

**Investigating the Claims of Konstantin Buteyko, M.D., Ph.D.:
The Relationship of Breath Holding Time to End Tidal CO₂ and Other Proposed
Measures of Dysfunctional Breathing is about End Tidal CO₂.**

Buteyko never claimed a link between etCO₂ and BHT. We know that he patented the formula for alveolar CO₂ (aCO₂) which he studied using arterial CO₂ and O₂ values. Buteyko KP, inventor. **Method of defining CO₂ content in alveolar air** [in Russian].
U.S.S.R. patent 1593627. October 17, 1986.

Is the difference between etCO₂ and aCO₂ known to the authors of the paper? Or why etCO₂ is not the same as alveolar or arterial CO₂? Dead volume, breathing frequency, and tidal volumes all influence the difference between alveolar and etCO₂. Some studies suggested formulas for the difference. It is only accidentally, from mechanical viewpoint of gas exchange, that etCO₂, in average, for modern man, is very close to alveolar CO₂.

This negative relationship which was received depends, as the paper stated, The statistical significance of this negative correlation was dependent on two extreme cases who had both previously undertaken breathing training? One using yoga and the other using the BBT. The finding of long BHT with low ET/CO₂ in these two cases was completely opposite from what would have been predicted by Buteyko's formula but in keeping with results of at least one other study that found an inverse relationship between BHT and alveolar CO₂ tension.

My question is what would happen with etCO₂-aCO₂ difference for people with shallow breathing or who practice shallow breathing?

It is known etCO₂ would be lower than the real aCO₂, but CP will be higher. Many days ago, before reading the paper itself, I suggested the following explanation which, as I see it now, is 100% correct:

As we all know Buteyko worked with severely sick, usually hospitalized, people. Such folks have about 5-10 s CP to start with. Learning the method meant to get CP 60 and indeed there were many examples in Russia showing that, with right teaching, they can get there. This is a profound change: breathing, as any observer can point out, almost disappears. The CP is 5-10 times more!

Most modern students, e.g., mild asthmatics, usually get about 22-25 s, while having about 15 s at the beginning. This allows to reduce or eliminate medication. A good result. But this is, strictly speaking, not learning the Buteyko method. It is rather learning or application of some elements of the method.

Going back to CPs, Buteyko had a range of CPs from 5 up to 60s and more. If one studies the CP-aCO₂ formula, it is good to have a workable CP range (from 3-5 s up to 40-60 s). Why? I have never met a student yet, who can come and say, "Look I breathe more now, but my CP is greater." Practice indicates that breathing less means higher CP for any particular student. Indeed, a good breathing teacher can predict the CP of the student with about 10% accuracy visually using heaviness of breathing as the only factor.

If there are many people with 20-30 s CP (or even wider range), [as it was the case for Rosalba's study] one can get any CP-etCO₂ relationship: positive, negative, or even a vertical or horizontal line (e.g., if all have the same CP, but etCO₂ will be different).

If one imagines the real Buteyko journey on the CP-etCO₂ plane, there will be still many ascending lines even though etCO₂ is not the same as aCO₂. (It will be almost one line on CP-aCO₂ plane. It would be great to study this link scientifically.) This is what any practicing student notices: they breathe less, the CP gets higher. In total, these lines will make an ascending strip. This will represent the correlation for etCO₂. However, if we take a microscope and investigate middle, or any other, part of the strip with many experimental measurements (specific measurements), especially using etCO₂ but not the real CO₂ parameter related to CO₂ in the body, we'll see that there is no correlation or anything is possible. It is the same, as to study a fly on a side of the elephant and, pointing at the elephant, claim, "This is a fly". Better microscopes can even find some germs on fly's legs...

Hence, the study is based on substitution of values (etCO₂ instead of aCO₂) and narrowing the normal range (from severely sick to perfectly healthy, and this is what the Buteyko method is for) to a group of modern so-so cripples with 20-30 s CP. There is also a huge philosophical question: Why did a **Buteyko** practitioner call these subjects, in this paper, "normal" and "healthy"? Buteyko clearly explained both these terms: what the norms are and what the normal health means.