

STUDY CONCERNING METALS CONCENTRATION IN SOME ASSORTMENT OF BISCUITS

STUDII PRIVIND CONCENTRAȚIA ÎN METALE A UNOR SORTIMENTE DE BISCUȚI

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Abstract. *In this paper we followed the identification and quantification of the presence of some heavy metals like: Fe, Cu, Zn, Cd, Mn and some macroelements: Na, K, Ca and Mg, in the following assortments of biscuits: glutenous, sugarous, with cream and diethetic. The samples have been harvested random from several trade centers and belong to some indigen and international producers. 23 samples have been exposed to the atomic absorption spectrophotometric analysis, after a previous 650°C calcination and 0.5M HNO₃ mineralization, as follows: 4 types of glutenous, sugarous and creamy biscuits and 3 assortments of digestive biscuits. And also, in the case of creamy products, the determination has been made separately from cream and lids. The obtained results have been compared both between biscuits attending to the same assortment and between the ones resulted from the analysis of different assortments. The interpretation has been made both graphical and analytical. We used the work protocol that is stipulated in the AOAC standards.*

Rezumat. *In prezenta lucrare s-a urmarit identificarea si cuantificarea prezentei unor metale grele: Fe, Cu, Zn, Cd, Mn, alcaline si alcalino- pamantoase: Na, K, Ca si Mg. in urmatoarele sortimente de biscuiti: glutenosi, zaharosi, cu crema si dietetici. Probele au fost recoltate aleatoriu din diverse centre comerciale si apartin unor producatori interni si internationali. Analizei prin spectrofotometrie de absorbtie atomica, dupa o prealabila calcinare la temperatura de 650°C si mineralizare cu acid azotic 0.5M, au fost supuse 15 probe dupa cum urmeaza: cate 4 tipuri de biscuiti glutenosi, cu crema si zaharosi si 3 tipuri de biscuiti digestivi. De asemenea, in cazul produselor cu crema, determinarea s-a facut separat din capace si crema. Rezultatele obtinute au fost comparate atat intre biscuitii apartinand aceluasi sortiment dar si intre cele rezultate din analiza celor aferente sortimentelor diferite. Interpretarea s-a facut grafic si analitic. Protocolul de lucru folosit a fost cel prevazut in standardele AOAC.*

Keywords: biscuits, metal, glutenous, cream, sugarous

INTRODUCTION

The biscuits are products that have in common their composition of flour, sugars and fats and low humidity. Because of the large number of raw and auxiliary materials that are used, of their different proportions and because the technological processes that are used, the assortment scale of the biscuits is very various. Depending of the sugar and fat amount in the recipe they can be: crackers, glutenous, sugarous and the last two can be filled with cream by interspersing a cream layer between two biscuit lids, the main purpose being the increase of the nutritive value as well as widening the assortment scale. If in plus, they are vitaminised, they can be framed in the dietetic products class. The biscuits are considered an important food for the human being, because they present the advantage that they have a relatively long valability limit, different compositions, that can be adapted to various nutritive needs, but in the same time represent an important energetic source [1,3,4].

METHOD AND MATERIALS

4 types of glutenous, sugarous and creamy biscuits and 3 types of dietetic ones have been analysed, the samples being harvested on random criteria from several trade centers, and from different local and international producers. Also, in the case of the creamy products, the determination has been made separately for lids and cream.

The analysed samples have been numbered according to (*table 1*):

Table 1

Analysed samples numbering

Sample name	Sample number
Bulk glutenous biscuits	1
Premium imported glutenous biscuits	2
Local digestive glutenous biscuits	3
Local vitaminised glutenous biscuits	4
Local, sugar free, dietetic glutenous biscuits	5
Premium imported dietetic glutenous biscuits	6
Local children glutenous biscuits	7
Premium imported sugarous biscuits	8
Medium local sugarous biscuits	9
Medium imported sugarous biscuits	10
Bulk sugarous biscuits	11

Premium imported vanilla cream biscuits	12
Cheap local vanilla cream biscuits	13
Local bulk wild strawberry vream biscuits	14
Medium local vanilla cream biscuits	15
12'th biscuite cream	16
13'th biscuite cream	17
14'th biscuite cream	18
15'th biscuite cream	19
12'th biscuite lid	20
13'th biscuite lid	21
14'th biscuite lid	22
15'th biscuite lid	23

The determination has been made using the atomic absorption spectrophotometric method, as follows:

I. Sample preparation.

10g of vegetal material from every sample have been weighted and exposed to 600 Celsius degrees calcination, for 8 hours. The obtained calcinate has been dissolved to 25 mL using 0.5M HNO₃ under continuous stirring until the ash was completely dissolved. From the obtained solvate we realised 1:10 dilutions in order to determine the Ca, Mg, Na, and K.

II. The identification and amount determination of the metals Cu, Zn, Mn, Fe, Ca, Mg, K și Na) using the atomic absorption spectrophotometric method.

The determination has been realised using an „contr AA 300” atomic absorption spectrophotometer, in the following standard conditions:

Flame type: C₂H₂/aer

Flamer hight: 6mm

C₂H₂ flow: 50l/h

Air flow: 568l/h

Distilated water has been used as standard solution.

Each metal amount has been determined with the formula:

$$Me = m_{me} \times \frac{25}{m_p} \times D \quad [\text{mg/kg}]$$

where Me = the contained metal amount, in mg/kg;

m_{me} = the metal amount read at the spectrophotometer, in mg/l

25 = HNO₃ 0,5N solution volume, in ml;

m_p = sample mass weighted for the analysis, in g;
 D = sample dilution.[6]

RESULTS AND DISCUSSIONS

The amounts, in mg/l, of each determined metal, read at the spectrophotometer and the wave length at which the determination has been realised are presented in (table 2).

Table 2

Metal amounts in mg/l in the samples read at the spectrophotometer

Sample No	Sample mass [g]	Mg [mg/l]	K [mg/l]	Ca [mg/l]	Na [mg/l]	Cu [mg/l]	Zn [mg/l]	Mn [mg/l]	Fe [mg/l]
1	7.0183	10.54	24.64	9.28	25.26	0.011	0	0	0
2	7.0204	12.97	25.75	17.69	25.3	0	0	0.03	0.13
3	7.1097	15.74	25.8	9.66	24.82	0.06	0.24	1.01	0.36
4	7.0216	13.32	25.17	8.91	24.67	0.49	0	0.22	10.21
5	7.0145	19.72	26.34	8.60	25.82	0.12	0.15	1.24	1.02
6	7.0077	4.85	16.09	3.93	26.23	0	0.89	0.39	0.69
7	7.0122	4.57	5.55	6.67	10.08	0.11	0	0	0
8	7.0621	12.06	25.10	8.25	23.88	0	0	0	0.04
9	7.0367	11.82	24.94	5.58	24.42	0	0	0	0
10	7.0255	12.53	25.30	6.13	24.32	0	0	0.10	0
11	7.0345	6.28	17.35	6.872	25.01	0	1.05	0.64	2.02
12	7.0386	11.80	24.83	6.37	24.13	0.36	0	0	0
13	7.0320	14.43	13.44	1.58	25.66	0.34	0.72	0.39	0.75
14	7.0344	13.29	17.35	4.26	24.32	0.18	0.66	0.35	1.52
15	7.0218	7.182	11.76	5.19	25.00	0.26	0.81	0.54	1.95
16	7.0077	2.97	20.98	3.79	14.02	0.08	0.02	0.01	0.07
17	7.0043	4.39	11.59	5.20	7.68	0.05	0.05	0	0.25
18	7.0059	0	11.63	3.87	5.51	0	0.01	0	0.30
19	7.0750	3.08	21.46	7.69	11.14	0.01	0	0	0.01
20	7.0742	4.94	14.84	5.60	17.94	0.27	0.69	0.54	1.23
21	7.0261	4.43	11.59	1.29	19.23	0.24	0.87	0.45	0.87
22	7.0088	4.70	11.63	1.47	17.63	0.19	0.68	0.29	0.75
23	7.0318	7.97	21.46	2.51	20.23	0.52	1.01	0.81	2.63

The amount of each metal in the analysed samples transformed in mg/kg are presented in (table 3):

Table 3

The metal amounts in the analysed samples calculated in mg/kg

Sample No	Mg [mg/l]	K [mg/l]	Ca [mg/l]	Na [mg/l]	Cu [mg/l]	Zn [mg/l]	Mn [mg/l]	Fe [mg/l]
Glutenous biscuits								
1	10.54	24.64	9.28	25.26	0.011	0	0	0
2	12.97	25.75	17.69	25.3	0	0	0.03	0.13
3	15.74	25.8	9.66	24.82	0.06	0.24	1.01	0.36
4	13.32	25.17	8.91	24.67	0.49	0	0.22	10.21
Dietetic biscuits								
5	19.72	26.34	8.60	25.82	0.12	0.15	1.24	1.02
6	4.85	16.09	3.93	26.23	0	0.89	0.39	0.69
7	4.57	5.55	6.67	10.08	0.11	0	0	0
Sugarous biscuits								
8	12.06	25.10	8.25	23.88	0	0	0	0.04
9	11.82	24.94	5.58	24.42	0	0	0	0
10	12.53	25.30	6.13	24.32	0	0	0.10	0
11	6.28	17.35	6.872	25.01	0	1.05	0.64	2.02
Creamy biscuits								
12	11.80	24.83	6.37	24.13	0.36	0	0	0
13	14.43	13.44	1.58	25.66	0.34	0.72	0.39	0.75
14	13.29	17.35	4.26	24.32	0.18	0.66	0.35	1.52
15	7.182	11.76	5.19	25.00	0.26	0.81	0.54	1.95
Cream								
16	2.97	20.98	3.79	14.02	0.08	0.02	0.01	0.07
17	4.39	11.59	5.20	7.68	0.05	0.05	0	0.25
18	0	11.63	3.87	5.51	0	0.01	0	0.30
19	3.08	21.46	7.69	11.14	0.01	0	0	0.01
Biscuit lids								
20	4.94	14.84	5.60	17.94	0.27	0.69	0.54	1.23
21	4.43	11.59	1.29	19.23	0.24	0.87	0.45	0.87
22	4.70	11.63	1.47	17.63	0.19	0.68	0.29	0.75
23	7.97	21.46	2.51	20.23	0.52	1.01	0.81	2.63

If we analyse the data in table 3 we observe the fact that the biscuits (in the case of bulk glutenous biscuits that are sold at the smallest prices) have the lowest micro and macroelements content. The other 3 assortments, prepacked, show a near concentration of the analysed components, the recorded differences being insignificantly, excepting the double Ca content of the imported biscuits, which also contain powder milk.

In the analysed dietetic biscuits group we observe the increased contribution in essential metals showed by the local sugar free dietetic biscuits compared with the other two groups, mostly with the ones addressed to the children.

Regarding the sugarous biscuits, that, according to the definition, are different of the glutenous ones by the increased sugar and fat contribution, we observe the low proportion of metals in the bulk product and the relatively equal repartition in the other three assortments.

Analysing the creamy assortments we observe an very different and random composition of macroelements, both between the whole biscuits and between the biscuits lids and creams, individually analysed. This isn't the case of the microelements, that have recorded a relatively homogeneous repartition in the samples numbered from 12 to 23.

CONCLUSIONS

Analysing the obtained results and the ingredients list on the products labels, we reached the following conclusions:

1. The flour type, which is the basic raw material is the one that gives the metallic profile of these food products.

2. The sugar and fat, egg and powder milk adding, in the case of the creamy biscuits has no influence in the increase of micro and macroelements composition of the product, even having an inverse influence in some assortments.

3. the unhomogeneity of the obtained data after analyzing the creamy biscuits, reported to the one realized on the lids and creams commits us to further wider and finer research over these assortments composition [2,5].

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