

# **ANALYSIS OF SOME BIOMARKERS TO EVALUATE THE OXIDATIVE STRESS POTENTIALLY INDUCED BY TOLUENE EXPOSURE**

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## **Introduction**

- **Oxidative stress is a condition of unbalance between the pro-oxidant status and the anti-oxidant protection.**
- **Oxidative stress is supposed to be one of the principal causes of cellular aging.**

## **Introduction**

- **Toluene is known as a toxic substance able to cause altered clinical signs of central nervous system or hepatic and renal damage.**
- **The aim of our study is the evaluation of the possible oxidative stress induced by toluene working exposure, measuring some specific biomarkers.**

## **Methods**

- **we evaluated the oxidative stress in 187 workers of a firm producing gummed texture using high amount of toluene.**
- **we studied the environmental and personal exposure levels of toluene.**
- **we also measured for every worker some oxidative stress biomarkers.**

## **Methods**

**For every worker we evaluated:**

- the environmental concentration of toluene in a standard working day;**
- the concentration of urinary toluene;**
- the concentration of haematic toluene;**
- the concentration of urinary hippuric acid.**

## Methods

The stress biomarkers evaluated have been:

The determination of plasmatic hydroperoxides.

- the evaluation of the marker has to be carried out in comparison with the level of haematic iron.
- the normal values, usually expressed in arbitrary units, should be under 300.  
(spectrophotometric evaluation)

## Methods

The measurement of the total plasmatic antioxidant barrier to determine the capacity of the single patient to control the production of free radicals;

The antioxidant systems are endogenous molecules (enzymes, uric acid, thyols groups, etc.) as well as esogenous molecules (vitamines, flavonoids, etc.)

## Methods

- The evaluation of the total plasmatic antioxidant barrier is based on the reduction of  $\text{Cu}^{++}$  in  $\text{Cu}^{+}$  by the antioxidant substances present in the human plasma.
- The normal value of the barrier is from 800 to 1100 micromoles/litre.
- Under the 800 micromoles/litre there is a relevant risk of oxidative cellular damage



## **Methods**

**We also carried out:**

**the measurement of plasmatic SH groups,  
considered important antioxidant molecules;**

**Their normal value is ranging from 450 to 650  
micromoles/litre**

**Under the value 450 micromoles/litre there is a  
relevant risk of oxidative cellular damage**

## Methods

We also carried out:

- the evaluation of 8 hydroxy 2 deoxyguanosine, biomarker of DNA damage, detectable in urine;
- the normal value of this marker is not well defined, according to many scientific references we defined an acceptable maximum level of 3.5 nanograms/millilitre.

## **Methods**

**We also studied:**

- **ELISA measurement of isoprostanes which are oxidation products of lipoproteins and particularly of arachidonic acid and are considered a reliable marker of oxidative stress.**
- **the evaluation of their levels in urine is normal for values under 3.5 nanograms/millilitre.**

## **Methods**

**We also carried out a complete evaluation of the same group of oxidative stress biomarkers in a group of 100 patients, having the same possible confounding factors (age, same attitude at consuming tobacco smoke, special diets, etc.), but engaged in work activities characterized by the absence of chemical toxics in the workplaces.**

## Results

- The results of the evaluations of environmental toluene have reached valued up to 66.4 milligrams/cube metre;
- The haematic toluene values have been in all 187workers below 0.01 milligrams/litre.
- The urinary toluene values have been in all 187 workers below 0.10 milligrams/litre.
- All the evaluations of urinary hyppuric acid were absolutely normal.

## **Results**

**In 23 workers (12.3%) we found at least one oxidative stress biomarker altered.**

**The biomarkers more frequently altered have been the isoprostanes and the measurement of plasmatic SH groups.**

**In the control group only 3.0% of the patients showed at least one oxidative stress biomarker altered.**

## Discussion

The results have shown, in a group of workers of chemical sector, exposed to a low but sure presence of environmental toluene a negativity of the markers of personal exposure traditionally used in occupational medicine.

## **Discussion**

**On the contrary among the different biomarkers of oxidative stress we found in a relevant number of workers altered values, in one or more biomarkers values.**

**The control group did not show a similar reactivity to the oxidative stress biomarkers.**



## **Discussion**

**The variability of the single oxidative stress biomarker is different in the different workers.**

**The evaluation of a single biomarker seems not to be useful to evidence completely a possible positive reaction in a single patient.**

## Conclusions

- **Our study is only the first of a group of researches we have planned to verify the utility of the evaluation of oxidative stress biomarkers in Occupational Medicine.**
- **The hypothesis we start to evaluate in this research has obviously to be confirmed in more studies, on larger populations of workers, exposed to different chemical substances.**