

Quantification of the nitrosamine Fruit and Vegetables

A. Haj Hosseini Babaei¹, M.parviz², s.panahi

1. *Researcher of Dept. of Biotechnology Development Center, Qazvin University of Medical Sciences, Iran.*

2. *Manager Director of Nemoone Azmaye Pasargad Company., Tehran,Iran*

3. *study MS of chemistry University Abhar, Qazvin,Iran*

Email: payeshmarja@yahoo.com

Abstract

We take samples of foodstuffs from different sources, The studied products where vegetables and fruit have been examined for the presence of nitrosamines . We use gas chromatography and high resolution mass spectrometry for precise determination. The vegetables and fruit had level of nitrosamines below the compulsory limits .

Key words: n-nitrosamines, nitrite, vegetables and fruit

INTRODUCTION

The formation of N-nitrosamines from the interaction of nitrite and secondary and tertiary amines is well documented and their presence in various foodstuffs has been detected in this laboratory and elsewhere. The carcinogenic properties of N-nitrosodimethylamine were established and

consequently it is important to ensure that the concentration present in food is below a level which is hazardous to man. Animal studies are in progress elsewhere to determine the effects of low concentrations of nitrosamines in the diet and to identify, if possible, guidelines for maximum permissible levels .

Published work on nitrosamines has concentrated on a few particular foodstuffs such as bacon and other cured meats. In this paper, we present data on the amounts of nitrosamines found in a wide range of foods over the period 2008-2010 .

As the analytical method for traces of nitrosamines in food is time consuming and sophisticated, the number of samples which can be analyzed is limited. Therefore, whilst aiming for an overall assessment it has been necessary to concentrate our efforts on those foodstuffs which have high nitrate, nitrite and amine contents, which could by interaction give rise to nitrosamines.

A significant source of nitrite in the diet is cured meat which it is used to impart colour, flavour and microbiological stability. Nitrite can be formed from the reduction of nitrate and data have been published on the nitrite and nitrate content of vegetables, milk and dairy products, and other basic dietary constituents. Nitrite has been shown to increase during the storage of fresh vegetables with high nitrate content. Many canned foods contain nitrate, from which nitrite can be formed under some conditions of sterilization or of corrosion. Nitrate is also present in varying amounts in domestic water supplies .

The amine and amino acid content of foods is less well documented and in many cases only a total rather than individual amine content is available. Many amines, including amino acids, could give rise to non- volatile nitrosamines but by degradation, simple volatile nitrosamines can result. For example, the formation of N-nitrosopyrrolidine has been observed from praline and it could also arise from the breakdown of a peptide containing this amino acid. Useful reviews of the occurrence of amino-compounds have been published. Numerous pesticides are capable of nitrosation, and antibiotics such as the tetracyclines which have been used in poultry husbandry, will nitrosate. Residues of such substances in food could

,therefore, form N-nitrosocompounds by reaction with nitrite under suitable conditions. Such residue levels are, however, far lower than the levels of many amines naturally present in food .

From a knowledge of the nitrate, nitrite and amine content of foods , it was decided to concentrate on meat and meat products, fish, dairy produce and canned foods (including baby foods), together with a range of appropriate miscellaneous foods to extend the coverage. Ready prepared meals and cooked complete meals have also been examined in those cases where interaction between constituents or the action of cooking could give rise to the formation of nitrosamines .

MATERIAL AND METHODS

The vegetables and fruit were prepared for analysis by the standard procedure used at this laboratory. They were cooked conventionally and ready prepared meals treated as directed by the manufacturers. Clean-up of the samples was by steam distillation and extraction into dichloromethane , followed by evaporation to small bulk to concentrate any nitrosamines. The resulting extracts were screened by gas chromatography using a Coulson electrolytic conductivity detector, and the presence of nitrosamines confirmed where appropriate by combined gas chromatography and high resolution mass spectrometry. Quantitative results are based on parent ion measurement after calibration against standard nitrosamine solutions and correction for recoveries. Each sample was examined for the following nitrosamines: N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA), N-nitrosodipropylamine (NDPA), N-nitrosodibutylamine

(NDBA), N-nitrosopiperidine (NPIP) and N-nitrosopyrrolidine (NPYR).(NDPA was used as an internal standard for the majority of samples to enable recovery corrections to be made.

Our analytical procedure has been used for the determination of volatile nitrosamines in collaborative exercises with other laboratories and has given satisfactory results .

RESULTS AND DISCUSSION

General

The vegetables and fruits examined in this laboratory are discussed below and the results compared with data reported in the literature. It is generally accepted that confirmation of analytical results for nitrosamines by mass spectrometry is essential, and any data derived from other techniques alone should be treated with caution. The detection limit for the nitrosamines in our study is 1 µg/kg. Over 50 samples analyzed by this laboratory are included, nearly all of which were obtained from normal retail outlets in Qazvin .

Vegetables

Several different types of common fresh vegetables were examined, totaling 16 samples . No volatile nitrosamines were found. A further selection of vegetables is covered under cooked complete salads .

Fruit

Several canned jams of apples with high amine and nitrate levels were examined, but in 14 samples no volatile nitrosamines were detected .

Table 1. Occurrence of volatile nitrosamines in vegetables and fruits

commodity	Examined	Number of samples:	
		Containing NDMA	
		1-5 ($\mu\text{g}/\text{Kg}$)	5-10 ($\mu\text{g}/\text{Kg}$)
Cucumber	16	0	0
tomato	16	0	0
potato	16	11	2
Apple	14	0	0

CONCLUSIONS

Most samples of potatoes contained NDMA in the 1-5 $\mu\text{g}/\text{kg}$ range. For the detection of nitrosamines significantly below 1 $\mu\text{g}/\text{kg}$, the only technique available is that based on chemiluminescence in which nitrosamines are converted into nitric oxide which reacts with ozone to give an infrared emission. The foods included in this survey in which no nitrosamines were detected will be re-examined by this procedure at a later date .

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