



Oxidative Stress and Oxidative Damage in Male Rat Erythrocytes Associated with Prolonged Exposure to Smoke Pollution

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ABSTRACT

Exposure of animals to different duration of smoke can result in a wide range of adverse clinical conditions. Toxicological consequences arising from prolonged exposure may not be totally enumerated. The present study was to evaluate the oxidative stress-inducing potential of a short and long-time exposure of male rat erythrocytes to environmentally relevant to public health. Male Wistar rats were exposed to open municipal land-fill smoke for 30 and/or 60 days. The oxidative stress in erythrocytes was evaluated by assessing the magnitude of malondialdehyde production and reduced glutathione (GSH) contents and the activities of superoxide dismutase (SOD), catalase (C) and glutathione reductase (GR) after 30 and/or 60 days of exposure. After 30 days there was no change in SOD, catalase and GR activities and no alterations in GSH and lipid peroxidation (LPO). After 60 days, the levels and activities of SOD (23.62%), catalase (5.24%), GR (14.87%) decreased. Overall, the study demonstrates that the chronic exposure of male rats to smoke results in induction of oxidative stress and simultaneous reduction in antioxidative defense system in erythrocytes at 60 days of exposure.

KEYWORDS

Lipoperoxidation; Antioxidants; Oxidative Stress; Antioxidases; Smoke Pollution; Oxidative Damage; Erythrocytes

Cite this paper

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References

- [1] S. Leahy, "A Dozen Countries Take on Toxic Pollution," North America Inter Press Service, Chicago, 2010.
- [2] Blacksmith Institute, "The World's Worst Polluted Places," 2007. <http://www.blacksmithinstitute.org/docs/costEff1.pdf>
- [3] WHO, "Public Health and Environment," 2007.
- [4] J. F. Zhou, D. Cai and G. Z. Tong, "Oxidative Stress and Potential Free Radical Damage Associated with Photocopying, A Role for Ozone?" *Free Radical Research*, Vol. 37, 2003, pp. 137-143. doi:10.1080/1071576021000036623
- [5] V. K. Singh, M. K. Pathak, V. Bihari, Jyoti, D. K. Patel, N. Mathur, C. N. Kesavachandra and M. K. J. Siddiqui, "Studies on Oxidative Stress Induced Nerve Conduction Deficits in Cigarette Smokers," *Journal of Environmental Biology*, Vol. 32, No. 1, 2011, pp. 39-42.
- [6] A. C. Achudume, F. Aina and B. Onibere, "Pollution Tolerance of Smoke in the Distribution of Neuro-Transmitter Enzyme (Acetylcholine Esterase and High Density Cholesterol," *Journal Environmental Protection*, Vol. 1, 2010, pp. 475-479. doi:10.4236/jep.2010.14055
- [7] P. Wilkson, K. Smith, M. Joffe and A. Haines, "A Global Perspective on Energy: Health Effects and

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- [8] Y. C. Chan, P. D. Vowles, G. H. McTanish, R. W. Simpson, D. D. Cohen, G. M. Bailey and G. D. McOrist, " Characterization and Source Identification of PM-10 aerosols Samples Collected with a High Volume Cascade Impactor in Brisbane (Australia)," *Science of Total Environment*, Vol. 262, No. 1-2, 2000, pp. 5-19. doi:10.1016/S0048-9697(00)00571-4
- [9] P. R. Salve, R. J. Krupadam and S. R. Wate, " A Study on Major Inorganic Ion Composition of Atmospheric Aerosols," *Journal Environmental Biology*, Vol. 28, No. 21, 2007, pp. 241-244.
- [10] O. Taiwo, " The State of Urban Air Pollution in Lagos: Crisis of Management," *Lagos Metropolitan Area Transport Authority (LAMATA) Bulletin*, 2005.
- [11] S. Mullyta and K. Kuvaja. " Societal Premises for Sustainable Development in Large Southern Cities," *Global Environmental Change*, Vol. 15, No. 3, 2005, pp. 224-237. doi:10.1016/j.gloenvcha.2005.01.001
- [12] D. G. Cook and D. P. Strachan, " Parental Smoking and Prevalence of Respiratory Symptoms and Asthma in School Age Children," *Thorax*, Vol. 52, No. 12, 1997, pp. 1081-1094. doi:10.1136/thx.52.12.1081
- [13] D. P. Strachan and D. G. Cook, " Parental Smoking and Lower Respiratory Illness in Infancy and Early Childhood," *Thorax*, Vol. 52, No. 10, 1997, pp. 905-914. doi:10.1136/thx.52.10.905
- [14] International Agency for Research on Cancer (IARC), " Monographs on the Evaluation of Carcinogenic Risk of Chemicals on Humans," *Tobacco Smoking and Tobacco Smoke*, Vol. 83, 2002. <http://monographs.iarc.fr/htdocs/monographs/vol/83/01-smoking.html>
- [15] R. L. Heath and L. Packer, " Photoperoxidation in Isolated Chloroplasts, 1. Kinetics and Stoicheistry of Fatty Acid Peroxidation," *Archieves of Biochemistry and Biophysics*, Vol. 125, No. 3, 1968, pp. 189-190. doi:10.1016/0003-9861(68)90654-1
- [16] H. K. Prins and J. A. Loos, " Glutathione," In: J. G. Yunis, Ed., *Biochemical Methods in Red Cell Genetics*, Academic Press, New York, 1969, pp. 127-129.
- [17] M. Madesh and K. A. Balasubramanian, " Mirotiter Plate Assay for Superoxide Dismutase Using MIT Reduction by Superoxide," *India Journal of Biochemistry & Biophys*, Vol. 35, 1998, pp. 184-188.
- [18] H. E. Aebi, " Catalase," In: H. U. Bergmeyer, J. Bergmeyer and M. GraBl, Eds., *Methods of Enzymatic Analysis*, 3rd Edition, Verlag Chemie, Weinheim, 1983, pp. 273-286.
- [19] D. M. Goldberg and R. J. Spooner, " Glutathione Reductase," In: H. U. Bergmeyer, J. Bergmeyer and M. GraBl, Eds., *Methods of Enzymatic Analysis*, 3rd Edition, Verlag Chemie, Weinheim, 1983, pp. 258-265.
- [20] J. Eritsland, " Safety Considerations of Polyunsaturated Fatty Acids," *American Journal of Clinical Nutrition*, Vol. 71, No. 1, 2000, pp. 197S-201S.
- [21] G. Van Ginkel and A. Sevanian, " Lipid PeroxidationInduced Membrane Structural Alterations," *Methods Enzymology*, Vol. 233, 1994, pp. 273-288. doi:10.1016/S0076-6879(94)33031-X
- [22] J. Cotovo, L. Onno, P. Justine, S. Lamure and P. Catroux. " Generation of Oxidative Stress in Human Cutaneous Models Following in Vitro Ozone Exposure," *Toxicology in Vitro*, Vol. 15, No. 4-5, 2001, pp. 357-362. doi:10.1016/S0887-2333(01)00036-4
- [23] Y. G. Zhu, J. F. Zhou, W. Y. Shan, P. S. Zhou and G. Z. Tong, " Potential Oxidative Stress in the Bodies of Electric Arc Welding Operators: Effect of Photochemical Smog," *Biomedical and Environmental Science*, Vol. 17, No. 4, 2004, pp. 381-384.
- [24] Y. Kono and I. Fridovich, " Superoxide Radical Inhibits Catalase," *The Journal of Biological Chemistry*, Vol. 257, No. 10, 1982, pp. 5751-5754.
- [25] P. M. Sinet and P. Garber, " Inactivation of Human Cu-Zn Superoxide Dismutase during Exposure to O₂ and H₂O₂," *Archives of Biochemistry and Biophysics*, Vol. 212, No. 2, 1981, pp. 411-416. doi:10.1016/0003-9861(81)90382-9
- [26] J. Bornholdt and M. Dybdahl, U. Vogel, M. Hansen, S. Loft, and H. Wallin, " Inhalation of Ozone Induces DNA Strand Breaks and Inflammation in Mice," *Mutation Research*, Vol. 520, No. 1, 2002, pp. 63-71.

[27] A. C. Achudume, " Environmental Health, Development and Economic Empowerment Ofrural Women in Nigeria," Environment, Development and Sustainability, Vol. 11, No. 2, 2009, pp. 459-469. doi:10.1007/s10668-007-9124-1