



Nitric Oxide in Nutrition and Us

Perna Singh^{1*}, Kapil Malviya² and Alok Raghav³

¹Department of Biochemistry, Banaras Hindu University, Varanasi, India

²Department of Anatomy, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

³Rajiv Gandhi Centre for Diabetes and Endocrinology, J.N Medical College, Aligarh Muslim University, Aligarh, India

***Corresponding Author:** Perna Singh, Department of Biochemistry, Banaras Hindu University, Varanasi, India.

Received: January 28, 2019; **Published:** February 22, 2019

Abstract

Nitric oxide (NO) is an important signaling molecule involved in many important processes inside the plant and animal system. In both plants and animals NO is produced by enzymatic and non-enzymatic sources. Deficiency of NO leads to several diseases and malfunctions in the body. There are many natural ways to enhance the NO content inside the body which may help to restore normal functions which are hampered due to NO deficiency.

Keywords: Nitric Oxide; Molecule; Nutrition

Over the last two decades nitric oxide has gained importance as a ubiquitous signaling molecule. It is a free radical containing single unpaired electron. It is highly reactive and has a very short half-life. It is involved in a plethora of processes in plant and animal system. In plants NO is involved in programmed cell death, pathogen response, signal transduction, stomatal closure, root organogenesis, growth, germination etc. [1,2]. In human body nitric oxide plays many crucial roles such as vasodilation, acts as signaling molecule, involved in nerve transmission, as an antimicrobial agent and many more. Synthesis of NO occurs inside the body primarily by two major pathways: non-enzymatic and enzymatic. The non-enzymatic pathway depends on dietary nitrates. In the enzymatic pathway, enzyme Nitric oxide synthase converts L-Arginine to L-Citrulline and NO. Nitric oxide synthase has 3 isoforms: Neuronal NOS (nNOS), Endothelial NOS (eNOS), Inducible NOS (iNOS). Neuronal NOS and endothelial NOS are constitutive enzymes. Their levels are relatively steady in the human body. They are found in endothelial cells, neurons, skeletal muscles, epithelial cells and many other tissues. Inducible NOS is inducible and stimulated by specific cytokines [3,4]. Since NO is involved in so many important processes inside our body, its deficiency may lead to symptoms like: insomnia, high blood pressure, anxiety, loss of libido/and/or erectile dysfunction, flagging stamina, etc. Sometimes NO deficiency occurs due to lack of proper nutrition and dietary intakes. There are many NO rich supplements which are available in the market

but they are associated with one or the other side effects. Hence natural sources of NO may be a better alternative than NO supplements. There are several natural sources which may be consumed to boost the NO levels inside the body, thus maintaining a healthy internal environment. The present article gives account of various natural ways to increase NO levels in the body:

1. Vegetables with high nitrate content: Since non-enzymatic NO production depends on nitrates therefore intake vegetables with high nitrate content might be helpful for increased NO levels. There are several vegetables with high nitrate content e.g. Celery, Lettuce, Beetroot, Spinach. With consumption of these vegetables, nitrates are converted into nitric oxide, which provides a wide range of health profits.
2. Dark Chocolate: Dark chocolate has a great influence on blood pressure. It contains antioxidants in the form of flavonols, which increases nitric oxide levels. Hence dark chocolate lowers blood pressure by increasing the production of nitric oxide in the body.
3. Antioxidants: Antioxidants neutralize free radicals, which cause the short life of NO [5,6]. Vitamin C, Vitamin E, polyphenols and glutathione are antioxidants which may help decrease the breakdown and extend the life of NO in your body.

4. NO boosting supplements: There are many supplements which do not contain NO but have elements that help to form NO. Two of the most commonly used ingredients are L-arginine [7] and L-citrulline [8]. They are available as supplements and have beneficial effects on vascular health and blood flow.
5. Exercise: Regular exercise improves endothelial function. Endothelium is the thin layer of cells that line the blood vessels. These cells produce nitric oxide, which keeps blood vessels healthy.
8. Castillo LETICIA., *et al.* "Dietary arginine uptake by the splanchnic region in adult humans". *American Journal of Physiology-Endocrinology and Metabolism* 265 (2003): E532-E539.

Volume 3 Issue 3 March 2019

© All rights are reserved by Prerna Singh, et al.

Conclusion

NO is an important entity for a healthy body. Acting as a vasodilator, NO causes the blood vessels to relax. This effect allows blood, nutrients, and oxygen to flow freely to every part of body. Therefore, an optimum level of NO is essential inside the body. A nitrate-rich vegetables diet, antioxidants, exercise and use of NO boosting supplements are some of the natural ways to boost NO levels inside the body.

Bibliography

1. Huang J., *et al.* "Transcriptome analysis of nitric oxide-responsive genes in upland cotton (*Gossypium hirsutum*)". *PLoS One* 13.3 (2018): e0192367.
2. Singh P and Shah K. "Evidences for reduced metal-uptake and membrane injury upon application of nitric oxide donor in cadmium stressed rice seedlings". *Plant Physiology and Biochemistry* 83 (2014): 180-184.
3. Lee M., *et al.* "Expression of human inducible nitric oxide synthase in response to cytokines is regulated by hypoxia-inducible factor-1". *Free Radical Biology and Medicine* 130 (2019): 278-287.
4. Wendehenne D., *et al.* "Nitric oxide: comparative synthesis and signaling in animal and plant cells". *Trends in Plant Science* 6 (2001): 177-183.
5. Lalminghlui K and Jagetia GC. "Evaluation of the free-radical scavenging and antioxidant activities of Chilauni, *Schima wallichii* Korth in vitro". *Future Science OA* 4 (2018): FSO272.
6. Lubos E., *et al.* "Role of oxidative stress and nitric oxide in atherosclerosis". *Frontiers in Bioscience: A Journal and Virtual Library* 13 (2008): 5323-5344.
7. Morris Jr SM. "Arginine: beyond protein". *The American Journal of Clinical Nutrition* 83 (2006): 508S-512S.