

摄食辐照食品者血清中微量元素分析研究

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关键词: 辐照食品 血清 微量元素 ICP-AES

十多年来,国内外对辐照食品进行了大量的工艺条件和卫生安全性的研究。系统地收集和评述辐照食品作为人类食品时,对人体健康有否影响的资料是辐照保鲜技术推广应用的一个极重要的工作。本工作在文献[1]、[2]的基础上,开展了人群摄食辐照食品卫生安全性评价研究,叙述了血清中微量元素分析法和研究结果,为辐照食品卫生安全性提供了依据。

一、实验对象与方法

1. 试食对象 (1)学生组:系上海医科大学卫生系学生,年龄18—23岁,共70人,其中男性36名,女性34名。无慢性疾病,不常服用药物,较少接触化学物质。而后按其性别、年龄、体重、体高予以配对,受试者随机分成食用辐照食品的试验组和食用相同品种的未辐照食品的对照组。(2)教工组:上海医科大学放射医学研究所和卫生系教工8人,年龄21—46岁,男女各半,其余均同学生组。

2. 辐照剂量 用 ^{60}Co 源的 γ 射线辐照35种食品。辐照剂量:香肠、牛肉干为8kGy;红枣、桂圆、黄花菜为1.5kGy;莲心、腐竹为1kGy;大米、面粉、黄豆、赤豆、花生仁、苹果、桔子、磨菇为0.4 kGy;卷心菜、黄芽菜、芋艿、茭白、萝卜、慈姑、荸荠、冬笋、乌笋、刀豆、花菜、青椒、扁豆、冬瓜、蕃茄、姜、毛豆、胡萝卜、藕为0.2kGy;马铃薯为0.1kGy。

3. 辐照时间 辐照食品占总膳食重量的60.3%,试食时间为90天,均以双盲法进行。

4. 血样采集 空腹从肘静脉取血,待血液凝结退缩后,离心15分钟(在3000r/min时),分离的血清存放于聚乙烯试管中,并保存于 -20°C 的冰箱内,待测试。所有血清均未见有溶血。

5. 血清分析 吸取采集到的血清1.00ml,放入石英坩埚中,并把它置于Edwards Mini Fast-680型冷冻干燥机内在 $-40\sim-50^{\circ}\text{C}$ 下冷冻干燥8小时,转入柳本LTS-154型低温灰化炉中灰化8小时(功率125W,氧气流量200ml/min),灰分用1mol/l HCl溶解,制得的试液用ICP-AES法测定其中12种微量元素含量。

仪器设备和ICP工作参数见文献[1]。

二、结果和讨论

1. 数据处理 血清中微量元素含量和用1ml人体混合血清的全程回收率列于表1。我们把试验组和对照组血清中的12种微量元素分析结果全部输入PDP11/70计算机进行F试验和t试验,从表1中F值可见:除Fe元素外其他11种微量元素含量无统计学上的差异,为了搞清

Fe含量差异的原因,我们把男女分开进行F试验统计。从表2可见:男性试验组与对照组血清中微量元素Fe含量无统计上的差异;女性两组间血清中Fe含量在统计学上有极明显差异。我们进一步把女性试食前血清中Fe含量输入70机进行t检验,结果列于表3。说明女性血清中Fe含量试食前有统计学上的差异。因此,我们认为试验组与对照组中女性间血清中Fe含量统计学上的差异,是由于试食前分组时已存在,并非食用辐照食品所致。

2. 误差 本方法的检出限为0.001—0.010 $\mu\text{g/ml}$ 。从表1的回收率数据可见:采用冷却干燥—低温灰化法,可避免血清中某些易挥发元素(如Sn)的损失,回收率较好,样品分析结果的偏差较小。尽管如此,Cr的回收率仍不令人满意,主要是由于空白太高(外加量1 $\mu\text{gCr/4ml}$);Se的回收率较好,但样品的测定值偏高,主要是由于Ca的影响所致。今后可用电化学法测定之。也是本法有待今后改进的工作之一。

表1 血清中微量元素含量、标准偏差、F值、回收率

元素	项目	波长(nm)	试验组*($\mu\text{g/ml}$)	对照组*($\mu\text{g/ml}$)	F 值	P 值	回收率(%)
Cd		226.5	0.0047 $\pm$ 0.0010	0.0058 $\pm$ 0.0010	2.0455	>0.10	98.06
Co		228.6	0.0102 $\pm$ 0.0026	0.0096 $\pm$ 0.0021	0.0057	>0.25	96.26
Cr		267.7	0.4190 $\pm$ 0.0473	0.4241 $\pm$ 0.0392	0.0031	>0.25	72.82
Cu		324.7	1.1713 $\pm$ 0.0425	1.1537 $\pm$ 0.0388	0.1195	>0.25	90.74
Fe		259.9	1.8505 $\pm$ 0.0625	2.1359 $\pm$ 0.0916	4.8480	<0.01	97.54
Mn		257.6	0.0601 $\pm$ 0.0194	0.0535 $\pm$ 0.0061	0.0649	>0.25	96.20
Mo		202.0	0.0231 $\pm$ 0.0020	0.0227 $\pm$ 0.0018	0.1539	>0.25	92.72
Ni		341.4	0.4761 $\pm$ 0.0562	0.4424 $\pm$ 0.0623	0.0958	>0.25	98.62
Pb		220.3	0.0604 $\pm$ 0.0115	0.0606 $\pm$ 0.0096	0.0023	>0.25	108.44
Sn		189.9	0.1490 $\pm$ 0.0058	0.1530 $\pm$ 0.0049	0.2041	>0.25	82.20
Se		196.0	0.3602 $\pm$ 0.0126	0.3668 $\pm$ 0.0108	0.0717	>0.25	97.58
Zn		206.2	1.3210 $\pm$ 0.0520	1.4301 $\pm$ 0.0547	1.9267	>0.10	92.16

* n=39

表2 试食后男性和女性血清中铁含量比较

组别	男 性 (n=19)			女 性 (n=20)		
	测得值($\mu\text{g/ml}$)	F 值	P 值	测得值($\mu\text{g/ml}$)	F 值	P 值
试验组	2.0421 $\pm$ 0.0747	0.0041	P>0.25	1.6477 $\pm$ 0.0765	10.2460	P<0.01
对照组	2.0762 $\pm$ 0.1280			2.1990 $\pm$ 0.1334		

表3 女性试食前血清中铁含量的比较

	测得值($\mu\text{g/ml}$)	t 值
试验组*	1.6778 $\pm$ 0.3557	$t_0=0.14176$
对照组*	1.6649 $\pm$ 0.3278	$t_{0.05}=2.0930$

* n=20

综上所述,食用35种辐照主副膳食90天的人群与食用相同主副膳食未辐照处理的对照人群,用ICP-AES法测定其血清中的12种微量元素含量,经F试验和t试验比较,未发现有数理统计上的显著差异。表明食用辐照食品不会引起人体血清中微量元素含量的变化。

林森浩、徐耀良、秦俊法同志帮助数据处理,特此致谢。

参 考 文 献

- [1] 黄宗枝等,核技术,5,43,(1986)。
- [2] 黄宗枝等,核技术,9,32,(1986)。

(1986年2月3日收到)

The precursor, chloro-lysine was obtained by the reaction of L-lysine hydrochloride with chlorine gas in concentrated hydrochloric acid medium under uv light radiation. Then tritiated L-lysine was prepared by catalysed halogen-tritium exchange.

The specific activity of L(β , γ - ^3H) lysine was 5.9 TBq/mmol ($\sim 16\text{Ci/mmol}$). The radiochemical purity was over 95%.

Keywords: chloro lysine halogen tritium exchange

The trace element spectrum characteristics in hair of longevo in Shanghai

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The contents of trace element in hair of 108 longevoes (18 males, 90 females) in Shanghai have been determined by XRF. It was found that the contents of Fe, Mn, Ca, Sr in hair of females were higher than males, while the contents of Ni, Cr in males were higher than females. In contrast with ordinary old people, the hair of longevo was obviously higher in Mn, Fe, Cr, Ti and lower in Cu contents. The contents of Ca and Sr were comparable in both cases.

Keywords: XRF hair trace element Mn Fe Cr Cu Sr

Preparation of tritiated succinyl cyclic 3', 5'-adenosine monophosphate (ScAMP)

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Dimethyl acetylenedicarboxylate was tritiated with $^3\text{H}_2$ in the presence of Pd-C catalyst and dehydrated to give (2,3- ^3H)-succinyl anhydride. Then, ^3H -ScAMP in the presence of triethylamine. After purification the specific activity was 40 Ci/mmol and the radiochemical purity was 97%. The calibration curve obtained for cyclic AMP RIA with labelled product was satisfactory.

Keywords: tritium labelling (2,3- ^3H)-succinyl cyclic adenosine monophosphate (ScAMP) (2,3- ^3H)-succinic acid

Analysis of trace elements in serum from human eating irradiated food

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A method of trace element analysis by ICP-AES in serum from human eating food preserved by irradiation is described. Trace element analysis in human serum is one of the research projects concerning the wholesomeness

78 serum samples of the human eating food preserved by irradiation were collected. After ashing and solving ICP-AES analysis of serum is performed for detection of 12 trace elements in specimen solution. The detection limitations are in the range of 10^{-2} — 10^{-3} ppm for different elements. The recoveries of elements are over 73%.

Concentrations of 12 trace elements in 78 human serum has been calculated with F and t tests at PDP 11/70 computer and it was concluded that there is no significant difference between testing group and control group.

Keywords: irradiated food serum trace element ICP-AES

Suitability and calibration of neutron survey meter

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Keywords: neutron survey meter ambient dose equivalent energy response calibration

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