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Biogenic amine content of Turkish soudjouc (sucuk) samples

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Abstract

In this study, biogenic amines in Turkish soudjouck samples purchased from markets in Ankara were determined by using HPLC. All the samples have been contained considerable levels of some biogenic amines. The concentration of biogenic amine of the samples fluctuated greatly. Tyramine (TYR), putrescine (PUT) and spermidine (SPD) were the predominant biogenic amines. Tyramine was present in 11 samples, which were 64.70%, and PUT and SPD 52.94%, 41.17% respectively. Although there are no legal limits for the values of biogenic amines, in some samples higher values were found than suggested limits. The highest level of cadaverine was detected in one sample with 514.24 mg/kg and TYR was with 198.14 mg/kg in another one. In addition, microbiological counts of APC, LAB, *Enterobacteriaceae, Enterococci, Staphylococci* and Yeasts were varied greatly among the samples. The numbers of viable aerobic bacteria (APC) are differed from 3.98 log CFU/g- 7.89 log CFU/g. The count of Lactic acid bacteria (LAB) were found very low level such as 2.45 log CFU/g and 2.79 log CFU/g in some samples.

Key words: Biogenic amines; microbiological counts; HPLC; Turkish soudjouck.

Contenido de aminas biogénicas en muestras de embutidos turcos (sucuk)

Resumen

En el presente estudio se determinaron por técnicas de HCLP los contenidos de aminas biogénicas en muestras de embutidos Turcos adquiridas en los mercados de Ankara. Todas las muestras contenían considerables niveles de aminas biogénicas. La concentración de amina biogénica de las muestras fluctuó grandemente. Tyramina (TYR), putrescina (PUT) y espermidina (SPD) fueron las aminas biogénicas predominantes. La Tyramina estuvo presente en 11 muestras, con un contenido de 64,7%, y PUT y SPD en 52,94% y 41,7%, respectivamente. Aunque no existen límites legales para los valores de aminas biogénicas, en algunas muestras se encontraron valores mayores que los límites sugeridos. El nivel más alto de cadaverina fue detectado en una muestra con 514,24 mg/Kg y el de TYR fue de alto 198,14 mg/Kg en otras muestra. Adicionalmente, el contaje microbiológicos de APC, LAB, *Enterobacteriaceae, Enterococci, Staphylococci* and levaduras varió significativamente entre las muestras. Los números de bacterias aeróbicas viable (APC) difirieron en el rango de 3,98 log CFU/g – 7,89 log CFU/g. El contaje de bacterias ácido lácticas (LAB) se encontró en lagunas muestras a niveles muy bajos táles como 2,45 log CFU/g y 2,79 log CFU/g.

Palabras clave: Aminas biogénicas; contaje microbiológico; HPLC; embutidos Turcos (sucuk).

Introduction

Biogenic amines are organic base compounds occurring in foods such as fish, fishery products, wine, cheese, beer and other fermented foods (1-9). They occur in these products from decarboxylation of amino acids or transamination of aldehydes and ketones or formed by bacteria, including starter culture (10-14). The estimation of biogenic amine amounts is important because of their toxicity and the use of spoilage indicators (5, 6, 8, 9, 14).

Hernandez *et al.* (1997a,b) reported that the toxic levels of some biogenic amines are 100mg histamine/kg of foods and 100-800mg of tyramine/kg and 30mg of β-phenylethylamine/kg of foods and suggested that putrescine and cadaverine were histamine/tyramine potentiators. However, they did not recommend toxicity limits (9, 14).

There are several studies concerning the levels of biogenic amines in meat and meat products (1, 5, 6, 9, 13, 18). Soudjouck is a fermented meat product which is prepared by mixing the ground beef, tallow fat, salt, sugar, spices, garlic and the other additives and stuffing into natural or artificial casing which is consumed commonly in Turkey (10).

The aim of this study was obtained to provide some data on the presence of biogenic amines in Turkish soudjouck samples purchased from markets in Ankara. In addition to biogenic amines, microbial analyses were also carried out.

Materials and Methods

Source of samples

Seventeen samples of Turkish soudjoucks were randomly purchased from local markets in Ankara.

High performance liquid chromatographic method

Biogenic amine extraction from the samples, their dansylation and quantitation were determined by a liquid chromatographic method as described by Eerola *et al.* (1993) (19) and Bütikofer *et al.* (1990) (20).

Microbiological Analyses

A 25-g sample was mixed with 225mL sterile peptone solution in a Waring blender (Waring Commercial, USA) and homogenised for 2 minutes. Serial dilutions were made with the same solution. Aerobic plate counts were performed by plating appropriate dilutions on standard Plate Count agar for total counts (Merck), MRS agar plates for lactic acid bacteria (de Man, Rogose, Sharpe agar, Merck), VRBG agar for

Enterobacteriaceae (Merck), Baird Parker Agar (Merck) for Staphylococci, Slanetz-Bartley Agar (Merck) for Enterococci, OGYE agar(Oxoid) for moulds and yeasts which were incubated at 280°C for 48 h, 300°C for 48 h, 370°C for 48 h, and 280°C for 72 h (yeasts) and 5 days (moulds) respectively.

Results and Discussion

It was found that all the samples have been contained considerable level of some biogenic amines. The concentration of biogenic amine of the samples fluctuated greatly. Despite this variability, tyramine (TYR), putrescine (PUT) and spermidine (SPD) were the predominant biogenic amines (Table 1). Tyramine was present in 11 samples, which were 64.70%, and PUT and SPD 52.94%, 41.17% respectively (Table 2).

Although there are no legal limits for the values of biogenic amines, in some samples higher values were detected than suggested limits (Table 1). As for example, the highest level of cadaverine was detected in one sample with 514.24 mg/kg, which the suggested limit, was 100 mg/kg by Stratton *et al.* (1990) (4). TYR level was detected as

Table 1
Concentration of biogenic amines (mg / kg) in Turkish soudjoucks samples

Samples Nº	TRY	PHA	PUT	CAD	HIT	TYR	SPM	SPD	Total BA
1	16.70	2.70	150.74	514.24	22.76	62.11		234.972	1004.22
2	42.88		9.35		12.80		337.53		402.56
3								284.87	284.87
4				8.00		12.08		228.01	248.09
5			4.04					238.74	242.78
6				6.83		198.14			204.97
7	4.63			8.28		8.15		169.85	190.91
8	3.11	56.77	20.45			83.87	25.91		190.11
9		59.19				19.81		62.52	141.52
10	4.46		44.10	71.42	6.01	7.09			140.17
11		1.80	63.89			23.88		49.62	139.19
12			7.61				118.60		126.25
13	6.52	114.55							121.07
14		101.53				18.48			120.01
15						106.08			106.08
16			3.28			92.11			95.34
17			17.18						17.18

Table 2
Biogenic amine ranges in soudjouck samples

Biogenic amines	Amine content (%)	Average	Min-Max. range
TRY	36.88	13.05	Nil-16.70
PHA	36.88	107.53	Nil-114.55
PUT	52.94	35.63	Nil-150.74
CAD	29.41	76.42	Nil-514.24
HIT	17.64	13.86	Nil-22.76
TYR	64.70	103.11	Nil-198.14
SPM	17.64	160.68	Nil-337.53
SPD	41.17	69.52	Nil-284.87

198.14mg/ kg in one sample which was higher than recommended limit by Hernendez-Jover et al. (1997b)(14). Several authors have showed that TYR and PUT are usually major amines in meat products (5, 9, 10, 14, 15, 21).

On the other hand, Hernandez *et al.* (1997a) emphasised that SPM and SPD were

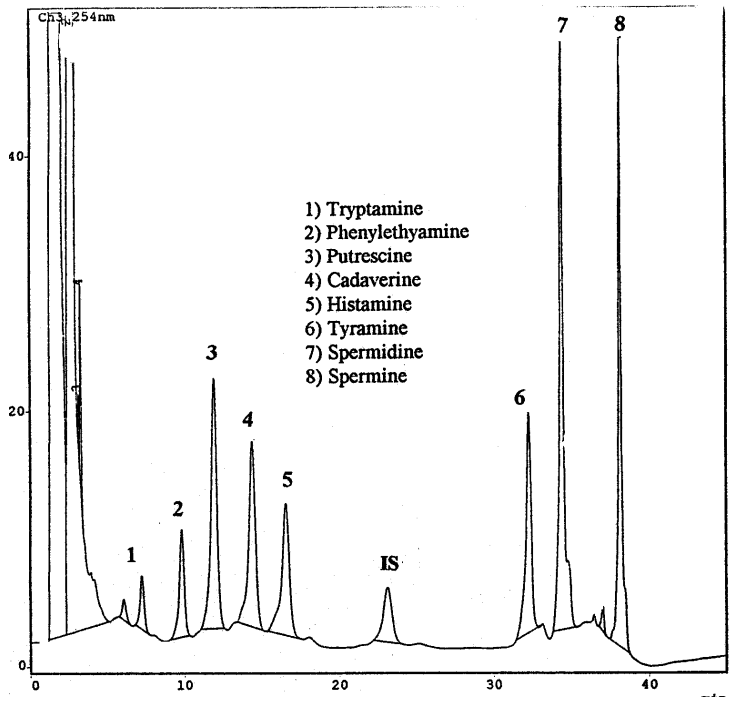

Figura 1. Chromatographics separation of dansyl derivates of biogenic amines by gradient elution.

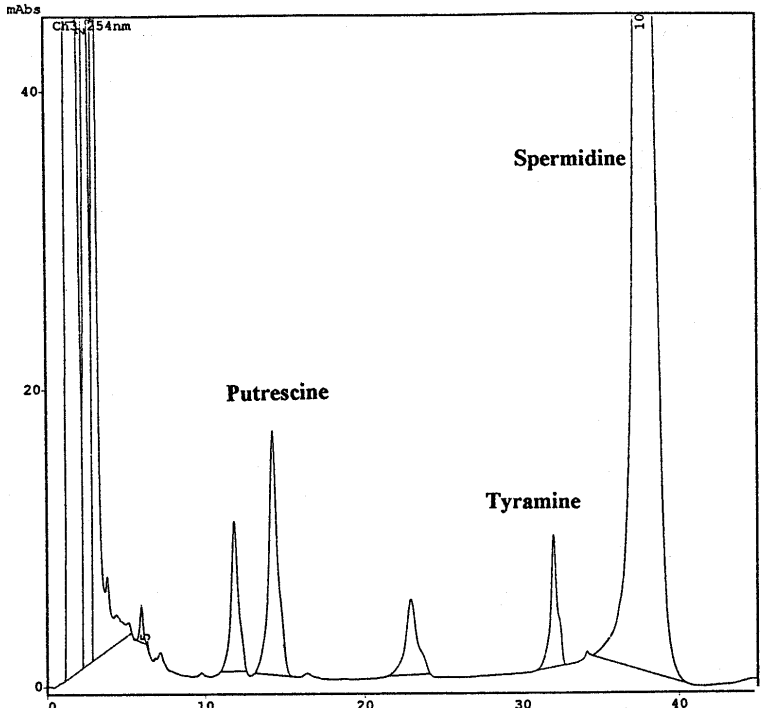

Figura.2. Chromatogram of amines extracted from a soudjouck sample (peak).

the only amines always detected in meat and meat products (9). They also showed Spermine contents decreased during ripening fuet sausage production but Spermidine level of the samples remained relatively constant. Additionally, they indicated that ripening with or without starter culture does not influence these amines, while their origin is the meat itself (14). The concentration of SPD tested samples was ranged from 49.62 mg/kg to 356.50 mg/kg and SPM was between 25.91 mg/kg and 337.53 mg/kg in the samples.

The high amount of PHA was found in four samples (Table1). This concentration has been reported, as toxic level is 30 mg/kg in foods by Hernandez *et al.* (1997b) (14).

The histamine level in the tested samples was lower (maximum 22.76 mg/kg) than toxic limits 100mg/kg in foods reported by Hernandez-Jover *et al.* (1997b) (14). These authors could not find HIT in fuet sausages. However, Maijala *et al.* (1995b) (6) determined the low level of histamine in dry sausages and Vidal-Carou *et al.* (1990) (21) detected considerable level of HIT in some Spanish ripened meat products.

All the amines were well separated on reverse-phase HPLC. The order of elution was TRY, PHA, PUT, CAD, HIT, TYA, SPM and SPD (Figure 1) and the chromatogram for amines extracted from a soudjouck sample are shown in Figure 2.

Microbiological counts are presented in Table 3. fluctuated greatly among the samples. The numbers of APC are differed from 3.98 log CFU/g- 7.89 log CFU/g.

In this study, the highest *Enterobacteriaceae* counts were found in two of samples with 3.47 log CFU/g and 3.20 log CFU/g

Table 3
Microbial counts ($\log_{10}$ CFU/g) of the samples

Samples Nº	APC	LAB	(*Enterobacteriacea*)	*Enterococci*	*Staphylococci*	Yeasts
1	7.09	7.00	<1.00	2.78	5.00	2.90
2	4.49	2.79	<1.00	<1.00	<1.00	<1.00
3	4.00	4.45	<1.00	<1.00	1.00	<1.00
4	4.00	4.45	<1.00	<1.00	1.00	<1.00
5	7.55	6.00	<1.00	5.06	6.40	4.74
6	3.98	3.80	<1.00	2.5	<1.00	<1.00
7	6.70	6.54	3.47	3.87	3.98	3.49
8	6.86	3.00	<1.00	<1.00	3.42	<1.00
9	7.00	6.96	<1.00	3.00	<1.00	3.86
10	5.19	6.30	<1.00	2.50	<1.00	<1.00
11	7.89	7.45	2.20	4.79	4.30	4.20
12	6.07	6.49	1.00	1.00	2.56	<1.00
13	7.17	6.72	<1.00	4.30	<1.00	<1.00
14	6.90	7.00	<1.00	3.87	5.13	4.52
15	4.25	2.45	<1.00	<1.00	<1.00	<1.00
16	4.65	5.51	1.00	2.50	<1.00	<1.00
17	7.05	5.09	<1.00	4.52	4.00	<1.00

where as the level of SPD as 169.85 mg/kg and 228.04mg/kg respectively. However, the count of *Enterobacteriaceae* was found as 1.00 log CFU/g in some samples. This can be explained as a consequence of the conditions such as pH, a_w and high concentration of salt during ripening of the samples. There was the only sample No 1 which contained all the biogenic amines except SPM and represented the highest total BA level as well (Table 1 and Table 3).

Edwards et al. (1987) reported that PUT concentration increased with total viable bacteria counts (APC) but CAD increased only high level of *Enterobacteriacea* were present. Additionally, Hernendez *et al.* (1997a) concluded that the formation of these amines produced during the manufacture of ripened products. They also reported that the high background flora naturally present on the starting meat has a great influence on the biogenic amine formation (9). We have found similar results in one of our study in which the major biogenic amines produced by *Enterobacteriaceae* are putrescine, cadaverine and tyramine both in culture medium and meat products (22).

Concerning the LAB counts of the samples, the lowest counts were found in the samples No 8; 2; 6 and 15 which can be explained by the lactic acid fermentation which has not been completed yet. Because the samples were collected randomly, it is not known that the manufacturers used the starters or not. On the other hand, the levels of some biogenic amines of these samples such as TYR, SPD and PHA were detected very high (Table 1).

Hernendez *et al.* (1997a) concluded that the same system of manufacturing could give products having variable levels of amines during the production of ripened meat products. They followed the amine levels in different batches of the same meat product of the same commercial brand, wide fluctuations were observed in TYR, PUT, CA contents in some Spanish meat products. In this study, Nº 9 and Nº 11 were produced without using starter cultures in the same pilot factory and in controlled conditions at different period of time. According to the results, the formation of biogenic amines obtained in the different level and types in both samples. It was also detected different microbiological counts at two of samples (Table 1 and Table 3).

It is obvious that there are many effects on the formation of biogenic amines in meat and meat products. For example, quality of raw materials, especially the contaminant lactic acid bacteria, processing time and temperature, even incorrect starter culture addition, the amount of free amino acids, presence of microorganisms are capable to produce decarboxylase as well as differences between manufacturers. Therefore, in order to produce the products consisting of the low level of biogenic amines all these factors should take into consideration all those factors.

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