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Assessment of micronuclei and sister chromatid exchange in the petroleum industry workers in province of Vojvodina, Republic of Serbia

Jasminka Mrdjanović^a, Slavica Šolajić^a, Sladjana Dimitrijević^b, Igor Đan^a, Ivan Nikolić^a, Vladimir Jurišić^{c,*}

^a Oncology Institute of Vojvodina, Experimental Oncology Department, Put Dr Goldmana 4, 21204 Sremska Kamenica, Serbia

^b University of Kragujevac, Faculty of Science, Radoja Domanovića 12, Kragujevac, Serbia

^c University of Kragujevac, Faculty of Medical Science, P.O. Box 124, 34000 Kragujevac, Serbia

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ABSTRACT

Persons who work with petroleum and petroleum derivatives (PPD) are potentially at risk of developing cancer mostly due to the carcinogenicity of benzene. Therefore, the aim of this study was to determine in which degree occupational exposure of workers to PPD causes damage to DNA by analysis of micronuclei (MN), sister chromatid exchanges (SCE) and proliferation index (PI). 30 workers of refinery in Novi Sad, participated in the study as exposed and 30 volunteers as control group. Workers exposed to PPD had significantly higher values of MN and SCE in comparison to controls. Exposition time to PPD and type of working place have also significantly effects to DNA damage. The influence of confounding factor such as smoking and age were also evaluated.

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1. Introduction

According to the International Agency for Research on Cancer, occupational exposure to petrol and petrol derivatives represents a potential risk of developing cancer in people, largely due to confirmed carcinogenicity of benzene, the main component of petroleum (IARC, 1989).

Persons working with petroleum and its derivatives (PPD) are by absorption through the skin or through inhalation of petroleum fumes exposed to a number of petroleum products. It is precisely this exposure to the petrol vapors of petroleum derivatives that may cause an increased incidence of the disease, which was confirmed in epidemiological studies of the human population (Lagorio, 1993; Lazarov et al., 2000; Carletti and Romano, 2002). Recent studies have shown haematotoxic effect at different concentrations of benzene including the concentration of 1 ppm in the air (McHale et al., 2012). It is known that benzene causes acute

myeloid leukemia (AML) (IARC, 1989), myelodysplastic syndrome and other hematologic malignancies such as non-Hodgkin's lymphoma and leukemia in children as well as lymphoproliferative disorders (Tompa et al., 2005; Griego et al., 2008; McHale et al., 2012; Recio et al., 2012).

Peripheral blood lymphocytes in numerous studies are used to determine different genotoxic effects by monitoring the following: the incidence of micronuclei (MN), the frequency of sister-chromatid exchanges (SCE) as well as chromosomal aberrations and DNA damage using different assay (Boess et al., 2003; Navasumrit et al., 2005; Harper et al., 2007; Mondal et al., 2010; Mrdjanović et al., 2012; Moeller et al., 2013). However, micronucleus test performed in epithelial cells from buccal mucosa has been shown to be an effective method to detect chromosomal aberrations as well (Celik et al., 2003; Diler and Çelik, 2011).

Therefore, it is important to assess the toxic effect associated with exposure to petroleum and petroleum products not only in accidental situations, but also in exposure to continuous low concentrations of benzene present in the environment (Bindhya et al., 2010). Also, given that smokers may be exposed to benzene 10 times more than non-smokers, smoking is considered to be an important additional factor that need be evaluated in individuals who are occupationally exposed to PPD (Mansi et al., 2012). Age

Abbreviations: AO, antioxidant; AML, acute myeloid leukemia; CBMN, cytokinesis block micronucleus; MN, micronuclei; PPD, petroleum and petroleum derivatives; SCE, sister chromatid exchanges; PI, proliferative index.

* Corresponding author. Tel.: +381 34306800.

E-mail address: vdvd@mailcity.com (V. Jurišić).

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