Formulation, Storage Possibilities, and Chemical Composition of Ready-to-eat Fish-Tahena Paste

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ABSTRACT

The formulation of ready-to-eat spreadable smoked fish-tahena paste (1:1) along with various additives is described. The system is multiphase with a predominant oil-disersed in a continuous polar phase. Tween 80 and glycerol monostearate at 2% of each showed a high stabilizing effect. Sorbitol (3%) decreased the desiccation of the paste while 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 of storage at 25°C and 6°C. Storage at 6°C was more suitable for storage of aluminum tubes containing the paste.

Moisture, protein, fat, carbohydrates, ash, iron, phosphorus, and calcium contents of the paste were 30, 29.5, 35, 3.7, 1.8, 0.0012, 0.76, and 0.619% respectively (results are based on dry weight basis). The essential amino acids were quantitatively estimated.

INTRODUCTION

Nowadays, there is a particular need for ready-to-eat foods, one of these foods is the concentrated pasty foods. The present work was performed in order to formulate a pasty food, consisting mainly of tahena and smoked fish along with other food additives.

Brissonneau and Lotz (1) prepared fish materials mixed with anionic colloids to yield paste-like composition which was packed into tubes. Yasuda (7) stated that fish paste covered with a film of heat resistant synthetic resin was steamed to yield a boiled paste product. Zaitsev *et al.* (8) reported on fish pastes which were prepared and packed tightly in time. Moharram *et al.* described the interrelated processes generally necessary for producing smoked fish products.

Accordingly to prepare an acceptable spreadable and highly nourishing pasty food, the present work was conducted with the following purposes:

1. Incorporation of smoked fish, tahena, stabilizers, antioxidants and flavoring materials in suitable amounts to prepare a highly acceptable product.
2. Assessing the rheological characters of the product and its stability in regards to phase separation.

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3. Detecting the chemical composition and amino acids content of the formulated paste.
4. Investigating the storage potentialities of the mixture in aluminum tubes at 25° C and at 6° C.

MATERIALS AND METHODS

Sesame butter: The tahena used in the present work was prepared from shelled saaidy sesame seeds at Ica Plant located in Alexandria, Egypt.

Smoked fish: The smoked fish (Sardinella aurita) was obtained from the Idfina Company for Preserved Foods, Alexandria, Egypt.

Preparation of salty paste: White tahena was passed in a colloidal mill for 2 minutes. The edible portion of the smoked fish was passed for three to four times through a meat grinder and mixed untill a fine homogenous paste was obtained. This paste was mixed with tahena in different proportions of each and tested organoleptically to select the proportion of fish to tahena. The mixtures received emulsifiers and antioxidants. The prepared pastes were packed into aluminum tubes (30 gm each) then stored at 6° C and at 25° C.

Chemical analysis: Methods of the determination of oil separation, peroxide value, titratable acidity, moisture, crude fat, protein, total sugars, ash, minerals, and essential amino acids were carried out according to the methods applied by El-Shahaly *et al.* (2).

RESULTS AND DISCUSSION

Fish-paste formulation: Proportions of smoked fish paste and tahena to be mixed with lecithin (2%), sorbitol (3%), sorbic acid (0.05%), sodium benzoate (0.05%), and anthracine (0.109%) were studied. The results of taste testing indicated that adding smoked fish to tahena in equal proportions (1:1) gave a highly acceptable paste and received the highest rating compared to the other proportions tested.

Characterization of the system: Microscopic examination of thinly spread samples of the paste indicated that the system consisted of disintegrated solid particles of varying size and shape forming a major component of the dispersion phase in which oil spots are scattered. Upon addition of 'Brilliant Blue' the continuous polar phase acquired its colour. The system is therefore a multiphase with oil dispersed in a continuous polar phase as described by Sherman (6).

Checking oil separation: Glycerol, glycerol monostearate (GMS), Span 60, lecithin, and Tween 80 were separately added to the smoked fish-tahena paste in different concentrations, namely; 0.5%, 1% and 2% proportions for each. The resulting mixture in each case was packed in aluminum tubes. The tubes were stored at 25° C and at 6° C for seven days. Pastes containing glycerol, lecithin, Span 60 in any of the previously mentioned concentrations showed oil separation. The oil separation was more pronounced with the rise in storage temperature and the decrease in emulsifier concentration. The least amount of oil separation occurred in the case of Tween 80 and (GMS) in the presence of 2% each; separately.

The different combinations were further tried namely, 0.5% Tween 80 + 0.5% GMS, 1% Tween 80 + 1% GMS, and 2% Tween 80 + 2% GMS. Paste containing 2% Tween

80 + 2% GMS showed the least amount of oil separation especially when stored at 6° C for seven days. Accordingly, this last mixture (containing 2% Tween 80 + 2% GMS) was used for stabilizing the smoked fish-tahena paste during further studies.

Effect of storage on free fatty acids (FFA): It is obvious from Figure 1 that the increase in FFA content was enhanced suddenly by the prolongation of the storage period particularly when the tubes were stored at 25° C. The initial FFA content was 3.5%, after 20 days of storage it reached 8.4% at 6°C, and 9.4% at 25°C after the same period of storage. At the end of the storage period the increase in FFA content was more pronounced at 25°C storage temperature compared to that reported at 6°C storage temperature, since it reached 13.5% at 25°C, while it was 9.3% at 6°C of storage (100 days).

Effect of storage on peroxide value: A gradual increase in the peroxide value occurred in the paste after 40 days of storage at 6° C as it changed from 4.65 to 5.07, then followed a moderate decrease in the peroxide value being 4.06 after 100 days of storage, (Table 1). In case of the tubes stored at 25°C, the fluctuation in the peroxide value was more remarkable than in case of those stored at 6° C. From these results it can be concluded

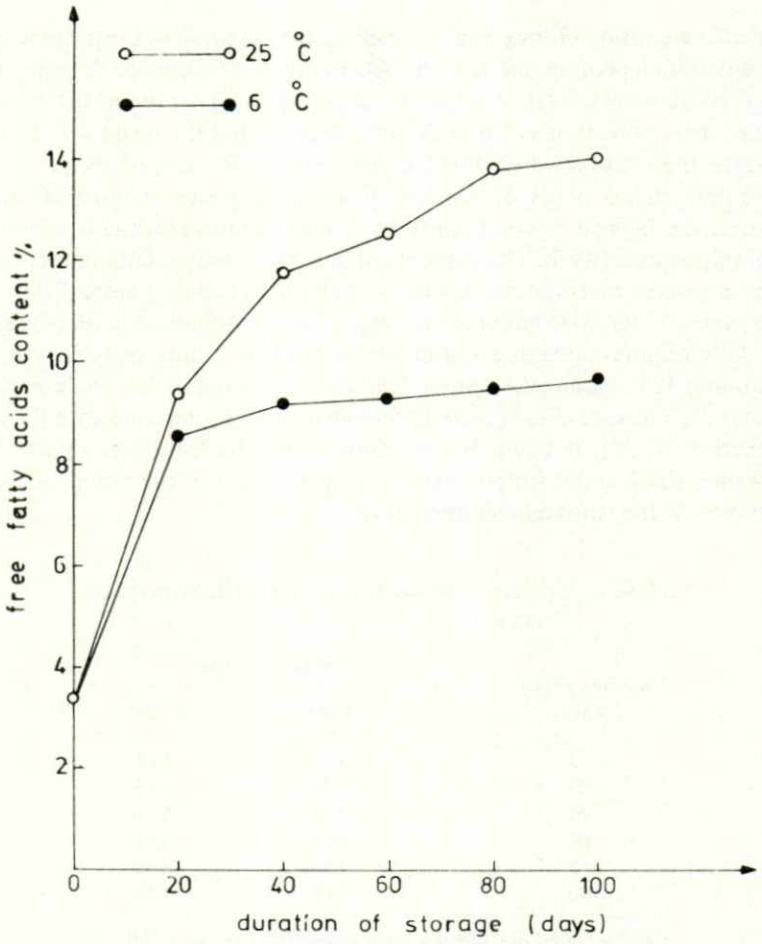

Fig. 1. Effect of storage duration and temperature on the free fatty acids content.

that storage of smoked fish-tahena paste in the presence of an antioxidant retarded the change in the peroxide value of the paste up to 100 days of storage at 6° C. Jacobs (3) correlated the peroxide value and results of organoleptic examination in smoked mackerel and found that the smoked fish product became rancid when the peroxide value ranged from 18.4 to 36.5.

Effect of storage on oil separation: Figure 2 shows a gradual increase in the amount of oil separation from the paste stored at 6° C and at 25° C. In refrigerated storage the percentage of oil separation were 0.30, 0.98, 1.72, 2.62, and 3.12 after 20, 40, 60, 80, and 100 days of storage. At the higher temperature (25° C) the separation of oil was more pronounced being 2.50% after 40 days of storage, compared to 0.98% after the same period at 6° C. These results show that low temperature storage of the paste is recommended, not only as a mean of preserving the products texture and checking oil separation, but also for delaying its oxidation.

Effect of storage on organoleptic properties: The results given in Table 2 showed that the fish-tahena paste did not suffer appreciable changes during storage at 6° C in comparison with that stored at 25° C, noting that the former needed about 20 minutes at room temperature to be spreadable on toast or bread as compared with that stored at 25° C.

The chemical composition of the paste: The moisture content of the paste was 30%. The paste contained high protein and fat contents being 29.5% and 35.0% respectively. The total carbohydrates were 3.7%. Analysis of the ash (1.8%) for the nutritionally important minerals: iron, phosphorus, and calcium revealed that the paste was a good source for them since their ratios were 0.0012, 0.760, and 0.619% respectively.

The essential amino acids of smoked fish-tahena paste (as gm/100 gm protein) indicated that the highest content was that of leucine (10.01) while the lowest content was that of tryptophan (0.83). The contents of the other amino acids, namely, threonine, isoleucine, arginine, methionine, histidine and phenylalanine were 5.83, 5.27, 4.74, 3.76, 1.60, and 1.52 gm/100 gm protein, respectively. Mohamed *et al.* (4) reported the minimum daily requirements of essential amino acids in grams as: lysine 0.8, threonine 0.5, methionine 0.5, valine 0.8, phenylalanine 1.1, leucine 1.1, isoleucine 0.7, and tryptophan 0.25. These results reported previously, when compared with those reported by Mohamed *et al.* (4), it could be concluded that the fish-tahena paste is a highly nourishing one which could supply considerable amounts of the amino acids furnished by the proteins of the smoked fish and tahena.

Table 1 Peroxide value* changes of smoked fish-tahena paste during storage.

Storage period (days)	Peroxide value	
	at 6° C	at 25° C
0	4.65	4.65
20	5.07	8.45
40	5.07	8.11
60	4.65	5.41
80	4.65	3.89
100	4.06	3.55

* As No. of ml of 0.005N sodium thiosulfate/one gm of oil.

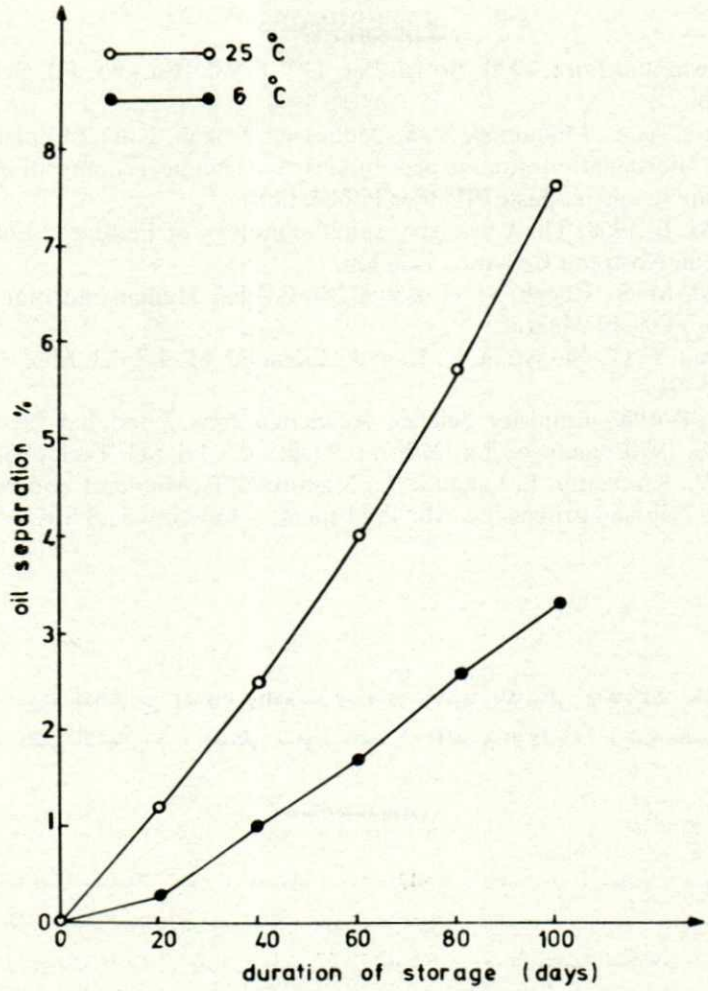

Fig. 2. Effect of storage duration and temperature on oil separation.

Table 2 Organoleptic characteristics of smoked fish-tahena paste as influenced by storage duration and temperature.*

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

*Tested by seven persons.

As A = Excellent
B = Very good
C = Good
D = Fairly good

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اعداد عجينة غذائية من السمك والطحينة ودراسة تركيبها الكيميائى واحتمالات تخزينها

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مستخلـــــص

تم فى هذه الدراسة اعداد خلطة من السمك المدخن والطحينة (زبدة بذور السمسم) بنسبة ١ : ١ فى صورة عجينة غذائية معدة للاستهلاك مع اضافة بعض المواد مثل جليسرول أحادى الستيارات ، سوربيتول والليسين بغرض تحسين قوام العجينة ٠ وقد أوضحت التحليلات الكيميائية مقدرة على أساس الوزن الجاف احتواء عجينة السمك والطحينة على الآتى : رطوبة (٣٠ ٪) ، بروتين (٢٩٫٥ ٪) ، دهن (٣٥ ٪) ، كربوهيدرات ـ (٣٫٧ ٪) ، رماد (١٫٨ ٪) ، حديد (٠٫٠١٢ ٪) ، فوسفور (٧٦٫ ٪) ، وكالسيوم (٦١٩٫٪) ٠ كما درست التغيرات التى تحدث فى كل من الرطوبة ، الأحماض الدهنية الحرة ، رقم البيروكسيد ، انفصال الزيت والخواص العضوية الحسية للعجينة بعد التخزين لفترة ١٠٠ يوم على درجتى حرارة ٥م٦ ، ٢٥ م٥ وتبين أن التخزين على درجة ٥م٦ فى عبوات من الالمنيوم كان أفضل ٠