Formulation, Storage Possibilities, and Chemical Composition of Ready-to-Eat Honey-Tahena Paste

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ABSTRACT

The formulation of ready-to-eat spreadable paste of honey (62.5%) and sesame seed butter tahena (37.4%) along with artificial honey flavour (0.1%) and various additives is described. The system is a multiphase with a predomenant oil — dispersed in a continuous polar phase. Tween 80 and glycerol mono-stearate at 1% each gave the best stabilizing effect. Sorbitol (3%) decreases the desiccation of the paste, and lecithin (2%) improved its texture and spreadability. Changes occurred in moisture, free fatty acids, peroxide value, oil separation, and organoleptic properties of the paste, upon storage up to 100 days at 25° C and 6° C. Storage at 6° C was recommended for storing the aluminum tubes containing the paste (30 grams per each).

Moisture, protein, fat, carbohydrates, ash, iron, phosphorus and calcium contents of the paste were 8.00, 11.76, 23.10, 55.00, 2.00, 0.024, 0.501, and 0.114% respectively. The essential amino acids were quantitavely estimated.

INTRODUCTION

Ready-to-eat foods have become a well established household commodity in present day life. Their potentialities are limitless in developed as well as in developing countries with the continuous rise in the percentage of working housewives, resulting in the limitation of time for housework and real preparation. Moreover, there is particular need and ever increased attention being paid to formulation, preparation, and preservation of concentrated pasty foods. Some of the areas where such products are proving their value are:

a. Nutrition of growing school children.
b. Feeding of armed forces in time of combat and while on special missions.

The present work was conducted to formulate sweet pasty food preparation of high caloric and nutritive values using tahena and honey. The chemical composition of honey was studied and reported by Foda (7), and Mohamed *et al.* (15). Honey was also found to contain diastase, Foda (8). The kinds of tahena, namely red and white tahena

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are produced in Egypt, Mosleh (16). The chemical composition of tahena in Egypt was described by El-Taibany (6).

Accordingly, to prepare acceptable spreadable and nourishing sweet paste food, this work was undertaken with the following objectives:

1. Incorporation of honey, tahena, stabilizers, antioxidants and flavouring materials in suitable amounts to prepare a highly acceptable products.
2. Assessing the rheological characteristics of the product and its stability in regards to phase separation.
3. Investigating the chemical composition and the amino acids content of the formulated paste.
4. Investigation of the storage potentialities of the mixture when kept in aluminum tubes.

MATERIALS AND METHODS

Materials

Tahena: Shelled Saaidy seeds butter was used.

Honey: Honey was obtained from a farm located in Alexandria.

Chemical additives: The different chemical additives, namely, glycerol, lecithin, glycerol monostearate (GMS), Tween 80 (Polyoxyethylene-sorbitan monooleate), Span 60 (Polyoxyethylene-sorbitan monostearate), Sorbitol, sorbic acid, sodium benzoate, anthracine, and artificial honey flavour used throughout the work were obtained through the courtsy of the Ica plant of the Egyptian Food Co. (Bisco Misr) in Alexandria, Egypt.

Methods

Preparation of sweet paste: White tahena was passed in a colloidal mill for 2 minutes in order to reduce the size of particles and obtain a homogenous suspension. Honey and tahena were mixed in different amounts along with different proportions of chemical additives. The prepared samples were tested organoleptically. The mixtures receiving high organoleptic scores were used for further experimentations.

Paste storage: After thorough mixing the product was packed manually in aluminum tubes (30 grams each). The presence of air was avoided by pressing the paste throughly into the tubes. The tubes were then covered and throughly closed from the bottom. The containers were stored up to 100 days at different temperatures, namely, 6°C and 25°C.

Organoleptic tests: The products were examined for their colour, flavour, and texture by seven persons according to the following scheme (Kramer and Twigg, 12):

10 — Ideal, 9 — Excellent, 8 — Very good, 7 — Good, 6 — Fairly good, 5 — Acceptable, 4 — Fair, 3 — Poorly fair, 2 — Poor, 1 — very poor, and 0 — repulsive.

Oil separation: A sample (10 gram) of the product was spread for 10 minutes on a previously weighed filter paper, (Whatman No. 1). The increase in weight of the filter paper after removal of the paste was recorded as the weight of the separated oil left on the paper.

Analytical methods: The titratable acidity, the crude fat, and the ash content were determined as described by the A.O.A.C. (1). The peroxide value was determined as described by Jacobs (10), the moisture content was determined by the toluene distil-

lation method described by Pearson (17), the protein content was determined by the microkjeldahel method as described by The A.O.A.C. (1) for the total nitrogen, then calculating the protein content by using the factor 6.25 as described by Mohamed *et al.* (14). Total sugars content was colourimetrically determined by the anthrone method reported by Friedman *et al.* (9), using the Fisher colourimeter at 620 mμ. Minerals were determined using dried paste according to Chapman and Pratt (3); Calcium and magnesium were determined by the ethylene diamine tetracetate (Versenate) method using eriachrome black T and ammonium purpurate indicators for calcium plus magnesium and calcium respectively, Cheng and Bray (4). Phosphorus and iron were determined colourimetrically using a Fisher II colourimeter according to methods described by Toth *et al.* (19).

For the determination of essential amino acids, the methods reported by Block *et al.* (2) was followed for the acid and alkaine hydrolysis of the samples. The monodimentional descending multible development technique of paper chromatography was employed for the determination of the amino acids. Whatman No. 1 filter paper was used and the lower edge of the paper was serrated before applying the samples. The solvent used for the separation was n-butyl alcohol: acetic acid: water 26:44:34. The movement of the most rapidly migrating amino acid was monitored by using a reference spot of ethanolic neutral red as suggested by Mikes (12). Tryptophan was determined colourimetrically in the alkaline protein hydrolyzate according to the method of Miller (13) using paradimethyl amino benzaldehyde. Standard curves showing the graphical relationship between the concentrations and the corresponding optical densities were constructed for each amino acid.

RESULTS AND DISCUSSION

Honey-tahena paste formulation: The amount of honey and tahena to be mixed to give an acceptable mixture were investigated in the presence of artificial honey flavour. A mixture of additives was added, containing lecithin, sorbitol, sorbic acid, sodium benzoate and anthracine in the following percentages of the paste: 2, 3, 0.05, 0.05, and 0.017 respectively. The formula of the honey-tahena paste which contain honey (62,5%), and tahena (37.4%) and 0.1% honey flavour showed an excellent rating organoleptically and was used throughout further experimentations. This mixture after preparation had a PH value of 5.2.

System characterisation: The system was examined using the dye solubility method, Sherman (18). Upon the addition of 'Brilliant blue' the polar phase acquired its colour. Microscopic examinations of thinly spread samples of honey-tahena paste indicated that the system consisted of disintegrated solid particles of varying size and shape, besides discontinuous oil phase which contained suspended particles. Addition of water to the sample on the microscopic slide resulted in extention of the continuous polar phase and dilution of the suspended particles without any change in the system. Conversely, upon addition of oil, the consistency and fluidity of the whole system were changed to a thick coarse phase. The examination revealed that the system is a multi-system, principally consisting of an oil in water system.

Checking oil separation: Different agents, namely, glycerol, glycerol monostearate (GMS), Span 60, lecithin, and Tween 80 were added to the honey-tahena paste. The products were packed in aluminum tubes, and stored at different temperatures, namely, 6° C. and 25° C. The tubes were examined after seven days of storage for the texture and the separation of oil. Pastes containing glycerol lecithin, Span 60 in concentrations of

0.5%, 1% and 2% exhibited quick oil separation, especially when stored at 25° C. When Tween 80 or GMS was added to the paste individually in amounts of 0.5%, oil separation decreased. Addition of 1% of either Tween 80 or GMS showed the best results especially when the tubes were stored at 6° C. Three different concentrations namely, 0.1% Tween 80 used alone, 0.5% Tween 80 together with 0.5% GMS, and 1% Tween 80 together with 1% GMS were also tried. Tubes containing the last mixture underwent the least amount of oil separation, when stored at 6° C. Accordingly, this mixture was used for stabilizing the honey-tahena paste during further studies.

Changes of paste moisture content during storage: The effect of storage up to 100 days at temperatures namely, 6° C and 25° C on the moisture content of the formulated paste was studied. The obtained results are shown in Figure 1.

Negligable increase in the moisture content occurred in case of storage at 6°C as the increase in the moisture content amounted only to 0.9% upon storage for 100 days.

The moisture content in case of storage at 25°C, amounted to 10%, and 12.5% after 40, and 100 days of storage respectively.

Effect of storage on free fatty acids content (FFA): The FFA content of the paste after preparation was 1.58% (calculated as oleic acid). Figure 2 illustrated a gradual but slight rise in the FFA content during storage at 6° C, but the increase was more pronounced and rapid upon storage at 25° C, particularly upon prolonged storage. This may be attributed to the increase in the moisture content of the paste during storage, and the lipase activity which may be present in the paste or produced by microorganisms especially upon storage at 25° C.

Effect of storage on the peroxide value: A gradual but moderate rise in the peroxide value occurred in case of the tubes stored at 25° C, and at 6° C through 100 days of

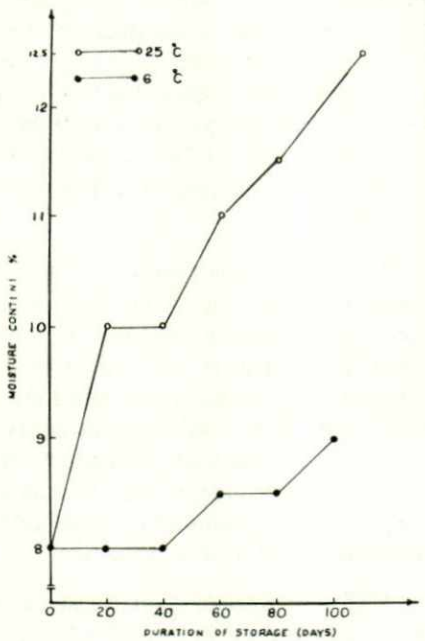

Fig. 1. Effect of storage duration and temperature on the moisture content of honey-tahena paste.

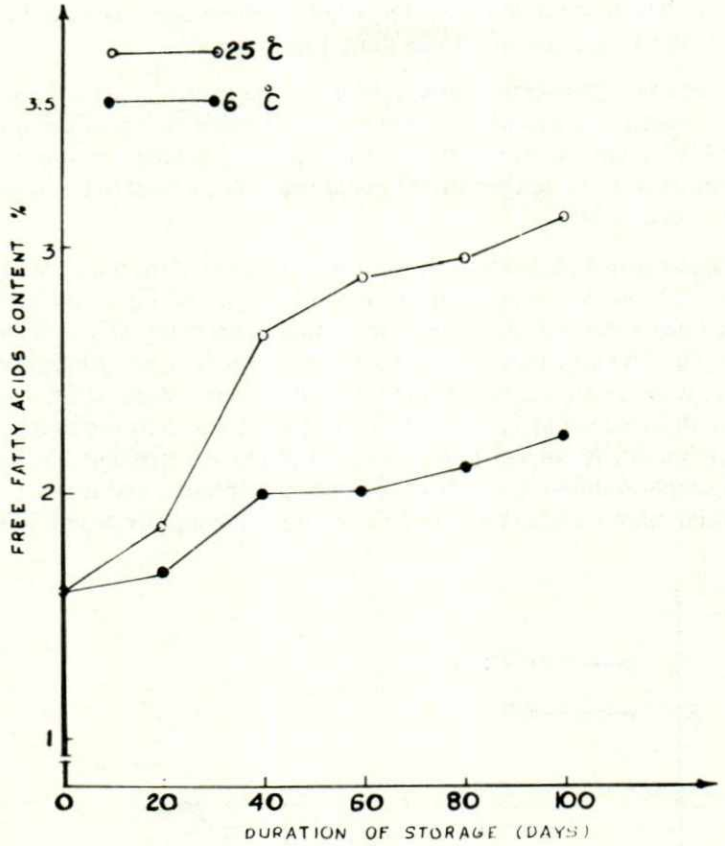

Fig. 2. Effect of storage duration and temperature on the free fatty acids content.

storage, Table 1. In case of the tubes stored at 25° C, there occurred a more sudden rise in the peroxide value during storage, rancid taste was not detected during storage up to 100 days at 6° C while upon storage at 25° C a slight change occurred in flavour after storage for 60 days.

Oil separation: The data illustrated in Figure 3 reveal that a gradual increase in the

Table 1 Peroxide values* of honey-tahena paste during storage.

Storage period (days)	Peroxide values**	
	at 6°C	at 25°C
0	2.55	2.55
20	2.54	4.43
40	2.41	4.01
60	2.68	3.21
80	3.48	2.94
100	3.81	2.96

*As No. of ml of 0.005 N sodium thiosulphate/one gm of oil.
**All values were averages of two duplicate determinations.

amounts of oil which separated occurred whether the paste was stored at 25°C or at 6°C. At 25°C the separation of oil was more pronounced.

Effect of storage on organoleptic characteristics: The results given in Table 2 indicated that the honey-tahena paste did not suffer any appreciable changes during storage up to 100 days at 6°C in comparison with the stored at 25°C noting that the former needed about 30 minutes at room temperature to be spreadable on toast or bread with the same ease as that stored at 25°C.

Chemical composition of the paste: The moisture content of the paste was 8%, the paste contained reasonable percentages of protein (11.76%), and high fat content (23.1%). The total carbohydrates consisted the major components being 55%. Analysis of the ash (2%) for the nutritionally important minerals, iron, calcium, and phosphorus revealed that the paste was a good source for them since their ratios were 0.024, 0.114, and 0.51 respectively. Mohamed *et al.* (15) reported that the human daily requirements of iron is 0.015 gm, calcium is 0.70 gm, and phosphorus is 1.30 gm. Accordingly, the honey-tahena paste could supply suitable amounts of calcium, phosphorus and iron.

The essential amino acids content of the honey-tahena paste as gm/100 gm protein

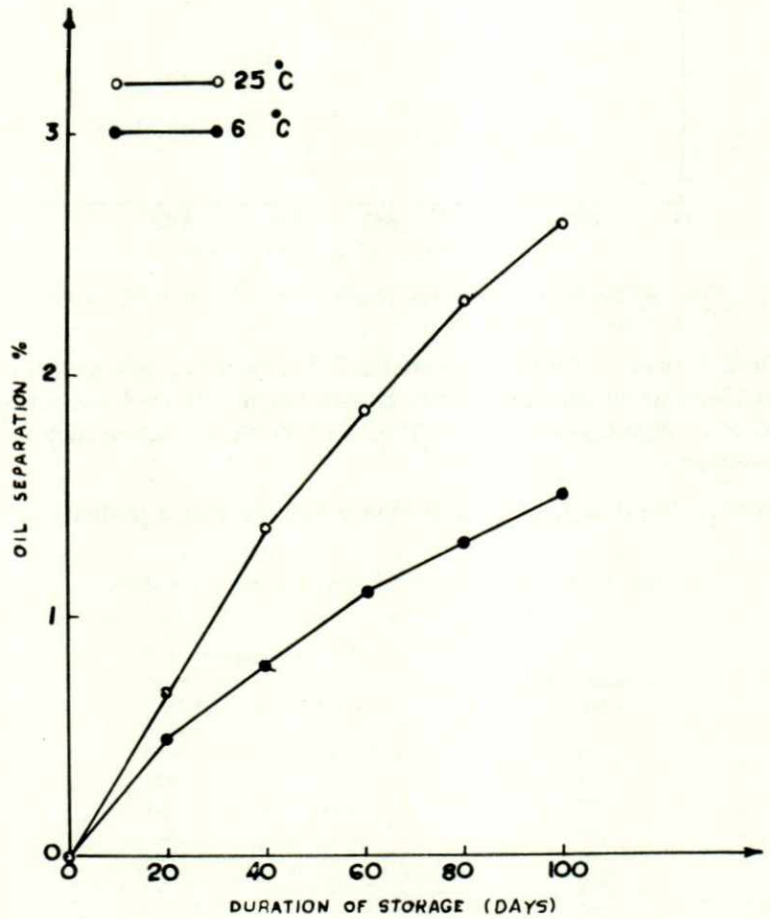

Fig. 3. Effect of storage duration and temperature on oil separation.

Table 2 Organoleptic characteristics of honey-tahena paste as influenced by storage duration and temperatures*.

Storage period (days)	Colour at		Flavour at		Texture at	
	6°C	25°C	6°C	25°C	6°C	25°C
0	B	B	A	A	A	A
20	B	B	B	B	B	B
40	B	C	B	B	B	B
60	C	C	C	C	C	C
80	C	C	C	C	C	C
100	C	C	C	C	C	C

*All values were averages of seven scores.
As A = Excellent
B = Very good
C = Good
D = Fairly good
E = Acceptable

indicated that the highest content was that of leucine (6.15) while the lowest was that for tryptophan (0.44). The content of methionine, threonine, arginine, isoleucine, histidine, phenylalanine, and lysine were 4.74, 4.60, 4.28, 3.53, 1.38, 1.16, and 1.02 gm/100 gm protein respectively. These results indicate that the prepared paste could be considered as a good source of the mentioned amino acids.

El-Dokany (5) reported that the essential amino acids content of halawa tahenya were threonine 0.582, methionine 0.766, valine 0.674, phenylalanine 1.042, leucine 0.966, isoleucine 0.726, and tryptophan 0.613 gm/100 gm protein, these amino acids are derived from the tahena used in manufacturing of halawa tahenya.

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اعداد عجينة غذائية من عسل النحل والطحينة ودراسة تركيبها الكيميائى واحتمالات تخزينها

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مستخلـــــــص

تم فى هذه الدراسة اعداد خلطة من عسل النحل والطحينة (زبدة بذور السمسم) بنسبة ٦٢ر٥ : ٣٧ر٤ ٪ فى صورة عجينة غذائية معدة للاستهلاك مع اضافة ١ ٪ من مواد معدة صناعيا بغرض اكســـاب نكهة عسل النحل الطبيعى ومواد أخرى بغرض تحسين قوام العجينة مثل ، جليسرول احادى الستيارات ، السوربيتول والليسيثين ٠

وقد أوضحت التحليلات الكيميائية مقدرة على أساس الوزن الجاف احتواء عجينة عسل النحل والطحينه على الآتى : رطوبة (٨ ٪) ، بروتين (٧٦ر١١٪) ، دهن (١٠ر٢٣٪) ، كوبوهيدرات (٥٥ر٠٪) ، رماد (٢٪) ، حديد (٠٢٤ر ٪) ، فوسفور (٥١ر٪) ، وكالسيوم (١١٤ر٪) ٠ كما درست التغيرات التى حدثت فى كل من الرطوبة والاحماض الدهنية الحرة ، رقم البيروكسين انفصال الزيت والخـــواص العضوية الحسية للعجينة بعد التخزين لفترة ١٠٠ يوم على درجتى ٦م٥ ، ٥٢٥م وأوضحت الدراسة ان التخزين على درجة ٦م٥ فى عبوات من الالمنيوم كان أفضل ٠