# *CO2*
# *Is Good For You*
# *And Tasty Too!*

## A Brief Look At Respiratory Physiology

## (Breathing Chemistry 101)

**CONTENTS**

I recently read that mosquitoes are attracted not by your body heat, but by the carbon dioxide that you give off. That was news to me.

And this may be news to you: Over 70% of the population tested to date show a deficiency of carbon dioxide in their system: a condition known as *chronic hypocapnia.*

In other words, if you are like most people, you are probably "blowing off" too much CO2 when you breathe: a condition known as *chronic hyperventilation*.

This CO2 deficit reduces the vital supply of oxygen to your cells and tissues: brain, muscles, etc.: a condition known as *chronic hypoxia.*

You see, you need a certain level of carbon dioxide in your system in order stimulate the transfer of oxygen from the blood to the cells and tissues that need it.

CO2 plays a key role in the dilation and constriction of blood vessels: large and small arteries in the heart, lungs, brain, and intestines.

CO2 also plays the critical role in maintaining your acid-base balance (pH).

In a recent article on the subject of hypocapnia (CO2 deficit) in the *New England Journal of Medicine* (J. Laffey and B. Kavanagh, 4 July 2002), the authors write:

> "…hypocapnia has the potential to propagate or initiate pathological processes. As a common aspect of many acute disorders, hypocapnia may have a pathogenic role in the development of systemic diseases." And, they go on to say, "Increasing evidence suggests that hypocapnia appears to induce substantial adverse physiological and medical effects."

The optimum level of carbon dioxide is in the range of 40 to 45 millimeters of mercury (mmHg) or about 5% of exhaled CO2. But, less than 3 people in 10 tested, measure more than 30 mmHg! In other words, most people are unconsciously, habitually overbreathing!

There is no way of knowing what your CO2 levels are without the use of a carbon dioxide monitor (*capnometer).* It can be measured directly through invasive monitoring, or indirectly by measuring the CO2 content in your exhaled air.

You can also infer hypocapnia by the presence of some of the symptoms, illnesses, and conditions that can be triggered or worsened by CO2 deficit due to over-breathing:

Feelings of breathlessness, shortness of breath
Chest tightness and pressure, chest pain
Feelings of suffocation
Sweaty palms, cold hands
Tingling of the skin
Numbness
Heart palpitations, irregular heart beat
Anxiety, apprehension

Emotional outbursts, stress, tenseness,
Fatigue, weakness, exhaustion
Dry mouth
Nausea
Lightheadedness, dizziness
Fainting, black-out
Blurred vision
Confusion, disorientation
Attention deficit
Poor thinking, poor memory, poor concentration
Impaired judgment and problem solving abilities
Reduced pain threshold
Headaches
Trembling, twitching, shivering
Muscle stiffness, tension and spasms
Abdominal cramps.

If you suffer from any of these symptoms, you may be able to reduce or even eliminated them with simple breath awareness and conscious breathing exercises!

## The following is from an article by Dr. Peter Litchfield.

*"Blood is circulated with great precision to specific body sites based on their local and immediate metabolic requirements. Higher metabolism in more active tissues and cells generates higher levels of $CO_2$ resulting in immediate local vasodilation (relaxation of smooth muscles with the result of increasing the diameter of the vessels), thus setting the stage for supplying the required oxygen and glucose to the associated tissues, such as to specific regions of the brain while thinking.*

*Higher levels of $CO_2$ also lead to an immediate drop in pH levels through the formation of carbonic acid, thus obliging the hemoglobin to more readily distribute its oxygen to meet local metabolic requirements. Lower levels of $CO_2$, as a result of lower metabolism, lead to blood vessel constriction (e.g., reduction in the diameter of the arteries) and to higher pH levels, thus permitting oxygen and glucose to go elsewhere where metabolic requirements are greater. In the simplest of terms, this is the biochemistry of healthy respiration.*

*Overbreathing is one of the most insidious and dangerous behaviors/responses to environmental, task, emotional, cognitive, and relationship challenges in our daily lives. Overbreathing can trigger or exacerbate a wide variety of serious physical and mental symptoms, complaints, and deficits in health and performance.*

*Even slight shifts in $CO_2$ chemistry associated with overbreathing may cause physiological changes such as hypoxia (oxygen deficit), cerebral vasoconstriction (brain), coronary constriction (heart), blood and extra-cellular alkalosis (increased pH), cerebral glucose deficit, ischemia (localized anemia), buffer depletion (bicarbonates), bronchial constriction, gut constriction, calcium imbalance, and magnesium deficiency.*

*Overbreathing is excessive ventilation of carbon dioxide, excessive because $CO_2$ levels in the blood no longer accurately reflect metabolic level. The consequence is a miscalculation of local metabolic requirements that leads to less than the required amount of vasodilation, or to vasoconstriction, and thus to potentially serious deficits of oxygen (hypoxia) and glucose (hypoglycemia) as well as of other required nutrients for the optimal functioning of a wide variety of tissues and physiological systems (e.g., brain, heart, and lungs).*

*This misinformation about metabolism also triggers constriction of other smooth muscles, e.g., in the bronchioles and the gut, thus potentially exacerbating both asthma and irritable bowel syndrome.*

*Carbon dioxide deficit means a reduction in carbonic acid and a corresponding shift of pH in the alkaline direction: alkalosis is an immediate consequence of hypocapnia. Because hemoglobin does not encounter pH levels that accurately reflect current metabolic requirements, it is less inclined to release its oxygen. Thus, although oxygen saturation may be maximized, oxygen distribution is restricted.*

*The coupling of vasoconstriction and "disinclined" hemoglobin (because of higher pH levels) means significant compounding of oxygen distribution problems where oxygen deficits (hypoxia) are considerably greater than those brought about by vasoconstriction alone, e.g., deficits, in effect, that may exceed 50 percent in the brain. Combining these effects with glucose deficit in the brain, in the heart, and in other physiological systems can precipitate,* *exacerbate, and even originate serious consequences, including physiological and psychological complaints, symptoms, and syndromes of numerous kinds.*

*Alkalosis, i.e., increased pH due to reduced levels of $CO_2$, leads to yet further compromises: increases oxygen demand, anaerobic metabolism, and antioxidant depletion. Alkalosis inhibits the negative feedback normally associated with lower pH levels that limit the production of metabolic acids themselves (e.g., lactate), and hence yet further compromises performance.*

*Blood alkalosis leads to migration of calcium ions into muscle tissue, including both smooth (e.g., coronary, cerebral, bronchial, intestinal) and skeletal tissue, resulting in increased likelihood of muscle spasm (tetany), fatigue, and pain.  And, platelet aggregation is increased, thus elevating the likelihood of blood clotting.*

*Overbreathing is an insidious and unconscious habit, one that is not readily detectable. Overbreathing may be precipitated at stressful times of the day, during times of defensiveness and emotionality, or during information overload.  Some individuals overbreathe with little provocation and may do so chronically, all day without knowing it.*

*And, unfortunately overbreathing is even induced (often) and reinforced by professionals who teach breathing mechanics (e.g., diaphragmatic training) in the name of relaxation, improved health, and better performance."*