

# SLEEP APNEA

## Antioxidant Status

It is well documented that sleep apnea patients have both reduced antioxidant capacity and higher levels of oxidative stress than controls. <sup>5,6,7,8</sup>

## Cysteine

Oral supplementation with cysteine, the precursor to glutathione, has therapeutic potential for sleep apnea. Snore time and duration were significantly reduced for patients treated with N-acetyl cysteine compared to untreated sleep apnea patients. <sup>1,2,3,4</sup>

## Vitamin C

Improves endothelial function (blood vessel health) in sleep apnea patients to levels seen in people without sleep apnea. <sup>9,10,11</sup>

## Vitamin E

Mitigates the oxidative stress seen in sleep apnea patients; Works synergistically with vitamin C. <sup>5,11,12</sup>

## Vitamin A

Sleep apnea patients have low retinol (vitamin A); Retinol suppresses the growth of vascular smooth muscle, a process that causes blood vessels to clog, linking low vitamin A levels to the cardiovascular complications seen in sleep apnea patients. <sup>13,14</sup>

## Vitamin D

People with sleep apnea have a high prevalence of vitamin D deficiency; The worse the apnea, the more severe the deficiency; Evidence suggests low vitamin D worsens sleep apnea's negative effect on heart disease risk. <sup>15,16,17</sup>

## Selenium

In one case report, selenium supplementation completely stopped snoring caused by non-obesity sleep apnea; Selenium's role as a potent antioxidant may reduce the oxidative stress seen in sleep apnea patients. <sup>18,19,20</sup>

## Copper

Considered a strong predictor of oxidative stress in sleep apnea patients; Copper's role as a key cofactor in the powerful antioxidant superoxide dismutase (SOD) explains this; SOD is very low in apnea patients. <sup>21,22</sup>

## Minerals

The trace minerals *zinc, copper, magnesium, manganese* and *selenium* are critical cofactors for the major antioxidant enzymes, which are important in repairing cellular damage caused by hypoxia (lack of oxygen) in sleep apnea. <sup>23,24</sup>

## Glutathione

Low levels linked to sleep apnea; This powerful antioxidant helps repair liver damage caused by sleep apnea. <sup>25,26,27</sup>

## REFERENCES

- <sup>1</sup>Sadasivam K, Patial K, Vijayan V et al. Anti-oxidant treatment in obstructive sleep apnoea syndrome. *Indian J Chest Dis Allied Sci* 2011;53:153-162.
- <sup>2</sup>Liu J, Zhang J, Lu G et al. The effect of oxidative stress in myocardial cell injury in mice exposed to chronic intermittent hypoxia. *Chin Med J* 2010;123:74-78.
- <sup>3</sup>Sekhar R, Patel S, Guthikonda A et al. Deficient synthesis of glutathione underlies oxidative stress in aging and can be corrected by dietary cysteine and glycine supplementation. *Am J Clin Nutr* 2011;94:847-853.
- <sup>4</sup>Dunleavy M, Bradford A, O'Halloran K. Oxidative stress impairs upper airway muscle endurance in an animal model of sleep-disordered breathing. *Adv Exp Med Biol* 2008;605:458-462.
- <sup>5</sup>Lee D, Badr M, Mateika J et al. Progressive augmentation and ventilatory long-term facilitation are enhanced in sleep apnoea patients and are mitigated by antioxidant administration. *J Physiol* 2009;587:5451-5467.
- <sup>6</sup>Murri M, Garcia-Delgado R, Alcázar-Ramirez J et al. Assessment of cellular and plasma oxidative stress in SAHS patients before and after continuous positive airway pressure treatment. *Clin Lab* 2010;56:397-406.
- <sup>7</sup>Baldwin C, Bootzin R, Schwenke D et al. Antioxidant nutrient intake and supplements as potential moderators of cognitive decline and cardiovascular disease in obstructive sleep apnea. *Sleep Med Rev* 2005;9:459-476.
- <sup>8</sup>Katsoulis K, Kontakiotis T, Spanogiannis D et al. Total antioxidant status in patients with obstructive sleep apnea without comorbidities: the role of the severity of the disease. *Sleep Breath*. 2011 Dec;15:861-866.
- <sup>9</sup>Grebe M, Eisele HJ, Weissmann N et al. Antioxidant vitamin C improves endothelial function in obstructive sleep apnea. *Am J Respir Crit Care Med*. 2006;173:897-901.
- <sup>10</sup>Büchner NJ, Quack I, Woznowski M et al. Microvascular endothelial dysfunction in obstructive sleep apnea is caused by oxidative stress and improved by continuous positive airway pressure therapy. *Respiration* 2011;82:409-417.
- <sup>11</sup>Celec P, Jurkovičová I, Buchta R et al. Antioxidant vitamins prevent oxidative and carbonyl stress in an animal model of obstructive sleep apnea. *Sleep Breath* 2012 June 7 [Epub ahead of print].
- <sup>12</sup>Singh T, Patial K, Vijayan K et al. Oxidative stress and obstructive sleep apnoea syndrome. *Indian J Chest Dis Allied Sci* 2009;51:217-224.
- <sup>13</sup>Day R, Matus I, Suzuki Y et al. Plasma levels of retinoids, carotenoids and tocopherols in patients with mild obstructive sleep apnoea. *Respirology* 2009;14:1134-1142.
- <sup>14</sup>Barcelo A, Barbe F, de la Pena M et al. Antioxidant status in patients with sleep apnoea and impact of continuous positive airway pressure treatment. *Eur Respir J* 2006;27:756-760.
- <sup>15</sup>Mete T, Yalcin Y, Berker D et al. Obstructive sleep apnea syndrome and its association with vitamin D deficiency. *J Endocrinol Invest* 2013 April [Epub ahead of print].
- <sup>16</sup>Bozkurt NC, Cakal E, Sahin M et al. The relation of serum 25-hydroxyvitamin-D levels with severity of obstructive sleep apnea and glucose metabolism abnormalities. *Endocrine* 2012;41:518-525.
- <sup>17</sup>Barceló A, Esquinas C, Piérola Jet al. Vitamin D Status and Parathyroid Hormone Levels in Patients with Obstructive Sleep Apnea. *Respiration* 2012 Nov 15. [Epub ahead of print]
- <sup>18</sup>Dekok H. Case report: the medical treatment of obstructive sleep apnoea syndrome (OSAS) with Selenium. *Med Hypotheses*. 2005;65:817-818.
- <sup>19</sup>Kato M, Roberts-Thomson P, Phillips B et al. Impairment of endothelium-dependent vasodilation of resistance vessels in patients with obstructive sleep apnea. *Circulation*. 2000;102:2607-2610.
- <sup>20</sup>Schnabel R, Lubos E, Messow C et al. Selenium supplementation improves antioxidant capacity in vitro and in vivo in patients with coronary artery disease The SELEnium Therapy in Coronary Artery disease Patients (SETCAP) Study. *Am J Heart* 2008;156:1201e1-11.
- <sup>21</sup>Volná J, Kemlink D, Kalousová M et al. Biochemical oxidative stress-related markers in patients with obstructive sleep apnea. *Med Sci Monit*. 2011;17:CR491-7.
- <sup>22</sup>Wysocka E, Cofta S, Piorunek T et al. Blood antioxidant status, dysglycemia and obstructive sleep apnea. *Adv Exp Med Biol*. 2013;756:121-129.
- <sup>23</sup>Wysocka E, Cofta S, Cymerys M et al. The impact of the sleep apnea syndrome on oxidant-antioxidant balance in the blood of overweight and obese patients. *J Physiol Pharmacol*. 2008;59 Suppl 6:761-769.
- <sup>24</sup>Shan X, Chi L, Ke Y et al. Manganese superoxide dismutase protects mouse cortical neurons from chronic intermittent hypoxia-mediated oxidative damage. *Neurobiol Dis* 2007;28:206-215.
- <sup>25</sup>Rosa DP, Martinez D, Picada J et al. Hepatic oxidative stress in an animal model of sleep apnoea: effects of different duration of exposure. *Comp Hepatol*. 2011;10:1.
- <sup>26</sup>Ntalapascha M, Makris D, Kyparos A et al. Oxidative stress in patients with obstructive sleep apnea syndrome. *Sleep Breath* 2012 [Epub ahead of print]
- <sup>27</sup>Mancuso M, Bonanni E, LoGerfo A et al. Oxidative stress biomarkers in patients with untreated obstructive sleep apnea syndrome. *Sleep Med*. 2012;13:632-636.