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## **Číslo 4**



### **PROTECTION OF HUMAN IN THE WORKING ENVIRONMENT**

#### **Dorota Kondej & Ewa Gawęda. *Metals in Dust Fractions Emitted at Mechanical Workstation.* S. 453-460.**

Workers at metal machining workstations are exposed to airborne dust particles containing metals and their compounds. Their harmful impact on the workers' health depends on both their chemical composition and their distribution. The aim of this study was to determine the content of metals in dust fractions emitted in the process of mechanical machining of products made of brass, steel and cast iron. Samples taken during grinding, turning and drilling were tested. The concentration of metals in dust fractions was determined with atomic absorption spectrometry. The content of iron, manganese, chromium, zinc, lead, copper and nickel in the dust fractions was highly differentiated depending on the size of the particles, the material and the processes used.

#### **Siti Zawiah Md. Dawal, Hilma Raimona Zadry, Sharifah Nadya Syed Azmi, Siti Rusyida Rohim & Sari Julia Sartika. *Anthropometric Database for the Learning Environment of High School and University Students.* S. 461-472.**

This paper presents an anthropometric database of high school and university students from Kuala Lumpur, Malaysia. Forty-one high school participants (21 males and 20 females), 13–17 years old, and 143 university students (74 males and 69 females) took part in the study. Twenty-one static body dimensions were measured. The greatest mean differences in the anthropometric data between male and female high school students were found in the sitting elbow height. In addition, a comparison of anthropometric data of male and female university students showed that data for males and females were significantly different, except for buttock–popliteal length, sitting elbow height and thigh clearance. The primary aim of this study was to develop an anthropometric database that could be used as a primary reference in designing products, devices and equipment for ergonomic learning environments.

#### **Małgorzata Peçillo. *Results of Implementing Programmes for Modifying Unsafe Behaviour in Polish Companies.* S. 473-485.**

This article presents the results of 3 Polish companies implementing programmes for modifying unsafe behaviour. Those programmes involved training workers and supervisors, and observing, registering and analysing the workers' behaviour. They focused on the quality of life and safety culture as factors key to the level of unsafe behaviour and, thus, to the level of safety in an organisation. To assess the effectiveness of the programmes, the quality of life and safety culture were studied before, during and after the intervention. The implementation of the programmes resulted in a higher level of safety culture and workers' well-being and fewer cases of unsafe behaviour. The improved level of safety culture and well-being was different in each company.

**Mohd Farooq & Abid Ali Khan. *Effect of Elbow Flexion, Forearm Rotation and Upper Arm Abduction on MVC Grip and Grip Endurance Time.* S. 487-498.**

This experiment was designed to know the effect of upper limb postural deviations on grip strength and grip endurance time. A full factorial design of experiment, i.e., 3 (0°, 45°, 90° abduction angles of upper arm) × 3 (45°, 90°, 135° angles of elbow flexion) × 3 (0°, -60° prone, +60° supine angles of forearm rotation) was used to find the effect of 27 combinations of postures on maximum voluntary contraction (MVC) grip strength and grip endurance time. The results showed that none of the main factors were significant on MVC grip, although there was a change in MVC grip. Grip endurance time significantly decreased with an increase in upper arm abduction. Also, grip endurance significantly increased with the elbow flexion angle and decreased with forearm rotation from neutral. These data will help designers and engineers to improve the workplace and tools to reduce the risk of injuries.

**Andrzej Wieczorek. *Effects of Construction Changes in the Teeth of a Gear Transmission on Acoustic Properties.* S. 499-507.**

This paper presents results of experimental research on the acoustic properties of gear wheels with high-profile teeth with differentiated tooth height. Those results showed that gear transmissions with high-profile teeth have the best acoustic properties, with the value of the transverse contact ratio  $\epsilon_\alpha \approx 2.0$ . They also showed that a reduction in tooth height, and thereby in contact ratio, increased the sound pressure level.

## **PROTECTION OF HUMAN AT THE WORKSTATION**

**Francisco Rebelo, K. Correia da Silva & Waldemar Karwowski. *A Whole Body Postural Loading Simulation and Assessment Model for Workplace Analysis and Design.* S. 509-519.**

This study reports on the development and validation of a new computer model for simulating human postures at work, and assessing the reaction forces and bending moments in 43 human articulation joints. The proposed model estimates the intradiscal pressure in the vertebral column in response to external loading forces encountered during human interactions with work objects or processes. The model was implemented in a self-contained interactive software package. The simulation results compare favorably with the reported experimental data, and provide reasonable confidence in the quality of the model. Its characteristics and its applications in evaluating physical task performance are also discussed.

**Somnath Gangopadhyay, Samrat Dev, Tamal Das, Goutam Ghoshal & Tarannum Ara. *An Ergonomics Study on the Prevalence of Musculoskeletal Disorders Among Indian Bus Conductors.* S. 521-530.**

This study was undertaken among 100 randomly selected bus conductors from 2 routes. A questionnaire study based on the modified Nordic musculoskeletal questionnaire, assessment of physical and physiological parameters, analysis of working postures and a detailed work study were performed. The analysis revealed that conductors had a work schedule of 16–18 h each day; the duration of work could vary from 15 to 20 days at a stretch. Discomfort leading to musculoskeletal disorders mainly affecting the leg (93.3%), knee (83.3%), shoulder (80%) and back areas (56.7%) had the highest 12-month prevalence rates and increased day by day. The conductors also suffered from extreme physiological stress due to prolonged working hours in hazardous standing posture conditions, excessive work pressure and minimum rest between trips. Consequently, all those factors affected their health and work performance.

**Banibrata Das, Tirthankar Ghosh & Somnath Gangopadhyay. *Assessment of Ergonomic and Occupational Health-Related Problems Among Female Prawn Seed Collectors of Sunderbans, West Bengal, India.* S. 531-540.**

Sixty female prawn seed collectors and 60 female control subjects from Sajenakhali and Sandeshkhali blocks of Sunderbans, West Bengal, India, were randomly selected to evaluate and compare musculoskeletal disorders and physiological stress. The control group was engaged in domestic work involving minimum handintensive activities. The modified Nordic musculoskeletal questionnaire and rapid entire body assessment were used. Most subjects suffered from discomfort in different body parts, especially in the lower back (98%), knees (88%), shoulders (75%), ankles (70%) and feet (67%). This study reveals that female prawn seed collectors suffer from significant physiological load and extreme physiological stress due to prolonged working hours in a standing posture and excessive work pressure. Consequently, all these factors affect female prawn seed collectors' health and work performance.

**Pia Perttula & Simo Salminen. *Workplace Accidents in Materials Transfer in Finland.* S. 541-548.**

The aim of this study was to show the proportion of workplace accidents related to materials transfer and to decide whether they were more serious than other kinds of workplace accidents. The research material for this study were statistics and data, available in Finland, regarding workplace accidents and fatal accidents. Twenty-five percent of studied fatal accidents were related to materials transfer; 26.9–27.7% of all workplace accidents in Finland in 2003–2007 were workplace accidents related to materials transfer. Over half (54.7%) of workplace accidents related to materials transfer caused disabilities lasting over 3 days. Most accidents related to materials transfer occurred to men aged 20–49 years. The most common types of injuries were dislocations, sprains and strains.

**Auditya Purwandini Sutarto, Muhammad Nubli Abdul Wahab & Nora Mat Zin. *Resonant Breathing Biofeedback Training for Stress Reduction Among Manufacturing Operators.* S. 549-561.**

The aim of this study was to examine the effect of resonant breathing biofeedback training for reducing stress among manufacturing operators. Resonant breathing biofeedback works by teaching people to recognize their involuntary heart rate variability and to control patterns of this physiological response. Thirty-six female operators from an electronic manufacturing factory were randomly assigned as the experimental group (n = 19) and the control group (n = 17). The participants of the intervention received 5 weekly sessions of biofeedback training. Physiological stress profiles and self-perceived depression, anxiety, and stress scale (DASS) were assessed at pre- and post-intervention. Results indicated that depression, anxiety, and stress significantly decreased after the training in the experimental group; they were supported by a

significant increase in physiological measures. Overall, these results support the potential application of resonant biofeedback training to reduce negative emotional symptoms among industrial workers.

**Masoud Neghab, Ahmad Soltanzadeh, Abbas Alipour, Jafar Hasanzadeh & Hamzeh Alipour. *Respiratory Morbidity Induced by Occupational Inhalation Exposure to High Concentrations of Wheat Flour Dust*. S. 563-569.**

**Introduction.** The main purpose of this study was to investigate the respiratory effects of exposure to high airborne concentrations of wheat flour dust. **Methods.** This cross-sectional study was carried out at a local wheat flour mill in Shiraz, southern Iran. Thirty-five male workers exposed to flour dust and 32 healthy male nonexposed employees were investigated. The prevalence of respiratory symptoms among them was evaluated and parameters of their pulmonary function were measured. Moreover, to assess the extent to which subjects were exposed to flour dust, airborne concentrations of its inhalable and respirable fractions were measured. **Results.** Airborne concentrations of dust exceeded current permissible level. The prevalence of regular cough, productive cough, wheezing, phlegm and dyspnea was significantly higher in exposed subjects than in nonexposed employees. Similarly, both acute and chronic significant ( $p < .05$ ) decrements in most parameters of pulmonary function were noted. **Conclusions.** Our findings provide corroborative evidence to further support the notion that exposure to flour dust is associated with a significant increase in the prevalence of respiratory symptoms as well as ventilator disorders of the lungs.

**Khursheed Ahmad Wani & Yogesh K. Jaiswal. *Health Risk Factors in Different Seasons of Carpet Industry in Kashmir, India*. S. 571-577.**

Carpet workers are exposed to different types of health risk factors in different seasons of the year. As the environmental conditions become harsh, risk for developing various types of diseases increases. These problems are further aggravated when the environmental conditions at the workplace deteriorate. An attempt has been made to study the health risk factors in the carpet industry in different seasons of the year. It has been concluded that in winter weavers are affected by several types of health risk factors as compared to the other seasons.

**Raul Santo de Oliveira, Turíbio Leite de Barros Neto, Angélica Alves da Silva, João Luiz Grandi & Isabel Bueno Santos Menezes. *The Relationship Between the Levels of Stress and the Age and Years of Service of Military Firefighters From the Fire Rescue Corps of the Metropolitan Area of the State of São Paulo*. S. 579-586.**

**Purpose.** To verify the relationship between stress indicators and the age and years of service of military firefighters from the fire rescue corps of the metropolitan area of the state of São Paulo. **Methods.** Forty military firefighters with the mean age of  $37.9 \pm 5.4$  years, from the 1st, 2nd and 8th fire brigades of the metropolitan area of São Paulo participated in this study. All underwent clinical, physical and psychological evaluations to verify the relationship between the age and years of service with the variables of levels of stress (tension, depression, anger, vigor, fatigue, confusion and total stress) on workdays and on days off. **Results.** On workdays, the mean scores for tension, depression, fatigue and stress were overall higher compared to those on days off. The older the firefighter, the higher the levels of stress, depression, anger and total stress. The more years of service, the greater the depression and anger. **Conclusions.** The levels of stress were high on workdays. Chronological age and years of service influenced the increase in the scores of stress.

**Duncan J.M. Macdonald, Kaveh A. Sanati & Ewan B. Macdonald. *The Costs and Characteristics of Occupational Injuries Admitted to a Trauma Unit.* S. 587-90.**

Occupational injuries requiring admission to a trauma unit were examined to outline the events surrounding the injury and to examine the costs. Sixty-nine patients were admitted over a 12-month period, representing 4.30% of all work-related injuries attending the emergency department and 4.25% of all admissions to the trauma unit. Most were male (91%), working in skilled trade occupations (65%), with a mean age of 38.8 years. Personal protective equipment was used only by 46% of injured workers who should have been using it. Sixty-one percent of patients believed that their injury was preventable. Half of the injuries were to the upper limb, fall was the most frequent mechanism (25%) and the median duration of admission was 2 days. The direct hospital costs were estimated at over 300 000 GBP. Failure to use protective equipment and to follow health and safety guidelines suggests that opportunities exist for injury prevention.