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OCCURRENCE OF VOLATILE NITROSAMINES IN EDIBLE OILS

(With One Table)

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دراسة عن وجود مركبات Nitrosamines
في الزيوت النباتية المعده للاستهلاك الآدمي

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بدأ الاهتمام في السنوات الأخيرة باستعمال الزيوت والدهون النباتية بينما قل استخدام مثيلاتها الحيوانية وذلك لخطورة الدهون الحيوانية في احداث أمراض الأوعية الدموية. وقد اجريت الكثير من التجارب بقصد دراسة وجود مركبات ال Nitrosamines في الأغذية ،كذلك الأثر الضار لها حيث ثبت أنها قادرة على احداث سرطانات مختلفة في الجسم. لذلك أجريت تلك الدراسة على ٢٠ عينة عشوائية من زيت الزيتون، زيت الذرة، زيت فول الصويا وبعض الزيوت الأخرى المنتجة محليا وكذلك الزيت المستعمل في عمليات القلي بالكافتيريا ، جمعت من مدينة أسيوط للكشف عن مركبات ال Nitrosamines . ودلت النتائج على وجود N-nitrosodimethylamine في ١٤عينة ، وكانت النتائج تتراوح بين ٣٨ر٠ - ٣٢ر٢ جزء في البليون. وتمت مناقشة مصادر هذه المركبات وتأثيرها على الصحة العامة وكيفية تحنب وجودها في الزيوت حفاظا على صحة المستهلك.

SUMMARY

A limited survey of edible oils was undertaken to determine the presence of volatile N-nitrosamines, a class of compounds carcinogenic to a broad range of animal species. Nitrosamines were detected and quantitated by a gas liquid chromatograph interfaced with a Thermal Energy Analyzer. Detectable N-nitrosodimethylamine, the only nitrosaemine found in 14 out of 20 samples of edible oils, ranged from 0.38 to 2.32 ppb. The potential helath hazard is discussed.

INTRODUCTION

In recent years there has been considerable interest in the presence of nitrosamines in foods because of their potent widespread carcinogenicity, these compounds can be formed by interaction between nitrite and secondary or tertiary amines (MIRVISH, 1970; FAN and TANNENBAUM, 1971) and data bave been published on the presence of nitrosamines in meat and meat products, milk and milk products, fish, vegetables and other basic dietary constituents (HOWARD et al., 1970; WALKER, 1975, GOUGH et al., 1977; LARKITZ and PENSABENE, 1981; HOFMANN, 1986 and ROCHE & CANDEBAT, 1986).

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The consumption of edible vegetable oils has increased dramatically in recent years, while the use of fats from animal sources has concurrently decreased. Reasons for this shift include public concern with the role of saturated fats and cholesterol and their etiology in cardiovascular disease.

In 1972, HEDLER et al., investigated the possible presence of N-nitrosamines in soybean oil based on an earlier observation that rats fed soybean oil had an increased incidence of tumors. These investigators reported the presence of 290 ppb of N-nitrosodibutylamine and 380 ppb- N-nitrosodimetylamine. A more thorough study was published by the same group (HEDLER et al., 1979) utilizing an improved analytical technique and found apparent N-nitrosodimethylamine and N-nitrosodiethylamine in concentrations up to 23 and 28 ppb, respectively in examined oil samples. More recently, FIDDLER et al., 1981 detected N-nitrosodimetlylamine at levels of 0.22 to 1.01 ppb, in 18 out of 21 commercial oil samples.

Because of the contradictory results of previous reports, the potential health hazard proposed to consumers of edible oils, this work was undertaken to investigate the presence of nitrosamines in some commercial Egyptian edible oils.

MATERIALS and METHODS

Samples :

As the analytical methods for traces of nitrosamines in food is time consuming and sophisticated, the number of samplen which could be analysed was limited.

20 different edible oil samples from several different sources were studied. They included 4 samples each of olive oil, corn oil, soybean oil, undesignated oil and heated oil. The olive, corn and soybean oils were obtained from several local supermarkets, while the undesignated samples were collected from retailers of the local companies of oils. Heated oils (used for frying of commercial prepared meals) were collected from different cafeterias in Assiut city.

Nitrosamine analysis :

Each sample was examined for the following nitrosamines: N-nitrosodimethylamine, N-nitrosodiethylamine, N-nitrosodipropylamine, N-nitrosopiperidine and N-nitrosopyrrolidine.

The method of WHITE et al. (1974) was used for isolation and separation of volatile nitrosamines in the examined samples. The concentrated extracts were analysed for nitrosamines with a Varian-Aerograph Model 2700 gas chromatograph containing a 9 ft x 1/8 in. stainless steel column packed with 15% carbowax 20 M-TPA on 60/80 Gas Chrom P and interfaced with a Thermal Energy Analyzer. the following conditions were used: The injector port temperature was 220°C, the oven was programed from 125 to 220°C at 4°C/min. and the helium flow rate was 42 ml/min.

RESULTS

Concentrations of apparent N-nitrosadimetlylamine in examined oils are in Table (1).

Table (1): Volatile nitrosamines in edible oils.

Type of oil	Positive/Total	Mean of N-nitrosadimethylamine (ppb)
Olive	2/4	0.66
Corn	3/4	0.84
Soybean	1/4	0.38
Undesignated	4/4	0.96
Frying 4/4	2.32	2.32

DISCUSSION

From Table 1, it is evident that in 20 samples of oil (olive, corn, soybean, undesignated and heated), 14 contained N-nitrosodimethylamine in a range of 0.38 to 2.32 ppb. No other volatile nitrosamines were detected.

Low levels of apparent N-nitrosodimethylamine were detected in 2/4 olive, 3/4 corn, 1/4 soybean oil samples. Slightly higher amounts of N-nitrosadimethylamine were detected in all undesignated oil samples which are distirubted by the local companies and whose consumption is widespread in Egypt.

These levels were mach lower than those previously reported by HEDLER et al. (1972 & 1979), but did not significantly differ from the values obtained by FIDDLER et al. (1981).

Table (1) show that only heated oils, which form a significant part of the diet of most Egyptians as they used in commercial and home prepared meals, were found having apparent N-nitrosodimethylamine in amounts greater than 1 pp (The mean value was 2.32 ppb).

Crude edible oils contain variable levels of phosphatides, which on decomposition or hydrolysis can liberate amines. It may be possible for nitrosamins to be formed during the numerous steps involved in the processing of edible oils, since an amine source and a nitrosating species, nitrogen dioxide (an environmental contaminant) may be available. However, the deodorizing and refining steps usually remove most of the volatile amines and nitrosamines contaminants.

The present levels of N-nitrosodimethylamine in healted oils may be due to the interaction between oil contuents and prepared meals or due to the action of cooking which may give rise to the formation of nitrosamines.

Funthermore, small amounts of nitrosamines have been found in human food in which nitrite had been used as preservative to develop color and flavor.

While N-nitrosodimethylamine has been shown to produce malignant tumors in animals (MAGEE & BARNES, 1956 and DRUCKREY et al., 1967) the carcinogenic effect in man of N-nitrosodimethylamine and nitrosamines in general has not been demonstrated, but is a matter of concern.

However, in this concern BELITZ and GROSCH (1982) stated that N-nitrosadimethylamine has toxic and carcinogenic effects to human beings and suggested that its amount in the diet should not exceed 0.1 ppm.

From these results, it appears that formation of nitrosamines in edible oils after cooking is possible, and a safe edible oil would be obtained after efficient refining and deodorizing steps of processing.

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