

# Comparative analysis of Oxa's relaxation score with Kubios.

## A product evaluation project



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**Abstract** The purpose of this project was to investigate the behavior of the Oxa relaxation score in comparison to published indicators. The project aimed to compare the newly developed relaxation score of Oxa with the established ANS tone parameters, PNS and SNS, from the gold-standard HRV software Kubios. The results of this pilot study demonstrate a strong correlation between the relaxation score and Kubios' PNS and SNS parameters, highlighting the potential of the relaxation score in indicating ANS tone live during breathing exercises.

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**Introduction** The heart's activity is influenced by the sympathetic (SNS) and parasympathetic (PNS) branches of the autonomic nervous system (ANS). By analyzing heart rate (HR) and heart rate variability (HRV), which are indicators of ANS tone, Oxa aims to provide a real-time relaxation score representing a metric representing ANS tone to the user. This study aimed to compare the relaxation score with the established PNS and SNS parameters from Kubios. The goal was to gain insights into the potential of the relaxation score as an effective live measure of ANS tone during breathing exercises.

**Method** Data from 15 sessions were anonymously downloaded from the Oxa backend, meeting specific criteria such as availability of relaxation score, session length of more than 5 minutes, and being a breathing exercise. The electrocardiogram (ECG) data was extracted from the downloaded files and analyzed using Kubios software. Oxa parameters for HR, HRV (RMSSD), and relaxation score were also extracted. Python scripts were developed to correlate the findings from Oxa and Kubios.

**Results** The data from 15 breathing exercises were analyzed. The average HR and RMSSD values computed by Kubios and Oxa showed a strong correlation (Figure 1 A-B). The relaxation score, based on HR and RMSSD, exhibited a significant inverse correlation with Kubios' SNS and a positive correlation with Kubios' PNS (Figure 1 C-D).

**Conclusion** This project successfully highlights the potential of Oxa's relaxation score to depict ANS tone, due to its congruence with the established PNS and SNS scores from Kubios. The strong correlations indicate the potential of the relaxation score to accurately reflect ANS tone during breathing exercises. However, it is important to consider the limitations of this pilot project, such as the relatively small sample size and the range of scores assessed. Future planned projects by Nanoleq will explore a wider range of relaxation values and personalize the relaxation score based on individual baseline HR and HRV. Overall, the findings of this project highlight the potential of the relaxation score of Oxa in reflecting ANS tone for the user.

**Figure 1:** Regression analysis indicates strong convergences between Kubios and Oxa metric for (A) heart rate, (B) RMSSD, (C and D) relaxation with SNS and PNS during breathing exercises. The natural logarithm of the Kubios RMSSD is presented in B.  $r$  = Pearson coefficient. The shaded area indicates the confidence interval.

