DIOXINS IN HUMAN MILK AND SERUM FROM TARANTO, ITALY

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Introduction

An iron and steel factory which has been in operation since 1964 is located northwest of the city of Taranto, Italy and investigators have been conducting studies to see if there is any excess exposure to residents of this area to polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). The purpose of our study is to compare the reported PCDD/PCDF TEQ levels found in breast milk samples and in pooled serum samples collected from individuals living in the area of Taranto with levels reported in other areas in Italy and in other countries.

The concentration of dioxin in human breast milk is highly variable and is affected by many factors besides exposure to a contaminant source[1]. All individuals in industrialized societies have measureable levels of PCDD, PCDF, and PCB congeners in their blood[2,3], and these chemicals are dissolved and equally distributed in the lipid stores of the body[4]. A toxic equivalency (TEQ) scheme for PCDD, PCDF, and PCB congeners has been developed and applied to congener-specific data[5].

Materials and methods

We have been provided PCDD/F analytical data for three breast milk samples from individuals residing in three different areas near Taranto as well as data from two serum pools from Taranto[6]. Pool A contained serum collected from five men (four were smokers) with an average age of 61.5 years who had resided in Taranto for multiple decades. Pool-B contained serum collected from five men (none were smokers) with an average age of 75 years who had also resided in Taranto for multiple decades.
No supporting laboratory data were provided for any of these samples to allow an assessment of the validity of the various reported PCDD, PCDF, and PCB levels.

Results and discussion

Breast milk samples among countries. Figure 1 is a plot of the PCDD/PCDF TEQ in breast milk from 26 countries that participated in a WHO-coordinated exposure study on the levels of PCBs, PCDDs, and PCDFs in human milk[7]. As can be seen in Figure 1, the levels in Italy—as well as the levels in the Taranto samples (shown in blue)—are within the range of levels reported from other countries.

Breast milk samples within Italy. There has been no statistically valid sampling of the Italian population by various demographic factors to compare results from the three breast milk samples from Taranto. However, a number of regional studies have been published. Figure 2 is a plot of the PCDD/PCDF TEQ in breast milk from various regional studies within Italy. The levels in the Taranto breast milk samples (shown in blue) are not elevated compared to other regional studies. The INCA laboratory reported the Taranto breast milk TEQs using the older 1998 TEF values. Even the maximum value for the three Taranto-area samples, 11.4 pg/g lipid, was about the same as the measured value for a pool of 12 samples from Milan (11.7 pg/g lipid). We have also recalculated the TEQs for the three Taranto samples using the newer 2005 TEF values. As can be seen in Figure 2, the Taranto levels are similar to levels reported from Piacenza, Milan, and Giugliano, which were collected during the same time period (2008–2009).

Pooled serum samples from Taranto. The results for the PCDD/PCDF TEQ in the Taranto serum pools are compared to the background reference range levels measured for a statistically representative sampling of the US population (CDC 2003-2004) in Figure 3. The PCDD/PCDF TEQ for both Taranto serum pools are within the median range of age-adjusted levels for men in the United States. Figure 4 shows the distribution of PCDD/PCDF TEQ levels by age for men in the US population compared to the levels measured in the two

Figure 1. PCDD/PCDF TEQ (pg/g lipid) in Human Milk by Country

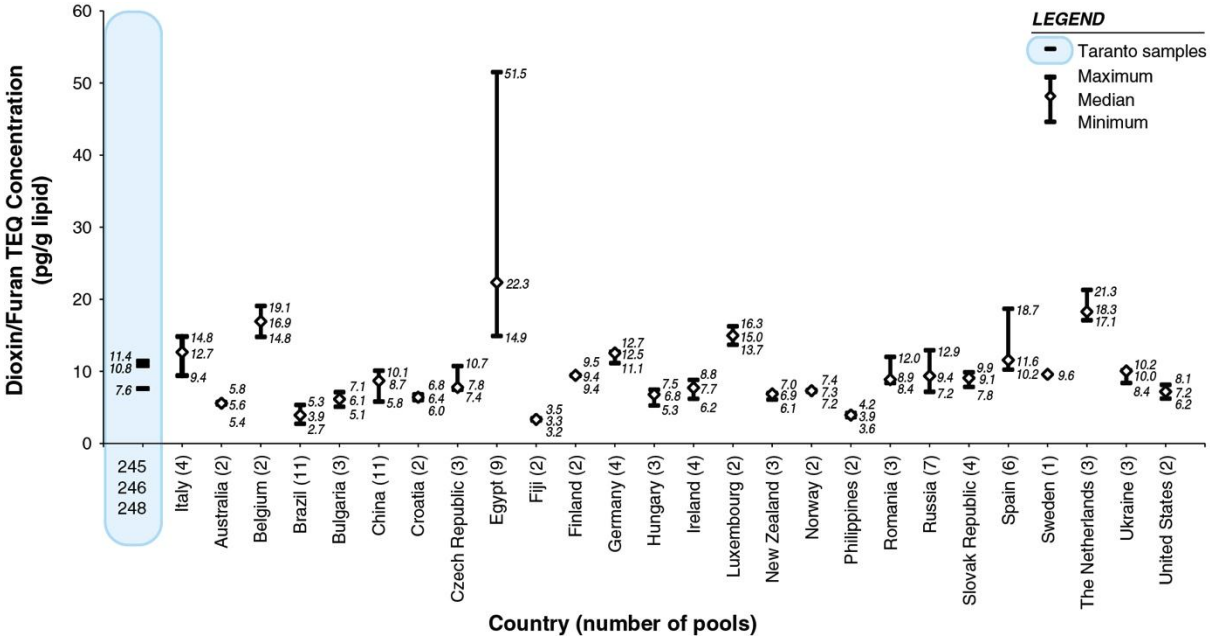
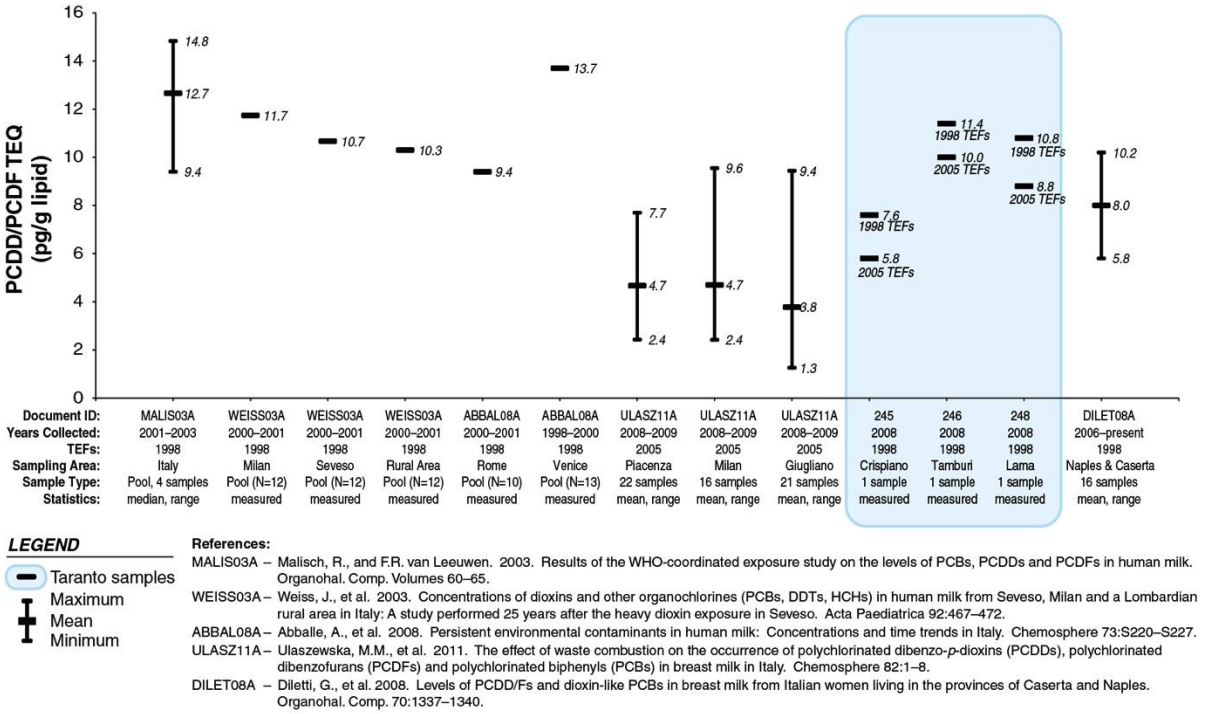


Figure 2. PCDD/PCDF TEQ (pg/g lipid) in Human Milk Within Italy



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ABBAL08A – Abballe, A., et al. 2008. Persistent environmental contaminants in human milk: Concentrations and time trends in Italy. Chemosphere 73:S220–S227.

ULASZ11A – Ulaszewska, M.M., et al. 2011. The effect of waste combustion on the occurrence of polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) in breast milk in Italy. Chemosphere 82:1–8.

DILET08A – Diletti, G., et al. 2008. Levels of PCDD/Fs and dioxin-like PCBs in breast milk from Italian women living in the provinces of Caserta and Naples. Organohal. Comp. 70:1337–1340.

Figure 3. Comparison of the Median PCDD/PCDF TEQ2005 in Serum from USA (NHANES 2003–2004) and Taranto, Italy

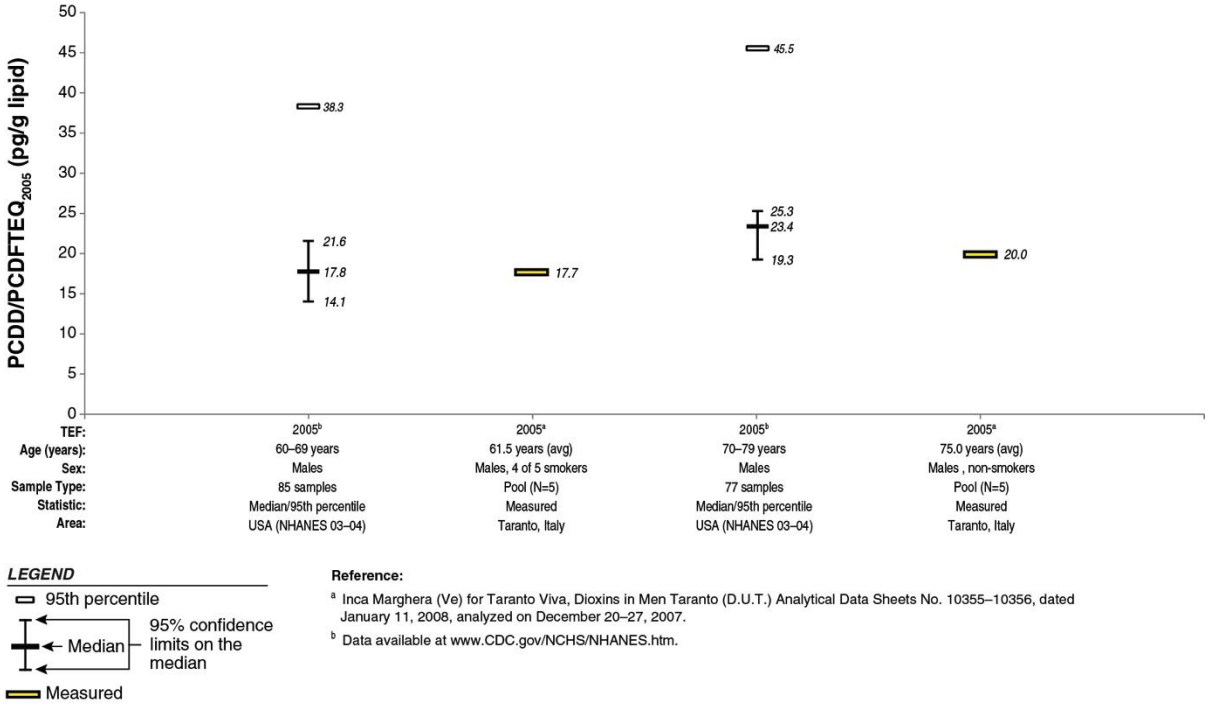
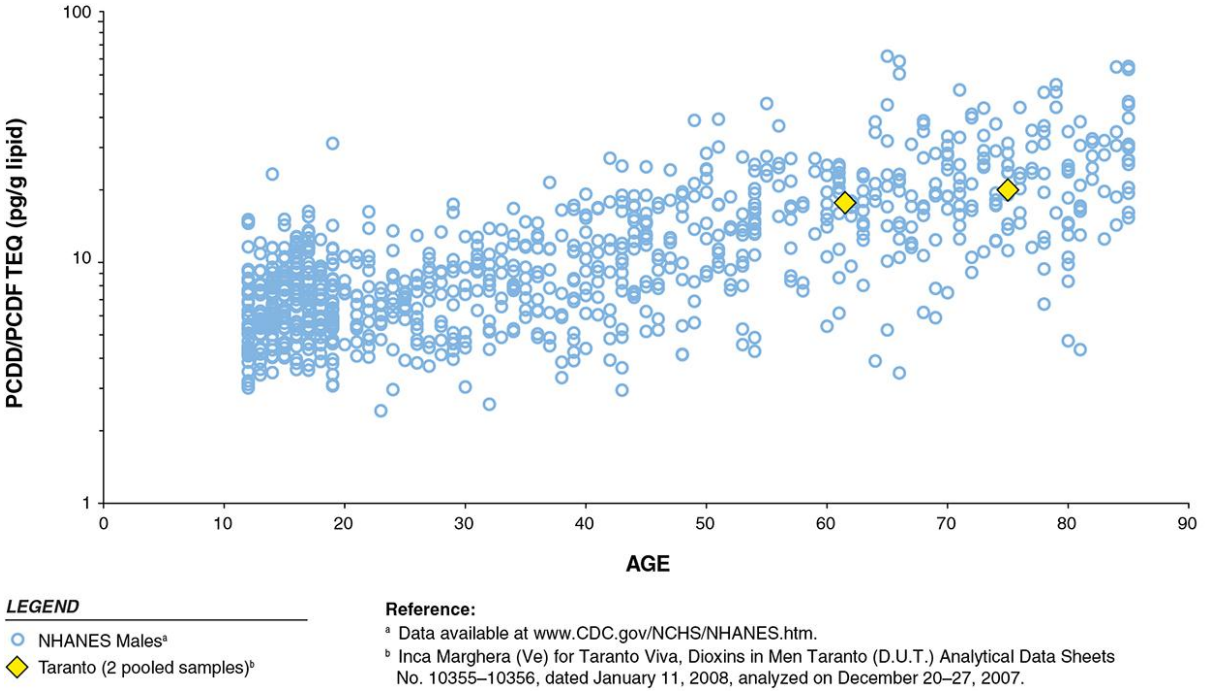


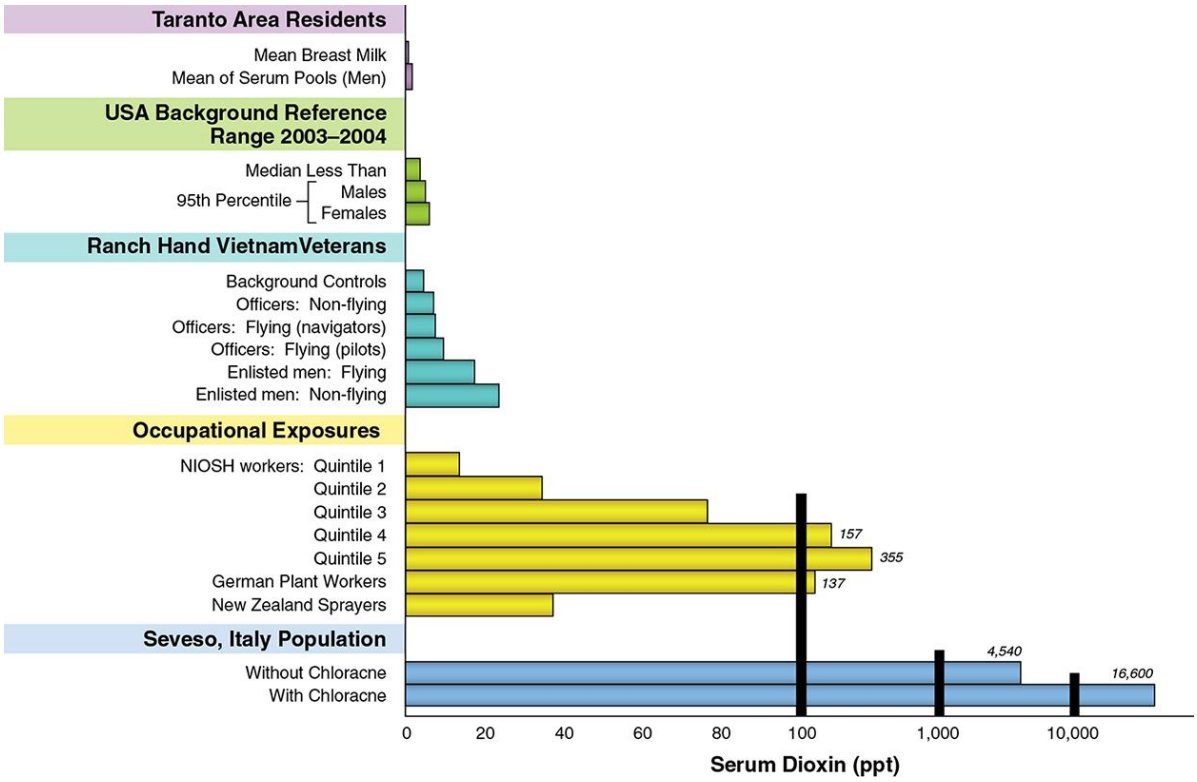
Figure 4. PCDD/PCDF TEQ in Pooled Serum of Males Living in Taranto for Multiple Decades Compared to Male USA Residents (NHANES 2003–2004)



Taranto serum pools. The levels in the Taranto pools are within the range of levels measured in a statistically representative sampling of men from the United States.

Comparison of 2,3,7,8-TCDD Levels in Breast Milk and Serum from Taranto with Selected Populations. Figure 5 is a comparison of Taranto breast milk and serum 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) levels with selected populations in different parts of the world. The Centers for Disease Control and Prevention (CDC) publishes every two years the results from measurements of chemicals in a statistically representative sampling of the US population. The median and 95th percentiles for TCDD from the latest survey in 2003–2004 are shown in Figure 5[3]. The top of Figure 5 shows the mean TCDD level for the three Taranto breast milk samples and the mean TCDD level for the two serum pools of men living multiple decades in Taranto. The levels from Taranto are within normal background levels in non-exposed populations.

Figure 5. Median Serum Dioxin Levels in Selected Populations (2,3,7,8-TCDD)



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