Science of the Total Environment 518–519 (2015) 61–64

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Overweight and urban pollution: Preliminary results

Barnaba Giuseppina Ponticiello [a], Assunta Capozzella [a], Valeria Di Giorgio [a], Teodorico Casale [a], Roberto Giubilati [a], Gianfranco Tomei [b], Francesco Tomei [a,*], Maria Valeria Rosati [a], Angela Sancini [a]

[a] University of Rome "Sapienza", Department of Anatomy, Histology, Medical-Legal and the Orthopedics, Unit of Occupational Medicine (Dir: Prof. F. Tomei), Viale Regina Elena 336, 00161 Rome, Italy
[b] University of Rome "Sapienza", Department of Psychiatric and Psychological Science, Piazzale Aldo Moro 5, 00185 Rome, Italy

HIGHLIGHTS

- Workers exposed to urban pollution have an additional risk for BMI increasing.
- Female exposed workers have a significant higher mean weight compared with controls.
- Gender differences in health surveillance of exposed workers have to be considered.
- Our preliminary study encourages to continue this line of research.

ARTICLE INFO

Article history:
Received 21 November 2014
Received in revised form 16 February 2015
Accepted 24 February 2015
Available online 4 March 2015

Editor: P. Kassomenos

Keywords:
Overweight
Obesity
BMI
Urban pollution
Outdoor workers

ABSTRACT

The aim of this study is to determine whether in workers exposed to urban pollution the risk of developing overweight and obesity is higher in workers exposed to urban pollution compared to a control group.
The study was conducted on 150 volunteers, 75 workers exposed to urban pollution (50 women and 25 men) and 75 indoor workers (50 women and 25 men). Once measured the weight and height and calculated body mass index (BMI) for each worker, the research was based on the comparison, between the two groups, of the mean values of the measurements and of the frequency of workers with BMI index higher than the cut-off of normality.
The only statistically significant difference found was for the mean value of weight in women, which was higher among outdoor workers compared to indoor workers. The mean values of BMI and the frequency of workers with BMI higher than normal was higher among outdoor workers compared to indoor workers in both sexes, but not statistically significant.
The data suggest that outdoor workers may be subject to an additional risk of developing obesity as a result of exposure to urban air pollution (which, like obesity, is a source of oxidative stress). So, our preliminary study encourages to continue this line of research by implementing the sample and considering all the confounding factors. Furthermore, the results highlight the necessity to take account of gender differences in the context of health surveillance of workers.

1. Introduction

Epidemiological studies have shown a clear association between cardiovascular and respiratory diseases and air pollution (Caciari et al., 2012; Karottki et al., 2014). The oxidative stress, expression of the biological damage that occurs when the pro-oxidant factors exceed the endogenous and exogenous antioxidant defenses causing damage, is one of the potential pathophysiological mechanisms by which pollutants may cause adverse health effects (Hoffmann et al., 2009; Yanga and Omaye, 2009). In fact, several pollutants act as free radicals, e.g. the nitrogen dioxide; some others, such as ozone and particulates, above all PM10 and PM2.5, have the ability to induce the production (Donaldson and Stone, 2003; Kelly, 2003; Kennedy et al., 1998).

The oxidative stress is induced even by improper feeding, as in the case of little varied or not balanced diets, especially if poor in fruit and vegetable, or fat and high-calorie diets. In the first case this is due to a deficiency of antioxidants and in the second case to an excess of pro-oxidants (Ohara et al., 1993; Reilly et al., 1998). In fact, in this regard, the oxidative stress is linked to high BMI (body mass index) and to the presence of obesity (Vincent and Taylor, 2006; Wu et al., 2009).

It can therefore be assumed that urban pollution, causing oxidative stress, may also have effects on the BMI. A study carried out in 2008 (Charles et al., 2008) evaluated the association between measures of adiposity (BMI, waist circumference, waist–hip ratio, waist–height ratio, abdominal height) and biomarkers of oxidative stress (glutathione, glutathione peroxidase, vitamin C, thiobarbituric acid reactive substances, and

* Corresponding author at: Via Monte delle Gioie 13, 00199 Rome, Italy.
E-mail address: francesco.tomei@uniroma1.it (G. Tomei).

http://dx.doi.org/10.1016/j.scitotenv.2015.02.084
0048-9697/

Trolox equivalent antioxidant capacity) in police officers exposed to urban pollution. The results of this research showed that, despite some differences related to the physical activity and the gender, high adiposity measures were correlated with increased levels of oxidative stress and decreased antioxidant defenses in these exposed workers.

Other research specifically targeted to the study of the effects of pollutants on the BMI and overweight is reported in Section 4.

The aim of this study is to ascertain, through the measurement of weight and height and the calculation of the BMI, the presence of overweight and obesity in a sample of workers exposed to urban pollution compared to a control group. The research is as a preliminary study in order to evaluate whether, according to our results, it is worthwhile to deepen this field of research with further studies.

2. Materials and methods

The research was conducted on an initial sample of 330 municipal police volunteers.

Two groups were studied: outdoor workers, who were traffic policemen, controlling traffic in roads and areas with heavy and medium traffic and monitor crossroads, parking and limited-traffic areas; indoor workers, who performed bureaucratic and administrative activities in office. The subjects of both groups worked for seven hours a day for at least five days a week.

For inclusion in the study each worker completed, in the presence of a physician, a questionnaire relating to: age, length of service, drug therapies, smoking cigarettes (number of cigarettes smoked per day and years of smoking), and intake of alcohol (wine, beer and spirits; number of drinks per day).

All subjects who referred habitual intake of drug therapies for the treatment of chronic diseases, and all subjects who were regular consumers of alcohol (more than 2–3 units of alcohol per day for men and more than 1–2 alcoholic units per day for women, where 1 unit of alcohol corresponds to about 12 g of ethanol (Italian National Research Institute on Food and Nutrition)) were excluded from the study.

Among the 279 traffic policemen and indoor workers who remained after the exclusions, only those who were comparable as to age, length of service and cigarette smoking were selected (an outdoor worker for every indoor worker). We identified as: current smokers the subjects who had smoked at least 100 cigarettes in their lifetime and that at the time of the research smoked every day or almost; former smokers the subjects who were not smoking at the time of the research and hadn't smoked for at least six months; non-smoking subjects those who had never smoked or had smoked fewer than 100 cigarettes in their lifetime and that at the time of the research were not smoking (New York State BRFSS).

After this procedure, 131 subjects were excluded because they were not comparable as to the above mentioned factors, and the final sample consisted of 150 employees, of which 75 (50 women, including 19 smokers and 4 former smokers, and 25 men, including 11 smokers and 3 former smokers) exposed to urban pollution (outdoor) and 75 (50 women, including 19 smokers and 4 former smokers, and 25 men, including 11 smokers and 3 former smokers) with indoor work, that constitute the control group. The characteristics of the final sample are shown in Table 1.

In outdoor workers the degree of exposure to different pollutants was evaluated through the execution of individual dosimetries (see Table 2).

This evaluation was not carried out for indoor workers, since it is known and supported by the literature that, in the city in which the study was carried out, the exposure to urban pollutants for traffic policemen is higher than for indoor workers (Crebelli et al., 2001; Tomei et al., 2001; Verdina et al., 2001).

For each subject the body mass index (BMI) was calculated after the weight and height measurement. The value of the BMI of each individual was compared with the reference values established by the WHO in order to detect values of BMI above the "cut off" of normal (BMI > 25).

All subjects agreed their personal information being available, declaring that they had been made aware that these data were ranked as "sensitive information", and consented they should be treated in an anonymous and collective way, with scientific methods and for scientific purposes in accordance with the principles of Helsinki Declaration.

2.1. Statistical analysis

The differences between the mean values of the anthropometric measurements were compared using the Student's *t*-test for unpaired data. The differences between the frequencies of subjects with BMI values higher than the cut-off of normality were compared using the chi-square test with Yates correction. The differences were considered statistically significant for p values < 0.05. These parametric tests were chosen because the data showed a Gaussian distribution, so it was not considered necessary to use more complex tests, also considering that this is a preliminary study.

3. Results

The results of the study are shown in Table 1.

In the female population the mean weight is significantly higher among outdoor workers than indoor workers ($p < 0.05$), while the mean height does not show statistically significant differences between the two groups. The mean values of BMI are higher among outdoor female workers than among indoor female workers. The frequency of outdoor female workers with BMI higher than the cut-off of normality (overweight and obese) is higher than the one observed in indoor female workers (52% vs. 34%), although both differences were not statistically significant ($p = 0.134$).

In the male population no statistically significant differences were found for the mean weight and height between outdoor workers and indoor workers. Even in male workers, the mean BMI is higher in outdoor workers compared to indoor ones and the frequency of outdoor workers with BMI above the cut-off of normality is higher than

Table 1
Features of studied population and results.

	Women			Men		
	Indoor	Outdoor	p	Indoor	Outdoor	p
	n. = 50	n. = 50		n. = 25	n. = 25	
Mean age (SD[a]) in years	44.9 (5,2)	45.6 (4.9)	0.49	48.2 (7.7)	48.2 (7.8)	1
Mean length of service (SD[a]) in years	6.3 (4.6)	6.5 (5.5)	0.84	8.7 (7.4)	10.4 (9.2)	0.47
Mean BMI (SD[a])	24.6 (3.9)	25.7 (4.3)	0.18	26.7 (3.8)	27.9 (3.0)	0.22
Mean weight (SD) in kg	64.6 (3.5)	67.4 (4.1)	**0.01**	81.7 (14.2)	85.4 (11.7)	0.32
Mean height (SD) in cm	162.7 (3.7)	161.9 (3.9)	0.29	174.9 (8.2)	175.6 (8.0)	0.76

Bold value indicate significance at p value <0.05.
[a] SD = standard deviation.