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## MAGNESIUM AND HYPERTENSION IN THE PROCESS INDUSTRY

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**Procesing '22** 1–3. jun 2022, Beograd

- Cardiovascular diseases are the leading cause of death in Serbia.
- Females were dying more often than males from cardiovascular diseases.

Institute of public health of Serbia "Dr Milan Jovanovic Batut"  
Health statistical yearbook of Republic of Serbia 2018. Belgrade:2019.



- Hypertension is diagnosed when the value of systolic blood pressure is 140 mm Hg and more and/or diastolic blood pressure 90 mm Hg and more.

National Institutes of Health, National Heart, Lung, and Blood Institute, National High Blood Pressure Education Program. The Seventh Report of the Joint National Committee on Prevention, and Treatment of High Blood Pressure. NIH publication No. 04-5230: 2004.



- The highest prevalence of hypertension is in Africa region and is 27%, and the lowest in the American region and is 18%.

World Health Organization; [cited 2022 April 22]. Available from:  
<https://www.who.int/news-room/fact-sheets/detail/hypertension>



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- There is a positive relationship between noise and hypertension prevalence.

S. Nserat, A. Al-Musa, Y. S. Khader, A. Abu Slaih, I. Iblan. Blood Pressure of Jordanian Workers Chronically Exposed to Noise in Industrial Plants, *Int J Occup Environ Med*, 8 (2017), pp. 217-223.



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**Procesing '22 1–3. jun 2022, Beograd**

- Occupational noise exposure is a potential risk factor for increased hypertension risk.

D Wang, M Zhou, W Li, W Kong, Z Wang, Y Guo, X Zhang, M He, H Guo, W Chen.  
Occupational noise exposure and hypertension: the Dongfeng-Tongji Cohort Study. *J Am Soc Hypertens*, 12 (2018), pp.71-79.



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**Procesing '22 1–3. jun 2022, Beograd**

- A systematic review and meta-analysis found that occupational noise exposure increases the risk of hypertension.

U Bolm-Audorff, J Hegewald, A Pretzsch, A Freiberg, A Nienhaus, A Seidler.  
Occupational Noise and Hypertension Risk: A Systematic Review and Meta-  
Analysis. *Int J Environ Res Public Health*, 17 (2020):6281.



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- Noise exposure is strongly associated with the prevalence of hypertension in steelworkers. In this population, noise reduction could be a way of decreasing the risk of hypertension.

F Zhou, A Shrestha, S Mai, Z Tao, J Li, Z Wang, X Meng. Relationship between occupational noise exposure and hypertension: A cross-sectional study in steel factories. *Am J Ind Med*, 62 (2019), pp. 961-968.



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- In workers in an automobile manufacturing company noise exposure may increase blood pressure.

LH Ding, RB Sun, K Wu, JB Wu, JR Zheng, ZP Yuan, LY Mei. Study on the effects of noise on hypertension and hyperglycemia among occupational workers. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*, 38 (2020), pp. 32-36.



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- In the aerospace industry workers exposed to noise levels between 82 and 106 dBA for 3-17 years may increase the risk of hypertension with a non-linear exposure-response pattern.
- Workers wearing personal protection equipment could reduce noise exposure and avoid hypertension development.

YT Lin, TW Chen, YC Chang, ML Chen, BF Hwang. Relationship between time-varying exposure to occupational noise and incident hypertension: A prospective cohort study. *Int J Hyg Environ Health*, 2020, 226:113487.



- There is significant association between exposure to high noise level and hypertension when the duration time to occupational noise was longer than 10 years.
- Hypertension is more prevalent in the noise-exposed group [higher than 85 dB(A)].

X Li, Q Dong, B Wang, H Song, S Wang, B Zhu. The Influence of Occupational Noise Exposure on Cardiovascular and Hearing Conditions among Industrial Workers. *Sci Rep*, 9 (2019);9:11524.



- In workplaces where work is performed in which daily noise exposure varies considerably from one to the another day the weekly noise exposure must not exceed 85 dB (A).

Rule book on preventive measures for safe and health work during noise exposure, *Official Gazette of the Republic of Serbia*, No. 96/2011 and 78/2015.



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- Hypertension prevalence is reduced by 1.4% by 5-dB noise reduction.

TK Swinburn, MS Hammer, RL Neitzel. Valuing Quiet: An Economic Assessment of U.S. Environmental Noise as a Cardiovascular Health Hazard. *Am J Prev Med*, 49 (2015), pp. 345-53.



- The main hemodynamic disorder in hypertension is increased peripheral resistance due to changes in vascular structure and function. Changes include thickening of the artery wall, increased vascular tone and endothelial dysfunction due to changes in the biology of cellular and non-cellular components of the artery wall.

RM Touyz. Role of magnesium in the pathogenesis of hypertension.  
*Mol Aspects Med* 24 (2003); pp.107- 36.



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- Magnesium is a natural calcium antagonist, potentiating the production of vasodilatory mediators (prostacyclin and nitric oxide) and altering the vascular response to endothelin-1, angiotensin II and catecholamines.

YP Mu, QH Huang, JL Zhu, SY Zheng, FR Yan, XL Zhuang, JSK Sham, MJ Lin. Magnesium attenuates endothelin-1-induced vasoreactivity and enhances vasodilatation in mouse pulmonary arteries: Modulation by chronic hypoxic pulmonary hypertension. *Exp Physiol* 103 (2018), pp.604-616.



- Magnesium has an impact on the inhibition of several vasoconstrictors, stimulation of vasodilators in the endothelium, and directly or indirectly inhibition of aldosterone production causing decreased kidney reabsorption of sodium and fluid.

JC Schutten, MM Joosten, MH de Borst, SJL Bakker. Magnesium and Blood Pressure: A Physiology-Based Approach. *Adv Chronic Kidney Dis* 25 (2018), pp.244-250.



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- A systematic-review and meta-analysis of prospective cohort studies found an inverse relationship between dietary magnesium intake and the risk of hypertension.
- Namely, a 100 mg increment of a daily dietary intake of magnesium is associated with a 5% reduction in the risk of hypertension.

H Han, X Fang, X Wei, Y Liu, Z Jin, Q Chen, Z Fan, J Aaseth, A Hiyoshi, J He, Y Cao. Dose-response relationship between dietary magnesium intake, serum magnesium concentration and risk of hypertension: a systematic review and meta- analysis of prospective cohort studies. *Nutr J* 2017,16:26.



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- Randomized, double-blind clinical trial showed that magnesium supplementation may lead to improved endothelial function and ameliorated subclinical atherosclerosis.

AR Cunha, J D'El-Rei, F Medeiros, B Umbelino, W Oigman, RM Touyz, MF Neves MF. Oral magnesium supplementation improves endothelial function and attenuates subclinical atherosclerosis in thiazide-treated hypertensive women. *J Hypertens* 35 (2017), pp. 89-97.



- An intervention study showed that a one month magnesium supplementation may lead to lower values of systolic, diastolic and mean blood pressure in patients with essential hypertension.

Banjanin N, Belojevic G. Changes of Blood Pressure and Hemodynamic Parameters after Oral Magnesium Supplementation in Patients with Essential Hypertension-An Intervention Study. *Nutrients* 10 (2018),pii:E581.



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- In western diet the recommended magnesium intake may be hardly reached due to food processing and food refining.

JJ DiNicolantonio, J Liu, JH O'Keefe. Magnesium for the prevention and treatment of cardiovascular disease. *Open Heart* 5 (2018), e000775.



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- In Serbia, nutritive magnesium intake in patients with essential hypertension is significantly below the recommended values.

Banjanin NĐ. Relationship of magnesium intake from food and water with blood pressure, hemodynamic parameters and arterial function in patients with essential arterial hypertension. Doctoral dissertation. Faculty of medicine, University of Belgrade, 2018.



- In men aged  $\leq 30$  years magnesium intake is 2.4 times less than recommended, and in women of the same age it is 55.2% compared to recommended.

Banjanin NĐ. Relationship of magnesium intake from food and water with blood pressure, hemodynamic parameters and arterial function in patients with essential arterial hypertension. Doctoral dissertation. Faculty of medicine, University of Belgrade, 2018.



- In men aged  $\geq 31$  years magnesium intake is 47,1 % compared to recommended, and in women of the same age it is 56,2% compared to recommended.

Banjanin NĐ. Relationship of magnesium intake from food and water with blood pressure, hemodynamic parameters and arterial function in patients with essential arterial hypertension. Doctoral dissertation. Faculty of medicine, University of Belgrade, 2018.



# CONCLUSION

- In conclusion, having in mind that there are many sources of noise in the process industry, magnesium supplementation may be useful in workers in the process industry.

