108. Indoor and outdoor air pollution

P1033

Exhaled nitric oxide in traffic professionals exposed to ambient urban air pollution

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Exhaled nitric oxide (eNO) has been used as a non-invasive method to assess lung

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inflammation. Urban air pollution is associated with inflammatory markers and increased risk of pulmonary diseases. Traffic professionals are at risk of vehicular pollution exposure. However few studies have been published testing eNO in this group. We aim to study the association between air pollution, blood inflammatory markers and eNO in traffic professionals of Sao Paulo city (SP). Non smokers cab drivers (N=46) and traffic controllers (N=23) of SP were evaluated 4 times after work shifts. Pollutants (PM2.5 measured by reflectance and NO2 by colorimetry) were collected by individual samplers during 24h exposure before each evaluation. eNO, ultra sensitive C- Reactive Protein (us-CRP) and Erythrocyte Sedimentation Rate (ESR) were measured by ozone-chemiluminescence, high pressure liquid chromatography, nephelometry respectively. Inflammatory markers data were tested against pollutants levels by Linear regression model for repeated measures through generalized estimated equations (LME GEE). Statistical significance was set at 10%. PM2.5 was 40.33±20.83ug/m³ and NO2 197.25±43.47 ppm. eNO was 23.28±16.72 ppb, us-CRP 5.28±6.07 mg/L and ESR 3.21±3.20 mm/h. After adjustment for cardiovascular risks (abdominal circumference, hypertension, diabetes, age, body mass index) GEE tests showed associations between eNO and ambient NO2 (p<0.10) and us-CRP (p<0.05, adjusted for ESR and NO2). PM2.5 was correlated to both inflammatory blood markers (ESR $p\!<\!0.05$ and us-CPR p<0.10). We conclude that eNO is an inflammatory marker of deleterious lung effects of ambient air pollution in traffic professionals from SP.

P1034

Individual exposure of urban children to black carbon

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Background: Epidemiological studies have reported that exposure to particulate matter (PM) from fuel combustion has adverse effects on the respiratory health in children (Gaudermann WJ et al. AMJRCCM 2002;166:76-84). However, the determinants of individual exposure remain unclear. Using a new portable monitoring device, we sought to determine individual exposure to black carbon (a surrogate for combustion-derived PM).

Methods: Primary school children were given an Aethalometer to carry with them at all times for a 24 hour period. Cumulative black carbon was calculated by calculating the area under the curve (AUC) when plotting BC vs time. Activity diaries were used to divide the day into time at home, time commuting, and time at school or work. Personal exposure was compared with non-cycling adult commuters.

Results: For children 50.6% (\pm 9.3%) of exposure was at home, 19.1% at school and 30.3% at other times. Compared with adults (n=28), children (n=6) had similar 24 h exposure to BC (1019167 vs 706640 ng.m-3, p=NS). Children were exposed to more BC during the school day than adults at work (202380 vs 128710 ng.m-3, p=0.03).



Conclusions: Children living in our urban area (East London) were exposed to more black carbon during the school day than adults working indoors. We speculate that this because school children spend a greater proportion of the working day outdoors, where PM levels are higher.

P1035

Penetration and remanence of pollen in dwellings

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Indoor pollens come from outdoor pollination but the temporal relationship between both phenomenons is poorly documented. In this study, we ried to compute the influx and remanence of various pollen species throughout the pollen season. **Material & methods:** Five families living in the same street of a suburban community volunteered to participate. Monitoring of indoor pollen counts was performed at 4 occasions (February, April, May and August 2008) through sampling of house-dust from the living room. During the same period, outdoor pollen counts were monitored using a Burkard pollen trap.

Results: Variation of pollen counts over time: Overall, there was a strinking increase in indoor pollen counts during each pollen season: cypress (February), plane tree (April), Poaceae and olive.tree (June).However, away from the pollination period, there was still high number of pollen grains for the main allergenic.

Between species differences: Two groups of species can be defined on the basis of these results: the first group includes Platanus, Quercus and Cupressaceae which exhibit high remanence (0.4) and a low penetration, and the second group contains species with high penetration but various remanences).

Time period effect: Increasing values were observed along seasons: from very low (2.6, p value=3%) in winter, to moderate in spring (13 to 15, p value=0.001% and 0.001%) and hudge in summer (204, p value=0.10%). Remanence coefficients were never significant.

Discussion: Both pollen species, housing and the sampling time period have bearing on penetration and remanence of pollen grains indoor. These pollen could then interact with the allergic patients who could get symptom away from the pollination period.

P1036

Influence of wildfire's smoke during heatwaves on the mortality and morbidity due to respiratory diseases in abnormally hot summer of 2010 year in Russia

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Atmospheric air pollutants from natural disasters such as enviramenal smoke from wildfires can cause pathologic response of airways. One of such natural phenomena was abnormally hot summer with extensive fires in Russia in 2010 year.

This study aims to investigate combined influence of high temperatures and air pollution on respiratory health and mortality from respirotory diseases in central regions of Russian Federation during summer 2010 year.

Methods: Time series analyses of morbidity and mortality during 2008-2010 years in central regions of Russia. Case-crossover study of influence of pollution levels and air temperature on respiratory health in 2010 year compare with 2008 and 2009 years. Panel study: examenation of 30 patients with asthma and lung function tests with peak expiratory flow measurements during the dusty days in comparison with another period.

Results: Were recorded significant growth in respiratory morbidity and mortality during extreme smoke and abnormal heat. Number of emergency calls due to brochopulmonary diseases was twice higher than in 2008, 2009 and 2010. The most frequent cause of seeking the emergency aid were bronchila asthma, acute bronchitis and exacerbation of chronic obstructive pulmonary disease.

Conclusion: Our data suggest that there were a short-term associations between daily air pollution data and frequencies of events (death, hospital admission, emergency aid etc.) in the most hot days of summer 2010 year.

P1037

A longitudinal study about lung function and symptoms in patients with pollution-related illness

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Background: Air pollution is known a leading cause of respiratory symptoms. In Japan, an improvement of the atmosphere was achieved by the pollution organic act, and patients with air pollution-related illness have received medical care for more than 20 years under the Pollution Compensation Law.

Objectives: This study was to verify the effects of Japan system by investigating the long-term consequences of exposure to air pollution on lung function and symptoms in patients with pollution-related illness.

Methods: The study included 782 surviving patients with pollution-related illness in Okayama who were \geq 65 years of age in 2009. The patients had all received medical care, including expectorants and bronchodilators, once or twice a month and had undergone spirometry and assessment of respiratory symptoms each year for more than twenty years. We analyzed lung function and symptoms from 2000-09.

Results: Almost all (male: 59.0%, female: 78.6%) of the subjects had normal pulmonary function. However, a high proportion of subjects reported respiratory symptoms. All measures of pulmonary function decreased. The annual mean change of the VC was -40.5 mJ/y (male) and -32.7 mJ/y (female). The change in the FEV₁ was -27.6 mJ/y (male) and -23.9mJ/y (female). In addition, there was a significant (male: p < 0.05, female: p < 0.01) worsening of dyspnea over time.

Conclusions: The annual mean changes of lung function were within the normal ranges. The findings suggested that the medical care compensation system in Japan is effective. Although in order to reduce dyspnea, we believe that it is necessary for patients with pollution-related illness to also receive respiratory rehabilitation.

P1038

Comparing children hospital admission due to asthma in days with GOOD and NONGOOD air quality in Tehran

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Background: The relationship between air pollution and asthma has been investigated but the results of these studies were different and a definitive conclusion was impossible especially about the type and amount of pollutants that are harmful to health. This study investigated the effects of various air pollutants using GIS-based information on the rate of hospitalizations due to asthma in children in Tehran.

Methods: Information of patients who admitted with diagnosis of asthma in government run hospitals in Tehran and the total number of admissions in the same age range (2 to 14 years) from March 3th 2009 to March 3th 2011 obtained from medical records. Days of year divided in GOOD and NONGOOD days according guideline for reporting of daily air quality-pollutant standard index (PSI). Two thousand two hundred nineteen cases enrolled in the study and asthma admission to total admission ratio compared with air pollutants data in admission day (725 days) using nonlinear regression method.

Results: Analysis of study data revealed that there is a significant relationship between NONGOOD nitrogen dioxide (P value < 0.001), ozone (P value < 0.001), and sulfur dioxide (P value=0.04), levels and admission due to asthma in children but There was no significant relationship between carbon monoxide levels and asthma admission in children.

Conclusions: Significant relationship between nitrogen dioxide, ozone and sulfur dioxide concentration in air and admission due to asthma at levels other than GOOD, reveals air pollutants levels can be significantly harmful for children before PSI reaches to hazardous levels.

P1039

Traffic-related air pollution in Poland as a risk factor of obstruction in urban and rural areas

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Background: Traffic-related air pollution (TRAP) is associated with a number of respiratory diseases. Specific traffic conditions in East-Central Europe foster an increased risk of diseases but there is still relatively small evidence between TRAP concentrations and a risk of obstruction among people living close to busy roads. **Material:** 4985 persons (urban and rural inhabitants) were investigated in a study made in 2008-2011 in Warsaw. Pulmonary function tests were completed (Easy One spirometer) and occurrence of respiratory system diseases symptoms, allergies, smoking, etc. were proved. Simultaneously traffic density and TRAP concentrations were measured. Association between place of living, air pollutants exposure and obstruction was explored by logistic regression analysis.

Results: TRAP concentrations were statistically significant higher (p<0.05) in the vicinity of roads comparing to rural areas. Significant association between living close to busy roads and risk of obstruction was found. 334 cases of obstruction were identified in Warsaw (8,6% of urban group) and 36 in rural areas (4,0% of group). The risk of obstruction was 4,25 times higher (95%CI: 2,29-7,89) comparing all non-smoking inhabitants of the city and rural areas. Amid smokers the difference in risk of obstruction dependent on place of living was insignificant. **Conclusion:** High TRAP concentrations in the proximity of main roads are one of the significant reasons of airways flow limitation. Therefore the risk of obstruction highly depends on place of living, particularly among non-smokers. Results obtained confirm the outcomes of the first investigation on the influence of TRAP on health carried out in Poland in 2005-2006.

P1040

Exposure to air pollution in a road tunnel and heart rate variability <u>Martin Anderson</u>^{1,2}, Nils Plato¹, Lena Hillert³, Helena Svensson¹,

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Road tunnels in central Stockholm has high pollution levels. Exposure to air pollution has been shown to cause changes in autonomic nervous activity measured as heart rate variability.

Sixteen volunteers were exposed for one hour to the traffic-polluted air in a traffic tunnel. In the control condition the volunteers wore an air mask providing clean filtered air. ECG was registered for 24 h starting before the exposure in the tunnel. During their stay in the tunnel air content of NO₂, NO, CO, and particulate fractions were assessed, as well as temperature and humidity. Individual exposure to NO₂ was measured for 24 hours with passive samplers. Heart rate (HR) and the spectral components of the heart rate variability (i.e. VLF - very low frequency, LF - low frequency, HF - high frequency, and the LF/HF ratio) was analysed

for the following time sectors: During the exposure in the tunnel; 3-6 hours after exposure, and between 01.00-04.00 am the night after exposure.

The average concentration in the tunnel for NO₂ was 97 μ g/m³ (SD 22.9 μ g/m³), NOx 998 μ g/m³ (SD 252 μ g/m³) and PM_{2.5} 255 μ g/m³ (SD 26 μ g/m³). Daily mean NO₂ was 21.5 μ g/m³ SD 5.4 μ g/m³) for exposed and 13.6 μ g/m³ (SD 3.0) for unexposed. During exposure in the tunnel HR increased by approximately 3% and LF/HF about 1% for the whole group. We found a pulse rise in terms of HR starting 4-5 hours after the exposure and remaining throughout the night. The results suggest that this very air polluted environment generates a biological stress reaction seen as a small influence on the balance of the sympathetic and parasympathetic nervous system. In conclusion, one-hour exposure in a busy road tunnel generates measurable response in the human body.

P1041

Protective effect of curcumin on pulmonary and cardiovascular effects induced by repeated exposure to diesel exhaust particles

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Particulate air pollution has been linked to increased risk of cardiopulmonary diseases. However, the underlying mechanisms are not fully understood. We have previously demonstrated that single dose exposure to diesel exhaust particle (DEP) causes lung inflammation and peripheral thrombotic events. Here, we evaluated several cardiopulmonary endpoints two days after repeated doses of DEP (15 $\mu g/mouse)$ every other day for 6 days, and the potential protective effect of curcumin (the yellow pigment isolated from turmeric) thereon. DEP exposure increased macrophage and neutrophil numbers, tumor necrosis factor α (TNF α) [but not interleukin-6 (IL-6)] in the bronchoalveolar lavage (BAL) fluid, and enhanced airway resistance to methacoline measured invasively using Flexivent. DEP also significantly increased Plasma C-reactive protein and $\text{TNF}\alpha$ concentrations, systolic blood pressure (SBP), as well as the pial arteriolar thrombosis. It also significantly enhanced the plasma D-dimer and plasminogen activator inhibitor-1. Pretreatment with curcumin 1h before exposure to DEP significantly prevented the influx of inflammatory cells and the increase of TNF α in BAL, and the increased airway resistance caused by DEP. Likewise, curcumin prevented the increase of SBP, CRP, TNF α, D-dimer and PAI. The thrombosis was partially but significantly mitigated. Our findings suggest that repeated exposure to DEP induces increases in airway and systemic inflammation, TNF α production in both in BAL and plasma, airway resistance, SBP, and coagulation. In conclusion, pretreatment with curcumin prevented the cardiopulmonary effect and inhibited the release of TNF α induced by DEP.

P1042

Environmental influences on the incidence and etiology of asthma in Galati, Romania

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Background: The increasing number of asthmatic children in Galati, one of the largest cities of Romania, very industrialized, requires a careful approach on the incidence and etiology of asthma based on heredity, pollution and income levels. **Materials and methods:** The study group consisted of 614 children in Galati and some adjacent areas, diagnosed in 2008-2010 with asthma.

Results: It showed that 71.15% of subjects in Galati city are living in the half of the city located in the vicinity of the industrial area.

Children from rural areas who had a history of repeated acute infections of the upper respiratory tract or symptoms such as cough or shortness of breath or wheezing present a risk of developing asthma, more than 8 times higher for allergy to Aspergillus (p=0.002), 3 times for mold allergy and feathers (p=0.0007) and 2.53 times higher for those allergic to tree pollen (p=0.0004). Under the same conditions, children in urban areas, have an increased risk of acquiring asthma 2 times higher with the combination of positive reactions to molds and mites and 3 times higher for the triple combination of allergy to Dermatophagoides pteronyssinus, Dermatophagoides farinae and storage mites. Additionally, in patients living near industrial area, the risk of exacerbations of asthma due to mite allergy is 1.32 times higher.

Conclusions: Although no statistically significant differences were highlighted in the incidence of positive reactions for most allergens tested, between subjects in Galati and those of other neighboring rural or urban, there was an increased incidence of asthma and allergy to dust mites and molds in patients living in areas near industrial areas.

P1043

Graphene may modulate the immune activation and survival of monocytes representative of the innate immunity

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Background: The graphene which is an allotrope of carbon has the honeycombing structure of one-atom-thick planar sheets. It can be produced and chemically modified by chemical vaporization device. It is used in modern electronic, informative technologies including medical device. Graphene oxide (GO) has oxygen functional groups on the graphene plane. We performed this experiment to define the effect of GO on the innate immunologic function.

Materials and methods: GO was prepared by the modified Hummers method using 2g of graphite powder. After sequential procedure, GO in water was used for experiment. U-937 cells were cultivated in RPMI 1640 containing various concentration of GO particle solution. We checked the surviving and dying cells and cell size with the morphologic change with light microscopy.

Results: The x-ray diffraction patterns observed for the graphite and GO. The pristine graphite has a peak centered at $2\theta = 26.5^{\circ}$ (d = 0.33 nm). This peak was shifted to $2\theta = 11.3^{\circ}$ (d = 0.78 nm) after applying the Hummers method. This means that the graphite is exfoliated and the d-spacing increased, indicating that GO is formed. As the graphene concentration increased, the cell survival was diminished. U-937 cells were aggregated which might be associated with phagocytosis.

Conclusion: GO in water diminishes the cell survival and activates phagocytosis and alters cell fate. as differentiation and molecules in the monocytes representative of the innate immunity.

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P1044

Lower socioeconomic classes are more exposed to air pollution in Italy

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Objective: The present study aims at investigating whether lower socioeconomic classes, who present a higher prevalence of current smokers, are also more exposed to air pollution in Italy.

Methods: In the frame of the GEIRD study (Gene Environment Interactions in Respiratory Diseases) 10494 subjects, randomly selected from the general population aged 20-44 years in 7 centres answered a screening questionnaire between 2007 and 2010 (response percentage=57.2%). It was investigated if residential exposure to industrial plants or heavy traffic changed as a function of education or profession.

Results: Subjects with lower education were more likely to live near factories or heavy traffic roads (Table 1). Workmen presented the highest exposure to industrial plants while unemployed and housewives experienced the highest exposure to heavy traffic. In multivariable analysis profession was more associated with residential proximity to factories while education level was more associated with proximity to heavy traffic roads.

Table 1. Residential proximity to factories and heavy traffic roads as a function of education and profession

	Living near factories	Living near heavy traffic roads
Education	p<0.001	p=0.001
primary/secondary	342/1653 (21%)	948/2010 (47%)
high school	945/4371 (22%)	2342/5529 (42%)
university	405/2305 (18%)	1185/2757 (43%)
Profession	p<0.001	p<0.001
unemployed	94/571 (16%)	345/669 (52%)
workman	302/1190 (25%)	626/1480 (42%)
housewife	126/637 (20%)	352/728 (48%)
clerk	742/3214 (23%)	1695/4072 (42%)
manager	15/140 (11%)	67/174 (38%)
businessman	69/295 (23%)	159/377 (42%)
freelancer	153/1026 (15%)	573/1276 (45%)

Conclusion: Lower socioeconomic classes are more exposed not only to active smoking but also to air pollution.

P1045

Vehicle exhaust levels outside home and exhaled NO – Results from the Swedish GA2LEN study

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Fraction of NO in exhaled air (FeNO) is a common method to assess airway inflammation. FeNO has been used to study effects of air pollution, especially short-term exposure. Our aim was to study if living in areas with high levels of vehicle exhaust results in chronically increased levels of FeNO.

We study subjects with asthma (n=473), sinusitis (n=109), asthma and sinusitis (n=130), symptoms suggestive of asthma (n=383), and a random control group (n=222), aged 17-76 years (median 45 years) from the Swedish GA^2LEN Study.

Exhaust exposure at the home address was modelled as the annual mean concentration of nitrogen oxides (NOx) in 50 m grids from a dispersion model using traffic counts and emission factors (NOx/km). We used log-transformed FeNO (50mL/s) from the clinical examination. The fully adjusted regression models included NOx at home, age, sex, current smoking, height and atopy, and in the combined model diagnosis category.

Overall there was a very weak positive, non-significant coefficient for the effect of NOx on FeNO. For the asthma group and the group with some asthma-like symptom, this increase was 4% per 10 $\mu g/m^3$ increase in NOx. The geometric mean FeNO levels were 19.3 for the asthmatics and 15.7 for the control group. Subjects with chronic high pollution exposure in terms of tobacco smoke had reduced FeNO also in our study.

In conclusion, we see no significant association between modelled annual level of vehicle exhaust outside home and FeNO in any of the studied groups. A few other studies have observed such an association. We have not yet adjusted for a possible short-term effect of air pollution levels on FeNO.

P1046

The effect of particular matter pollution on emergency room visits due to COPD and asthma and the association with hospitalization rate in Düzce City Ege Gulec Balbay¹, Peri Arbak², Oner Balbay², Ali Nihat Annakkaya². ¹Chest Diseases, Duzce Ataturk State Hospital, Duzce, Turkey; ²Chest Diseases, Duzce University Faculty of Medicine, Duzce, Turkey

To investigate the effect of particuler matter levels on patients with COPD and asthma applied to emergency department and relation with hospitalization rate in Duzce city.

Between January-December 2009, the patients diagnosed as COPD and asthma at State Hospital were retrospectively evaluated. The monthly average values of particulate matter obtained from the official data.

61.4% of total 2499 cases were male. The average PM10 concentration of Duzce city was highest in November (184 mgr/m³) and was lowest in July (41 mgr/m³). The rates of COPD and asthma were 77.8% and 22.2%, respectively. COPD rates in males and females were 85.1% and 66.4%, respectively. Asthma was observed in 33.6% of females while 14.9% of males were diagnosed as asthma (p=0.000). The admittance rates to the emergency department for females and males were 69.3% and 66.2%, respectively (p>0.05). The patients with COPD were frequently applied in winter (27.9%) while the patients diagnosed as asthma admitted in autumn (p=0.010). While particulate matter was over 100 µgr/m3, the odds ratios for COPD and asthma diagnosis were 1.039 (0.990-1.091) and 0.878 (0.749-1.029), respectively. Only the age was found an independent factor (β =-0,382, t=-20,645, p=0.000). COPD patients were older (r=-0,382, p=0,000). The factors independently effective on diagnosis according to univariate analysis were gender (R=10,664, F=65,182, P=0.000) and season (R=0,700, F=4,278, p=0.005). It seems that increase in PM10 concentration causes an increase in admission to emergency department with the diagnosis of asthma and COPD.

P1047

8-isoprostane in exhaled breath condensate (EBC) and air pollution exposure in children with wheezing

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Background: Oxidative stress is proposed as the underlying mechanism of air pollutants aggression over the airways. 8-Isoprostane is a reliable biomarker of

oxidative stress. 8-Isoprostane could be detected in several fluids including exhaled breath condensate (EBC).

Objective: To study the relation between 8-isoprostane in EBC and air pollution exposure.

Methods: In the scope of a prospective study, EBC samples were collected from 27 wheezing children in order to measure 8-isoprostanes. Children were also evaluated through spirometry and skin prick tests for airborne allergens. After the definition of a day activity pattern for each children and direct measurements of air pollutants in different microenvironments (home, school and outdoor), individual exposure was calculated for PM₁₀, O₃, NO₂, xylene, toluene, benzene, formaldehyde and ethylbenzene. Spearman rank correlation was used to study the associations between 8-isoprostane and air pollutants.

Results: The mean age of the studied children was 7.9 ± 1.1 years. Eleven were boys. The mean FEV₁ was $96.7\pm9.6\%$. Ten of the studied children were atopic. Exposure to volatile organic compounds (VOCs) including toluene (rho = 0,604, p = 0,008), xylene (rho = 0,685, p = 0,002) and ethylbenzene (rho = 0,788, p<0,001) was correlated with 8-isoprostane concentrations in EBC. There were no correlations between EBC 8-isoprostane and PM₁₀, O₃, NO₂ neither between EBC 8-isoprostane and spirometric results.

Conclusions: Individual exposure to VOCs seems to be related with oxidative stress evaluated through 8-isoprostanes measurement in EBC.

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P1048

Feasibility of minimising motorised traffic interaction as an air pollution exposure risk management strategy for bicycle commuters <u>Thomas Cole-Hunter</u>^{1,2}, Lidia Morawska^{1,2}, Ian Stewart¹, Rohan Jayaratne²,

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Bicycle commuting in an urban environment of poor air quality has been demonstrated as a potential cardiopulmonary health risk for susceptible participants; however, limited studies have assessed the feasibility of risk management strategies. The potential of minimising motorised traffic interaction during bicycle commuting to reduce ultrafine particle (UFP; < 0.1 µm, main particle diameter range) exposure was investigated using air quality measurements and acute health endpoints in healthy individuals. Thirty-five healthy adults (n = 35; mean \pm SD age = 39±11 yr; 29% female) rode two return trips of pre-determined minimal (MIN) and maximal (MAX) motorised traffic interaction variations of their typical bicycle commute route. Particle number concentration (PNC) and diameter were collected in-commute, along with ambient air quality data from fixed monitoring sites. Health endpoints including acute respiratory symptoms, lung function and spontaneous sputum were collected immediately pre-commute, and then one and four hours post-commute. MIN facilitated a significant reduction in mean PNC (1.91 x e4 vs 2.95 x e4 ppcc; p = 0.01) compared to MAX. Besides incidence of in-commute offensive odour detection (42.4 vs 55.8%; p = 0.03) and nasopharyngeal irritation (31.2 v. 40.9%; p = 0.04), health endpoints were not significantly associated to air quality measures, nor were reduced with MIN compared to MAX. Acute health detriment from in-commute air pollution exposure is not indicated in healthy bicycle commuters; however, susceptible participants may benefit from a significantly reduced PNC associated with minimising motorised traffic proximity.

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Effects of swimming on lung inflammation and oxidative stress in diesel exposed mice

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Background: Studies have reported that exposure to diesel exhausted particles (DEP) induces lung inflammation and increases oxidative stress, both able to be changed by physical exercise. However, the effects of high intensity exercise on lungs exposed to DEP when exercise stops are not clear.

Objective: To evaluate the effects of swimming on lung inflammation and oxidative stress in mice concomitantly exposed to DEP and after exercise cessation. **Methods:** Male Swiss mice were divided into four groups: Control (n=6), Swimming (Sw) (30 min/day) (n=7), DEP (3 mg/mL,10 μ L/mouse) (n=7) and DEP+Sw (n=7). Mice were submitted to two weeks of swimming sessions and when second week started, DEP instillation occurred simultaneously to exercise for one week. After this period, animals received just DEP instillation for one week more. Twenty four hours after last DEP exposure, anesthetized mice were euthanized and we performed measures of total inflammatory cells from bronchoalveolar fluid (BALF), IL-1 β , TNF- α , IL-10, IL-1ra by enzyme-linked immunosorbent assay (ELISA), total glutathione (GSH), non proteic thiols (NPSH) and anti-oxidants enzymes (Catalase and Glutathione Peroxidase).

Results: Swimming sessions increased GSH, NPSH, and Catalase (p<0.05), as well as decreased total number of cells from BALF, IL-1 β and TNF- α levels in mice exposed to DEP (p<0.05). IL-10 and IL-1ra levels showed an increase in DEP+Sw group when compared with Control group (p<0.05).

Conclusion: Our results showed that exercise attenuated lung inflammation and improved oxidative stress status, suggesting that beneficial effects from swimming can be observed on lung injury induced by DEP, simultaneously and after exercise cessation.

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Airway reactivity and neuroimmune relationships in animal model of air born irritants induced symptoms – Role of trigeminal TRPA1 channels Zuzana Biringerova¹, <u>Mariana Brozmanova¹</u>, Silvia Gavliakova¹, Martina Sutovska², Sona Franova², Marian Adamkov³, Milos Tatar¹, Jana Plevkova¹. ¹ Department of Pathophysiology, Jessenius Faculty of Medicine, Comenius University, Martin, Slovakia (Slovak Republic); ²Department of Pharmacology, Jessenius Faculty of Medicine, Comenius University, Martin, Slovakia (Slovak Republic); ³Department of Histology and Embryology, Jessenius Faculty of Medicine, Comenius University, Martin, Slovakia (Slovak Republic)

Air born pollutants modulate functions of airways. Many experimental models use inhalation of air born irritants containing aerosols to mimic environmental exposure however, most exposed part is the nose. The aim of our study was to assess the general effects and modulation of airway defensive reflexes in animal model by selective nasal challenges with TRPA1 agonist AITC – allylisothiocyanate. TRPA1 is known to be relevant for most air born irritants.

15 male Dunkin Hartly guinea pigs were repeatedly exposed to 10mM AITC, $15 \mu l$ administered into both nostrils and nasal symptoms, cough, specific airway resistance (Saw) and bronchoalveolar lavages (BAL) were analyzed afterwards. Nasal administration of 10 mM AITC induces reproducible nasal symptoms, sneezing, discharge, crackles and conjunctival reaction. Also, nasal application of 10mM AITC induces spontaneous rise of Saw measured by Pennock's method in vivo and increases Saw after inhalation of methacholin (p<0.05) rather than histamine, suggesting for nasobronchial reflex. Saw after oxymetazoline (1%) and salbutamol pretreatment suggesting for combined mechanisms. Citric acid induced cough after nasal AITC challenge was significantly suppressed (p<0.05) and it was prevented by pretreatment with TRPA1 antagonist AP18. Nasal AITC challenges in experimental animals for a week induced rise of the count of eosinophils in BAL when comparing to controls confirming the concept of upper and lower airways neuro - immune relationships. Results document the role of TRPA1 in onset of environmental and occupational airway symptoms making it target for clinical applications. VEGA 1/0031/11.

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Effects of metal oxide nanoparticles on static and cyclic stretched AT II cell cultures

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Metal oxide nanoparticles (NP) have become very important for a variety of applications, even though NP could possess adverse impacts on health. Thus, assessment of NP safety is crucial. For the first time, we investigated effects of ZnO-, CeO2- and TiO2-NP on primary alveolar type II cells (ATII) considering the fact that lung cells are in vivo exposed to mechanical tensions caused by breathing. Therefore ATII cultures were in vitro applied to stretching patterns simulating the breathing process during NP exposition.

Nanotoxicology was determined using the MTT assay as well as staining with annexin V-FITC/PI. Cell staining with H2DCFDA was performed to measure intracellular formation of ROS. Release of pro-inflammatory cytokines MCP1 and MIP2 into culture supernatant was evaluated by ELISA.

ZnO-NP induce strong intracellular formation of ROS (200% rel. to control) and reduction of cell viability (10% rel. to control) in unstretched ATII cultures. These effects are diminished by half in ATII cultures applied to stretching patterns. CeO2 and TiO2-NP do not significantly affect viability or ROS formation whether if the ATII cultures are stretched or not. Cellular uptake of CeO2-NP could be assumed due to a dose-dependant change of the flow cytometric side scatter (350% rel. to control). Application of stretching patterns reduces this effect by one third. NP exposure does not affect the release of MCP1 or MIP2 regardless of the applied NP type or stretching pattern.

These results demonstrate that NP could affect primary ATII cultures and that these effects are modified when ambient conditions in the context of breathing are taken into account during NP exposition.

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Heart rate and ventilation in a group of burned sugar cane cutters (Brazil): Estimative of particulate matter (PM_{2,5}) exposure load <u>Izabela Cozza¹</u>, Danilo Nambu¹, Frederico Fernandes¹, Marcos Bussacos², Renato Paceli¹, Gustavo Prado¹, Mario Terra-Filho¹, Ubiratan Santos¹.

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Introduction: The sugar cane harvesting exposes workers to pollutants released by sugar cane burning held hours before. The workers earn per ton cut, what carries considerable physical effort with consequent increase in heart rate (HR) and ventilation (Ve). The HR keeps a good correlation with oxygen uptake and consequently with Ve. Its measurement is a useful method to estimate Ve, which allows estimating the exposure load of pollutants.

Objectives: Develop an equation of the linear correlation between HR and Ve and apply it to estimate the pollutant exposure load in sugar cane cutters.

Methods: Was developed an equation of the regression line, through data from HR and Ve obtained in ergoespirometry tests of 26 sugar cane cutters. The equation was used to estimate the exposure load in another group of 84 cutters, after registration of HR (using POLAR), during a working day, with concomitant registration of $PM_{2.5}$ environmental concentration.

Results: The PM_{2.5} average concentration was 61μ g/m³ (IIQ: 41.3-86.8 μ g/m³). The individual equations obtained from the 26 workers, showed a high correlation with average R²=0.9. The general equation (26) =0.97548+0.01965-LogVe5xCF, showed lowest correlation: R²=0.78. The estimation of exposure/workday in the group of 84 workers ranged from 282.5 to 1140.1 μ g/m³ (677.4 \pm 190.7 μ g/m³). **Discussion/Conclusion:** Exposure to pollutants was high and there was great variation in daily load exposure among workers. Although the general equations are less suitable than the individual equation to estimate the pollutants load inhaled by an individual, it can help in exposure estimation in population groups.

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