semi-solid sugar mass, the heating being stopped while the mixing was continued for 10–15 min. The cooked mixture was then poured hot on an equal weight of sunflower tahina-like butter with vanillin added at 0·1 % concentration. Sunflower tahina-like butter (containing 1 % glycerol monostearate) was used as such or after mixing with 50 % sesame tahina. The tahina-sugar mixture was tempered by hand and mixed gently until the correct consistency was reached. It was then divided, placed in plastic frames and left to cool at room temperature. To delay rancidity, butylated hydroxy anisole (BHA) and butylated hydroxy toluene (BHT), each at 0·02 % concentration based on oil content, were added to tahina used in halawa-making as an antioxidant (Deobald *et al.*, 1964).

Analytical procedures

Moisture, crude protein, ash and ether extract of tahina and halawa tahinia were determined as described by the AOAC (1975). The tahina samples were treated by a cold extraction procedure (El-Iraqi, 1976) in order to determine that ether extract content. The total carbohydrate content was determined by difference. The peroxide value of tahina oil was determined as described by the AOAC (1975). The oven storage test was used to determine the stability of sunflower oil. It consisted of holding the extracted oil (50 g) in capped glass jars in an electrically heated oven at 65 °C (Luckadoo & Sherwin, 1972). The end point was the time when rancid odor was detected in the sample by the majority of the organoleptic taste testers. The dye (Sudan III) solubility method was used to determine the type of emulsion in sunflower tahina-like butter, as described by Becher (1965).

Oil separation
The tahina sample was weighed (50 g) and carefully placed in a measuring cylinder (50 ml volume; 2·5 cm in diameter). The separated oil was allowed to float on the surface of the tahina whilst it was standing undisturbed. The result was recorded by reading directly the volume of oil which was separated during 90 days' storage at room temperature (25 °C).

Organoleptic properties
Taste testing was followed to detect differences in the halawa tahinia samples using a hedonic scale between 0 and 10 as described by Kramer & Twigg (1962). The tasters judged the samples for appearance, texture and flavor. The data were statistically analyzed by applying the analysis of variance method (Snedecor & Cochran, 1967).

RESULTS AND DISCUSSION

The results in Table 1 show that the moisture content of sesame tahina was 0·67 % whilst that of sunflower tahina was 0·84 %. Glabe *et al.* (1957) mentioned that the ground product of roasted sesame had a low moisture level (1 %). El-Dokany (1965) reported that the moisture content in white tahina (prepared from decorticated sesame seeds) ranged between 0·61 and 0·63 %. Tahina obtained from sunflower seeds had a higher ether

TABLE 1
Chemical Composition of Sunflower and Sesame Tahinas (On a Dry Matter Basis)

Constituents (%)	*Sunflower tahina*	*Sesame tahina*
Moisture	0·84	0·67
Ether extract	62·3	55·3
Crude protein	23·1	23·0
Ash	2·5	2·8
Total carbohydrates	12·1	18·9

extract content (62·3%) than that of sesame seeds (55·3%). El-Taibany (1970) found that fat contents in tahina obtained from Sudanese-imported sesame and local sesame seeds (mixed Saaidy, Behairy and Sharkkawy) were 54 and 63%, respectively, while El-Dokany (1965) reported that the oil content in white tahina varied from 57·8 to 65·2%. Sesame tahina was higher than sunflower tahina in ash and carbohydrate contents whilst the protein content was practically the same in both.

Microscopic examination of sunflower tahina-like butter indicated that the system consisted of disintegrated solid particles of the ground sunflower kernels in a continuous oil phase, simulating that existing in peanut butter (Singleton & Freeman, 1950) and sesame tahina (El-Taibany, 1970). The continuous phase acquired a red color whilst the dispersed particles remained unstained upon the addition of Sudan III dye. The consistency of the sample was changed to a thick coarse paste with the addition of water to the sample on a microscope slide, while no change in the system occurred upon the addition of oil, both tests indicating a water in oil (W/O) system.

The separation of oil in sunflower tahina-like butter and sesame tahina started 3 and 6 days after preparation, respectively. Figure 1 shows that the rate of oil separation was the same in both types of tahina during the first 30 days of storage, then it further increased in sunflower tahina, exceeding that in sesame tahina. The amount of oil separated reached 7·6% and 11·8% after 90 days' storage of sesame and sunflower tahinas, respectively. The difference in oil contents of the two types of tahina might explain the variation in the rate and extent of its separation with the elapse of time of storage. The addition of glycerol monostearate (GMS) to sunflower tahina-like butter had a pronounced stabilizing action, reducing the oil separation in comparison with the untreated tahina.

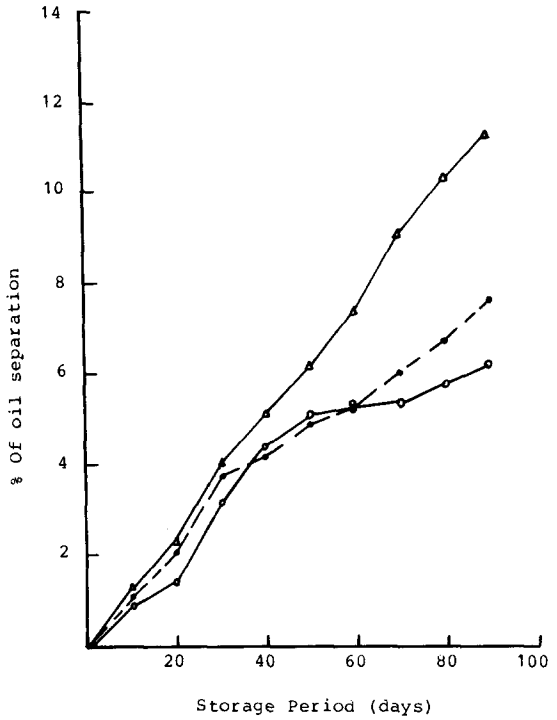

Fig. 1. Oil separation in tahina during storage at room temperature. (▽) Sunflower tahina; (○) sunflower tahina containing 1 % glycerol monostearate; (●) sesame tahina.

Although the separation occurred at the start, however, it amounted to 6·25 % only after 90 days of storage. Mickle *et al.* (1964) reported that emulsifiers with low hydrophil–lipophil balance value, such as glycerol monostearate, were the most effective in producing stable water in oil emulsions.

The results shown in Fig. 2 indicate that oil extracted from sunflower tahina-like butter had a higher peroxide value than that from sesame tahina, which was more resistant to rancidity. The antioxidant effect of sesame tahina might be due to the phenolic compound sesamoline (Glabe *et al.*, 1957), yielding, when hydrolyzed, the active sesamol, and also due to the tocopherols it contains (Langer, 1950). The peroxide value of sunflower tahina oil increased on prolonged storage, reaching a maximum value after 90 days, subsequently decreasing. This might be due to the decomposition of the peroxides to aldehydes and carbonyl compounds (Metwaly, 1973). Rancid taste was undetected in sunflower

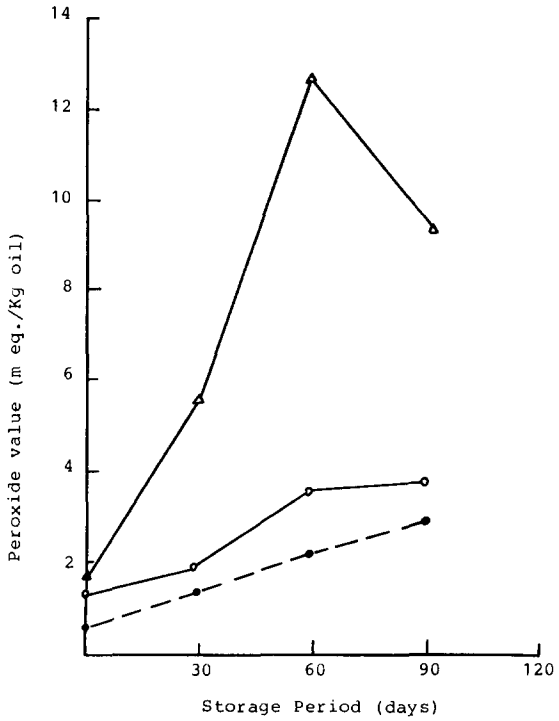

Fig. 2. Peroxide value in tahina oil during storage at room temperature. (▽) Sunflower tahina oil; (○) sunflower tahina oil containing 0·02% butylated hydroxy anisole and 0·02% butylated hydroxy toluene; (●) sesame tahina oil.

tahina-like butter after reaching the peak of peroxide value but was detected after the decomposition of peroxides occurred. The addition of antioxidants postponed the peroxide formation in sunflower tahina and increased its stability from 18 to 47 days (Table 2).

The mean scores of the panel evaluation of halawa characteristics are illustrated in Table 3. No significant differences between sunflower and sesame halawas were noticed except for the somewhat darker color of sunflower halawa. The flavor of sunflower halawa was quite acceptable and the panellists judged it as 'pleasant nutty'. The introduction of equal parts of sunflower and sesame tahinas in halawa-making resulted in a very desirable product as far as texture, flavor and color were concerned.

The chemical composition of halawa tahinia obtained from sunflower tahina-like butter (Table 4) showed close similarity to that of sesame

TABLE 2
Oxidative Stability of Sunflower and Sesame Tahina Oils

Treatments	*Stability evaluation (oven days)*
Sunflower tahina	18
Sunflower tahina containing 0·02% BHA and 0·02% BHT	47
Sesame tahina	68

TABLE 3
Organoleptic Characteristics of Sunflower and Sesame Halawas

Type of tahina in halawa	*Appearance (10)*	*Texture (10)*	*Flavor (10)*	*Total acceptability score (30)*
Sesame	8·8 a*	9·3 a	9·0 a	27·1
Sunflower	6·1 b	8·9 a	9·0 a	24
50% Sunflower + 50% sesame	8·1 a	9·4 a	9·3 a	26·8
Least significant difference	0·74	0·56	0·52	

* The mean value of quality parameters followed by the same letters are not significantly different at the 5% level of probability of the T-test.

TABLE 4
Chemical Composition of Halawa Tahinia (On a Dry Matter Basis)

Constituents (%)	*Sunflower halawa*	*Sesame halawa*	*50% sunflower + 50% sesame halawa*
Moisture	3·4	3·1	3·4
Ether extract	34·1	30·4	32·4
Crude protein	11·4	11·1	11·2
Ash	1·5	1·6	1·6
Total carbohydrates	53·0	56·9	54·8

halawa. The results further emphasize the high caloric, as well as nutritive, value of sunflower halawa.

The mixing of sunflower tahina with sesame tahina in equal parts for halawa-making is suggested as a means of doubling its production without having to import sesame seeds.

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