



## INFLUENCE OF UNFAVOURABLE ENVIRONMENTAL FACTORS UPON HEALTH OF WORKERS AND CORRECTION OF RESULTANT ALTERATIONS

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**Abstract.** Intensified formation of free radicals is one of the most important unfavourable consequences of factors of industry acting upon human organism. Under physiological conditions, antioxidative system preserves from harmful influence of free radicals. To avoid a disturbing influence of oxidative stress upon the processes of human homeostasis, additional quantities of antioxidants are indispensable. Dynamics of alterations of markers of oxidative stress caused by unfavourable industrial factors of metal processing (chemical agents, vibration, noise) under impact of native biomodulators were studied using native pollen. The programme was performed on 50 workers of metal processing, 9 males and 41 female, who used pollen during a period of 1 month. Control group consisted of 57 persons, 10 males and 47 females living and working under the same conditions. Blood tests (diene conjugates, malonic dialdehyde and katalase) using spectrophotometric methodology were studied before and after the course of treatment. After the treatment, contents of metabolites of lipid peroxidation, diene conjugates and malonic dialdehyde in blood serum essentially reduced. Activity of catalase decreased significantly in blood serum of males and regularly smoking females. In conclusion, presented data demonstrate antioxidative efficiency of native pollen and suggest more often applying of native biomodulators in cases with altered processes of homeostasis under impact of unfavourable environmental factors.

**Keywords:** environmental factors, metal processing, native biomodulators, oxidative stress, pollen, smoking.

### 1. Introduction

Problems of health of people living and working under impact of contemporary harmful factors of an industrial environment require nonstandard methods of prophylaxis, rehabilitation and treatment. Against a background of intensive chemical pollution and of physical factors - noise, vibration, electromagnetic alterations and others, usual pharmacological agents quite often prove to be not very efficacious, while medicines become an additional source of allergens. The processes of a pathogenetic and ethiotropic treatment become distorted by contamination of exogenous origin which affects the human organism. Interaction of drugs with the contaminants that are present in organism and have got into it from its surroundings and with their metabolites has not been studied much, yet constituting a problem of great importance. Today quite a number of complica-

tions of chemotherapy are related to the intricate enzymic processes not characteristic of human organism under ordinary conditions. The essence of these processes consists in pathologic peroxidation reactions which are initiated by a great number of organic and inorganic compounds of industrial occurrence and during which free radicals are formed, joining the chain of vital processes of the cell, changing its electric potential, disturbing permeability of membranes and exhausting native antioxidative systems [1]. All these complicated events of oxidative stress disturb homeostasis of human organism, suppress its vitally important functions, weaken its general and specific immunity. The action of nonmedicamentous measures of prophylaxis and treatment, application of which is based on longterm observations, has been explained of late decades by the development of complex of positive changes in homeostasis under the effect of those measures [2].

Industrial pollution is not a single and the only exogenous source of free radicals in humans working at industrial enterprises. Some factors of the mode of life of those workers, especially tobacco smokers, also play a great role in the intensified processes of free radicals and are well-known satellites of people working under impact of harmful factors of an industrial environment [3–5]. Much additional information corroborating the hazards of smoking come from the WHO studies, the Kaunas-Rotterdam Intervention Study (KRIS) and Monitoring of Trends and Determinants in Cardiovascular Diseases (MONICA) among them [6]. As S. Domarkienė, A. Tamošiūnas, R. Reklaitienė (2003) reported, during the last 19 years the prevalence of smoking in middle-aged population of Kaunas has increased among women, by 7,2 %, and has not changed significantly among men [7]. Some epidemiological studies of the last period, and those from Lithuania among them, announced significant decrease in prevalence of smoking among men related to their higher education, while this tendency among people who obtained secondary or lower education has not been found [8–10]. As some groups of researchers from Sweden, Japan, United Kingdom et al. have announced, people working under impact of harmful factors of metal processing consist of a group of high risk to become ill with cardiovascular diseases and cancer, and this probability for smokers may be increased 2–3 times. R. Petrauskaitė Everatt (2000) presenting data of retrospective case control study, found a relative dependence of risk to become ill with lung cancer upon occupation (workers of metal processing among them), period of working under impact of hazardous professional factors and smoking [11].

An object of nonmedicamentous measures and methods acting upon the organism is vegetative nervous system which can be influenced by native chemical compounds, physical and physiological means. The chief thing is their merit of moderately regulating of the processes going on in the organism – stimulation, inhibition, and maintaining balance among them. Nonmedicamentous measures promote cleaning processes in eliminating unnecessary materials of endogenous and exogenous origin. Modern science has already recognized native worldwide substances and products of vital activities of organisms as having the properties of biomodulation [12]. Among them, bee products, medicinal herbs and other native or preformed native substances standing out for such properties in Lithuania and foreign countries similar with respect to geographical conditions [13, 14].

In recent years, bee products attract an everincreasing attention of physicians, scientists and public. Pollen, as one of bee products, easily available and has been used long since because of its broad spectrum of action for the purposes of prophylaxis and treatment in Lithuania as well as in Latvia, Byelorussia as close countries with respect to climate and flora [15–16].

Biomodulative effects of pollen on different links of human homeostasis were studied estimating alter-

ations of clinical biochemical and immunological tests and indices reflecting processes of lipid peroxidation and antioxidative system activity. Considerable positive alterations established after treatment – diminution of immunodeficiency, reduced concentrations of lipid peroxidation metabolites, positive changes of biochemical blood tests – substantiate recommendations for more extensive usage of pollen as an effective biomodulative complex for rehabilitation and strengthening of the population health [17, 18].

The present study aimed to estimate and evaluate the indices of chemical agents of metal processing, noise and vibration at the workplaces of workers, and evaluate alterations of markers of oxidative stress as well as dynamics of those indices under impact of native pollen.

## 2. Material and methods

The object of investigation – practically healthy middle-aged workers (34–50 years old) working under the same harmful conditions of metal processing, indices reflecting their status of health and factors of chemical pollution, noise and vibration at their workplaces. All the persons who took part in the study were asked about their smoking habits according to a standard questionnaire [10].

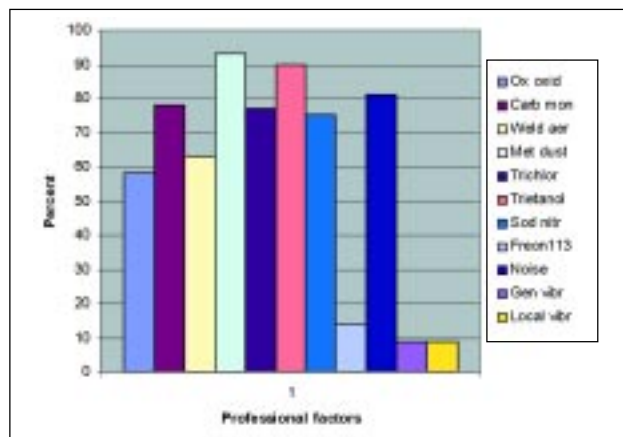
The programme was performed on 50 workers of metal processing, 9 males and 41 female, working under impact of the same industrial agents for more than 10 years, during a cold season of the year. Before administering bee products, a special purpose history as to hypersensitivity to them, was taken additionally. All of them used native pollen 10 g per day during a period of 1 month. A control group consisted of 57 persons, 10 males and 47 females, living and working under the same conditions.

Blood tests (diene conjugates, malonic dialdehyde and katalase) using spectrophotometric methodology were studied before and after the course of correction.

Contamination of an industrial environment during the investigation was evaluated by ascertainment of 8 chemical substances in the air of industrial premises using gas chromatography (nitrogen oxides, carbon monoxide, welding aerosol, metal dust, trichloroethylene, trietanolamine, sodium nitrite, freone 113). Noise, general and local vibration were evaluated by a standard methodology. Measurements ( $n = 24$ ) of all the factors of professional risk were performed by the specialists of engineering staff at the Laboratory of Labour Protection of the enterprise. Results of the investigation were evaluated comparing with the highest permissible concentrations and levels in accordance with their validity at the period of investigation Lietuvos Higienos Norma (1993), by PC. The results of blood tests were analysed in relation to sex and smoking habits before and after the course, among the participants and workers of the control group, by PC, using package of programmes SPSS Version 11.

### 3. Results and discussion

During the process of statistical analysis of the data reflecting industrial contamination with chemical substances, it was found that indices of contamination of industrial premises with trichloroethylene exceeded the permissible index up to 2,9 times, contamination with trietanolamine – 1,3 times, contamination with sodium nitrite – less than 2 times. Indices of contamination with metal dust and sodium nitrite, and the level of noise exceeded the permissible indices by more than 75 % of all the measurements (Fig)



Indices of evaluated professional factors exceeding permissible indices (in percents) at workplaces

All the persons who received pollen felt well during the course of treatment. After the treatment, 46 % of participants pointed out to a considerable improvement of a general condition, increase in work capacity, 62 % of all the participants had improved their appetite. 24 % of persons, who had constipation troubles, pointed to normalized evacuation of their bowels.

After the correction, in blood serum of the participants, both males and females, concentration of metabolites of lipid peroxidation significantly reduced: concentration of diene conjugates – by 33–39 %, concentration of malonic dialdehyde – by 36–28 %. Activity of catalase prominently reduced in blood serum of males, by 35 % ( $p < 0,05$ ). Comparing the indices of the workers from the main and control groups after the course, significant differences of concentration of metabolites of lipid peroxidation were found: under the effect of pollen lower concentrations by 43–45 % in blood serum of both males and females were obtained ( $p < 0,05$ ). Activity of catalase in blood serum of males from the main group was found to be significantly lower, comparing with the index of males from the control group (by 36 %;  $p < 0,05$ ). In blood serum of regularly smoking persons ( $n = 26$ ) concentrations of diene conjugates and malonic dialdehyde after the course reduced by 51 % and 49 %. As it was found, activity of catalase in blood serum of regularly smoking females (who used no less than 1 cigarette per day) reduced essentially – by 53 % ( $p = 0,0001$ ).

In general, examined workers of metal processing during the period of observation were exposed to a complex of factors of professional risk significantly exceeding permissible indices (including sodium nitrite and trichloroethylene, well-known for their genotoxic effects). Under the effect of native biomodulators of pollen, significant positive changes restituting the balance among the processes of lipid peroxidation and activity of antioxidative system were obtained. The most important positive processes in blood serum of smoking workers were found. The presented data demonstrate antioxidative efficiency of native pollen and suggest more frequent application of native biomodulators in cases with altered processes of homeostasis under the impact of unfavourable environmental factors. During the investigation, no cases of allergic reactions or hypersensitivity were observed. Keeping in mind possible allergy, before correction it may be suggested to pay great attention to a special purpose history as to hypersensitivity to bee-products.

### 4. Conclusions

- During the period of investigation, examined workers were working under the impact of a complex of unfavourable industrial agents.
- Under the effect of native biomodulators of pollen, positive changes of indices of oxidative stress were found: significantly reduced amounts of metabolites of lipid peroxidation in blood serum of males and females, and decreased activity of catalase in blood serum of males.
- After the course of pollen, activity of catalase significantly decreased in blood serum of regularly smoking females.
- Native pollen are effective biomodulative agents correcting alterations of the balance among lipid peroxidation and activity of antioxidative system caused by oxidative stress.
- As an effective biomodulator, native pollen may be more often recommended for people working under harmful conditions. Before the administration, purpose history as to hypersensitivity or allergy to bee-products must be taken.

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## NEPALANKIŲ APLINKOS VEIKSNIŲ POVEIKIS DARBUOTOJŲ SVEIKATAI IR DĖL TO KYLANČIŲ ALTERACIJŲ KOREGAVIMAS

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### S a n t r a u k a

Nepalankių išorinės aplinkos veiksnių poveikis žmogaus organizmui ryškiausiai pasireiškia padidėjusiu laisvųjų deguonies radikalų sintezės intensyvumu. Įprastinėmis fiziologinėmis sąlygomis nuo žalingo laisvųjų radikalų poveikio ląsteles apsaugo antioksidacinė sistema. Oksidacinio streso metu šių procesų sukeliams negatyviems homeostazės rodiklių pokyčiams atkurti reikalingi papildomi antioksidantų kiekiai. Oksidacinio streso žymenų alteracijų, atsiradusių veikiant nepalankiems žmonių sveikatai pramoniniams veiksniams metalo apdorojimo procesuose (cheminės medžiagos, vibracija, triukšmas), dinamika, šių pokyčių atkūrimo natūraliais biomoduliaciniais galimybės buvo vertinamos, naudojant bičių suneštas žiedadulkes. Programoje dalyvavo 50 pramonės įmonės darbuotojų, dirbančių metalo apdorojimo procesuose – 9 vyrai ir 41 moteris. Jie vartojo žiedadulkes kasdien 30 dienų. Kontrolinę grupę sudarė 57 asmenys – 10 vyrų ir 47 moterys – gyvenantys ir dirbantys tokiomis pačiomis sąlygomis. Visiems asmenims prieš korekciją ir po 30 dienų buvo tiriami dviejų lipidų peroksidacijos metabolitų – dijenų konjugatų ir malono dialdehido kiekiai kraujo serume, antioksidacinio fermento katalazės aktyvumas. Tyrimai atlikti pagal spektrofotometrines metodikas. Po korekcijos nustatyti lipidų peroksidacijos procesų pokyčiai. Jie pasireiškė esminiu dijenų konjugatų ir malono dialdehido kiekių sumažėjimu tirtų asmenų kraujo serume. Antioksidacinio fermento katalazės aktyvumas reikšmingai sumažėjo tiriamosios grupės vyrų bei reguliariai rūkančių moterų kraujo serume. Tyrimo duomenys patvirtina antioksidacinį bičių suneštų žiedadulkių efektyvumą. Rekomenduojama plačiau taikyti žiedadulkes kaip efektyvius biomoduliacinius, kurie gali sėkmingai koreguoti nepalankių aplinkos veiksnių sukeltus homeostazės pokyčius.

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