

Johann Sebastian Bach's "Goldberg variations" to treat insomnia from renal lithiasis pain. Sleep research in Nuclear Medicine

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Hell J Nucl Med 2016; 19(1):13-14

Published online: 1 April 2016

The organist Johann Nikolaus Forkel (1749-1818) was the first to describe the "Goldberg variations" (BWV 988) and their influence on sleep disorders of Count Hermann Karl von Keyserlingk (1696-1764) in his book from 1802 on Johann Sebastian Bach's life, art and works [1]: "[For this work] we have to thank the instigation of the former Russian ambassador to the electoral court of Saxony, Count Kaiserling, who often stopped in Leipzig and brought there with him the aforementioned Goldberg, in order to have him given musical instruction by Bach. The Count was often ill and had sleepless nights. At such times, Goldberg, who lived in his house, had to spend the night in an antechamber, so as to play for him during his insomnia. ... Once the Count mentioned in Bach's presence that he would like to have some clavier pieces for Goldberg, which should be of such a smooth and somewhat lively character that he might be a little cheered up by them in his sleepless nights. Bach thought himself best able to fulfill this wish by means of Variations, the writing of which he had until then considered an ungrateful task on account of the repeatedly similar harmonic foundation. But since at this time all his works were already models of art, such also these variations became under his hand. Yet he produced only a single work of this kind. Thereafter the Count always called them his variations. He never tired of them, and for a long time sleepless nights meant: 'Dear Goldberg, do play me one of my variations.' Bach was perhaps never so rewarded for one of his works as for this. The Count presented him with a golden goblet filled with 100 louis-d'or. Nevertheless, even had the gift been a thousand times larger, their artistic value would not yet have been paid for."

Hence, Count Hermann Karl von Keyserlingk (Figure 1) was suffering from pain due to "lithiasis" [2]. This often resulted in sleeplessness, and-according to the aforementioned anecdote by Forkel-the Count asked his young and brilliant harpsichordist Johann Gottlieb Goldberg (1727-1756), who had his bedroom next to his bedroom, to play in the variations originally entitled "Clavier Übung bestehend in einer ARIA mit verschiedenen Veränderungen vors Clavicimbal mit 2 Manualen", which Johann Sebastian Bach (Figure 2) had composed in 1741 for the Count (and probably also for his gifted student Johann Gottlieb Goldberg).

In this context, in a recent review from the Cochrane collaboration, Jespersen et al. (2015) state that, although more clinical study data is certainly needed, listening to music may be effective for improving subjective sleep quality parameters in insomnia [3].

The gold-standard pathophysiological marker of insomnia is electroencephalography (EEG), and although neuroimaging with (functional) magnetic resonance tomography (MRT), positron emission tomography, or single-photon emission tomography (SPET) is available for years [4], it was [5] and still is [6, 7] rarely used in sleep research. Papers about the physiology of sleep in cases of fatigue [8] and about delay of gastric emptying during sleep [9] have been published in HJNM. With the option to "freeze" the brain perfusion status by e.g. using SPET and ^{99m}Tc-labelled N,N'(1,2-ethylenediyl)bis-L-cysteine diethyl ester, while scanning some hours later, when the patient is awake, nuclear medicine offers a huge advantage over radiology, where the loud MRT environment is an obstacle for investigations during sleep. This, even more, will apply to studies investigating the influence of music on resolving insomnia.

In conclusion, insomnia is an interesting research field-however neglected by modern neuroimaging. Especially nuclear medicine provides the researcher with tools which offer a better spatial resolution and patient comfort than does the current gold standard EEG. Why not look at it-of course, with Bach's "Goldberg variations" in your minds?

The authors declare that they have no conflicts of interest.



Figure 1. Count Hermann Carl von Keyserlingk. Oil painting from Michael Christoph Hagelgans (1725-1766): Cabinet of Curiosities Saint Petersburg.



Figure 2. Johann Sebastian Bach at the age of 61. Copy of the oil painting from Elias Gottlob Haußmann (1695-1774).

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