

## POLYCHLORINATED DIBENZO-*p*-DIOXINS AND DIENZO-FURANS IN FAST FOOD OF KOREA

Kyoung-Sim Kim, Jong-Guk Kim<sup>1</sup>

Department of Environmental Engineering, Chonbuk National University  
 Research Institute of Industrial Technology in Chonbuk National University<sup>1</sup>  
 664-14 Duckjin-Dong, Duckjin-gu, Chonju, Chonbuk, 561-756, Korea

### 1. Introduction

Food, especially dairy products, meat and fish are the primary sources of dioxins to non-occupational human exposure. It is necessary to grasp the environmental level of it in order to estimate dietary exposures. In particular, "Fast food" has steadily increased in consumption in many other country as well as Korea, these days it is a more popular type of foodstuff. However there appears to be a few data in order to understand the intake of dioxins by fast food intake. As regards the above information, the main object of this study is to investigate the levels of PCDDs/PCDFs in representative four types of fast food such as Hamburger, Chicken nugget, Pizza and Noodle (Ramyon) and to make a comparative study with existing data.

### 2. Material and Methods

#### *Sampling and sample preparation*

We divided fast food into four groups as Hamburger, Chicken nugget, Pizza and Noodle (Ramyon) and Three items of all samples were purchased in three different places during March and October 1999. Table 1 below gives information in each of the four samples.

**Table 1. Four fast food types and sample information**

Food Type	Sample name	No. of Pools	Analyzed sample weight (g)
Hamburger	Burger king	6	215
	Big Mac	6	101
	Lotte Lia	6	187.5
Chicken nugget	KFC	12	88
	Pop-eyes	12	58
Noodle	UM <sup>P</sup>	6	60
	KC <sup>P</sup>	6	60
	SN <sup>C</sup>	6	66
	CT <sup>C</sup>	4	60
	MK <sup>C</sup>	4	60
	YK <sup>C</sup>	6	60
Pizza	Meatza (D)	3	44.5
	Supersupreme (P)	3	76.6
	Potato (D)	3	75
	Half & Half (D)	3	54.6
	Half & Half (P)	3	50

Note: <sup>C</sup> is cup type noodle, <sup>P</sup> is pack type noodle, (D) is Domino<sup>®</sup> Pizza, (P) is Pizza Hut pizza

Analytical method

Samples were deboned if necessary, grounded and finely homogenized. Then equal amounts of each sample was mixed with the same ratio of individual food and taken for a composite sample. Samples were extracted with toluene in a Soxhlet extractor for 20 hrs and then were digested in 1N-KOH ethanol solution at room temperature for a period of 2hrs. After extraction, the samples were treated with sulfuric acid. Crude extract from every sample was further purified in silica gel column, basic Alumina column and finally, in activated carbon impregnated silica-gel column chromatography. Quantifications were performed with J&W Scientific DB-5 column(60m×0.25mm i.d×0.25µm film thickness) and Supelco SP2331(60m×0.32mm i.d×0.20µm film thickness) on Autospec Ultima NT at >10,000 resolutions. The levels were expressed in 2,3,7,8-TCDD toxic equivalents using calculations of International Toxic Equivalent Factors (I-TEFs) for PCDDs/PCDFs

**3. Results and Discussion**

Concentration of hamburger, nugget and Pizza

The measured concentration of hamburger and pizza are shown in Table 1. In hamburger samples total PCDDs and PCDFs ranged from 1.873 pg/g wet weight for Burgerking, 2.213pg/g wet weight for Lotte Lia, 2.696g/g wet weight for Big Mc and Chicken nugget of KFC appeared 2.382 pg/g wet weight.

Table 1. Concentration of Hamburger, nugget and pizza

Type	Item	Total Concentration (pg /g wet wt)			I- TEQ concentration (pg TEQ/g wet wt)		
		PCDFs	PCDDs	SUM	PCDFs	PCDDs	SUM
Hamburger	Burger king	0.119	1.754	1.873	0.008	0.012	0.020
	Big Mac	0.249	2.447	2.696	0.018	0.022	0.040
	Lotte Lia	0.148	2.065	2.213	0.011	0.013	0.025
Chicken Nugget	KFC	0.282	2.100	2.382	0.025	0.022	0.046
	PopEyes	0.239	2.086	2.325	0.022	0.012	0.034
Pizza	Meatzaa (D)	6.370	5.696	12.066	0.196	0.158	0.354
	Supersupreme(P)	3.262	4.548	7.810	0.101	0.095	0.196
	Potato (D)	3.921	6.544	10.464	0.150	0.142	0.292
	Half&Half(D)	1.287	1.776	3.064	0.068	0.040	0.108
	Half&Half(P)	3.794	4.833	8.627	0.109	0.082	0.190

Note: (D) is Domino' Pizza, (P) is Pizza Hut pizza

# POPs IN FOOD-POSTER

In pizza, "supreme pizza" was detected with 7.180 pg/g wet weight and half & half was 3.064(Domino), 8.627(Pizza Hut) pg/g wet weight.

I-TEQ levels of fast food samples ranged from 0.020 to 0.040 pgTEQ/g wet wt for hamburger, 0.034~0.046 pgTEQ/g wet weight for nugget. The value of pizza samples is slightly higher than one of Schecter et al (1997) as 0.108~0.354 pgTEQ/g wet weight. Especially "supreme pizza" of the same sample in Schecter's study is similiar to it.

## Concentration of Noodle(Ramyon)

We divided two types of noodles into cup noodle and pack noodle and, the analyzed results are shown in Table 2. It shows the measured levels of noodles, total concentrations are 6.905~48.546 pg/g wet weight for cup noodle, 7.659~29.502 pg/g wet weight for pack noodle. Total concentration was the same even when converted into TEQ level. According to the principal ingredient, in fast food stuff, this is somewhat more different.

Table 2. Concentration of noodles

Type	Item	Total Concentration (pg /g wet weight)			I-TEQ concentration (pg TEQ/g wet weight)		
		PCDFs	PCDDs	SUM	PCDFs	PCDDs	SUM
Noodle (Ramyon)	UM <sup>P</sup>	0.888	6.771	7.659	0.042	0.035	0.077
	SN <sup>P</sup>	0.866	28.636	29.502	0.049	0.058	0.108
	KC <sup>C</sup>	2.687	45.859	48.546	0.104	0.077	0.181
	CT <sup>C</sup>	0.909	16.163	17.072	0.054	0.047	0.101
	MK <sup>C</sup>	2.945	3.959	6.905	0.441	0.103	0.545
	YK <sup>C</sup>	0.947	25.205	26.152	0.157	0.064	0.221

Note: <sup>C</sup> is cup type noodle, <sup>P</sup> is pack type noodle.

## Comparison of general food group

In this study we intend to compare and estimate the difference of TEQ values between korean retail food groups and fast food as given Figure 1.

Samples of retail food groups were collected and examined from the period of March to Octoer 1999. As results indicate total concentrations of PCDDs/PCDFs in food samples had a whole weight basis ranged from 0.02 to 6.33pg/g wet weight. The mean TEQ values of fish/shellfish and meat samples value were 0.188 and 0.034 pg TEQ/g wet wt.

On the other hands, mean TEQ values of fast food are 0.028 pgTEQ/g wet weight for hamburger, 0.040 pgTEQ/g wet for nugget, 0.228 pgTEQ/g wet for Pizza and 0.205 pgTEQ/g wet for noodles.

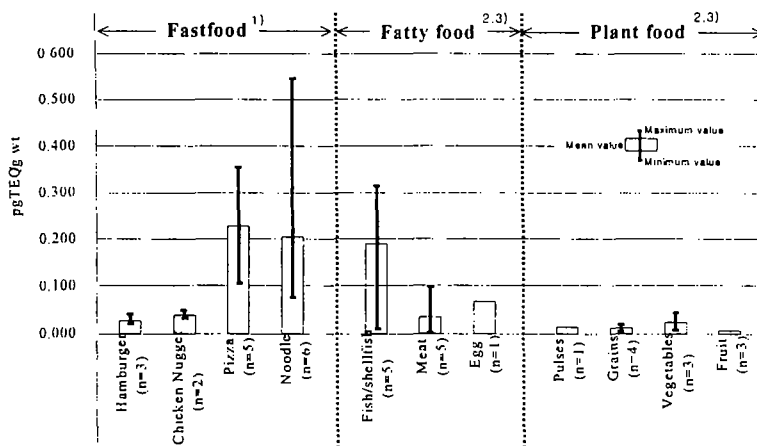


Figure 1. Comparison of TEQ values between Korean retail food groups and fast food

## References

1. Arnold Schecter; "Dioxins, Dibenzofurans, Dioxin-like PCBs and DDE in U.S. Fast food, 1995", *Chemosphere* Vol.34, Nos. 5-7 pp.1449~1457, 1997
2. Jong-guk, Kim, "Exposure of PCDD/DFs via air and food in Koreans", *Organohalogen compounds*, 47, 314~317
3. Jong Guk Kim, Noriyuki Suzuki, Shigeki Masunaga and Junko Nakanishi: Concentration and Bio-Sediment Accumulations of Polychlorinated Dibenzo-p-dioxin and Dibenzofuran in Fish and Shrimp from Lake Kasumigaura, *Journal of Environmental Chemistry*, Vol. 6, No. 4, 541-549, 1996