**Supplementary Material**

**Table 1. Effects of Meditation on HRV and Respiratory Rate**

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| Meditation effects on the HRV and the respiratory rythm |
| Author | Population | Design  | Intervention | Comparison | HRV | Respiration |
| Krygier, J. R., Heathers, J. A., Shahrestani, S., Abbott, M., Gross, J. J., & Kemp, A. H. (2013). Mindfulness meditation, well-being, and heart rate variability: a preliminary investigation into the impact of intensive Vipassana meditation. *International Journal of Psychophysiology*, *89*(3), 305-313. | 36 beginnersEnrolled in a retreat age : +/-43 years | VipassanaMeditation 2 sessions:5 min rest5min méditation focus on breathing | Data has been collected 1 day before retreat and +/- 4 days after retreat Between 15 and 18h | Long-Term meditators : before and after the retreatAnalysing HRV-Well Being |  Meditation Vs Rest :↑Absolute HF power (ln HF) HF n.u no significantLF no significantInteraction time x meditation task (1X2)↑nu HF ↓THM (=LF) during meditation after retreat. |  |
| [Takahashi](http://www.citeulike.org/user/dr0x29a/author/Takahashi%3AT) T.,  [Murata](http://www.citeulike.org/user/dr0x29a/author/Murata%3AT) T.,  [Hamada](http://www.citeulike.org/user/dr0x29a/author/Hamada%3AT) T.,  [Omori](http://www.citeulike.org/user/dr0x29a/author/Omori%3AM) M., [Kosaka](http://www.citeulike.org/user/dr0x29a/author/Kosaka%3AH) H.,  [Kikuchi](http://www.citeulike.org/user/dr0x29a/author/Kikuchi%3AM) M., [Yoshida](http://www.citeulike.org/user/dr0x29a/author/Yoshida%3AH) H.,  [Wada](http://www.citeulike.org/user/dr0x29a/author/Wada%3AY) Y., (2005) Changes in EEG and autonomic nervous activity during meditation and their association with personality traits**,** *International Journal of Psychophysiology*, Vol. 55, No. 2., pp. 199-207. | n=20 male student+/- 25 yearsbeginners | Zen meditation Laying downControl of breathing and attention 5 min of stabilization 15 min. rest 30 min. break | EEG, RR, ECG ( HRV)Counting from 1 to 100 focusing on breathing with a metronome.0. 25HzEEG and ECG + breathing | EEG HRV character traitsRest Vs méditation | ↑ nuHF meditation↓nuLF et LF/HF ratio |  |
| Tang, Y. Y., Ma, Y., Fan, Y., Feng, H., Wang, J., Feng, S., ... & Zhang, Y. (2009). Central and autonomic nervous system interaction is altered by short-term meditation. *Proceedings of the national Academy of Sciences*, *106*(22), 8865-8870. | n=80 students beginners4 groups:-IRM+Physion=20 meditationn=20 control group-EEG+ Physion=20 meditationn=20 control group | Méditation Mindfulness Formation 5 jours/ 20 min./j | 5 periods for data collection: baseline data before training, 3 x 9 min training period and baseline data after treatment | Meditation IBMT Vs control group | ↑(nuHF) HRV meditation group VS relaxation group.↓RC in a significative way | ↑ abdominal respiratory amplitude and ↓ Thoracic RR in the meditation group Vs relaxation |
| Peng, C. K., Henry, I. C., Mietus, J. E., Hausdorff, J. M., Khalsa, G., Benson, H., & Goldberger, A. L. (2004). Heart rate dynamics during three forms of meditation. *International journal of cardiology*, *95*(1), 19-27. | 11 Kundalini yoga experienced, 3 to 5 years, 5 times a week. | 3 interventions in a session:ECG (chest)Abdominal and thoracic straps10 min of each practicePreceded by a rest of 10 min (control) | Meditation: focus on a mantra Fire breathing: fast breathing: 140 / min, thoracic level Segmented breathing: inspiration and expiration on 8 beats | Comparing rest VS intervention | **Meditation :** RC : ns↑HRV↑LF**Fire Breathing**↑RC↓VRC↓TP↓LF↑HF**Slow breathing:**↑RC: ↑HRV↑LF↓HF/LF Ratio  |  |
| Delgado-Pastor, L. C., Perakakis, P., Subramanya, P., Telles, S., & Vila, J. (2013). Mindfulness (Vipassana) meditation: Effects on P3b event-related potential and heart rate variability. *International Journal of Psychophysiology*, *90*(2), 207-214. | n=10 experienced | VipassanaMEditation2sessions :-5-minute rest-Listening an audio- 30-minute meditation/wandering thoughts-listening an audio | ECG et EEG |  | Méditation↑HRV↑LF | Not taken into account |
| Wu, S. D., & Lo, P. C. (2008). Inward-attention meditation increases parasympathetic activity: a study based on heart rate variability. *Biomedical Research-Tokyo*, *29*(5), 245-250. | n= 10 experiencedn= 10 control group | Zen Meditation One session with 2 interventions :Rest and meditation | The meditator focuses his attention on a Zen chakra at the level of the heart ECG and waist belt at the nave | Compare HRVcontrol group Vs experienced | Meditation : No effect on RMSSD↑TP↓LF↓LF/HF ratio↑HF | Respiration rythm : no significant changes |
| Phongsuphap, S., Pongsupap, Y., Chandanamattha, P., & Lursinsap, C. (2008). Changes in heart rate variability during concentration meditation. *International journal of cardiology*, *130*(3), 481-484. | n=35 experienced(teacher of meditation)n=17volunteerscontrol groupSITTING position !!! | 4 weeks. 5 periods for data collection: baseline data before training, 3 x 9 min training period and baseline data after treatment  | 5 min at rest 10 min meditation focused on breathing | Effects on HRV Domain temp. : DRQL RC Frequency domain: nu HF, nu LF, nuVLF | During medtation :↑ HRV↑nuLF  | Not taken into account |
| Peressutti, C., Martín-González, J. M., García-Manso, J. M., & Mesa, D. (2010). Heart rate dynamics in different levels of Zen meditation. *International journal of cardiology*, *145*(1), 142-146. | n=19 experiencedG1: n=5:4.5 years-experiencedG2: n=4: 16 years-experiencedG3 :13, 6 years +/- 5 years | Zen Soto meditation 2-4 sessions on a one-month retreat with rest and meditation. -10 min rest -40 min of meditation -20 min AF: Focusing on breathing 20 min MM: Without directed attention, observing what happens. | Sitting position, ECG and RR recording | Comparison of 3 groups Rest data Meditation and breathing in frequency domain | ↑HRVLF predominate especially in G3. HF ↓MM MindfulnessG1 LF-HF FA Focused AttentionG1 :VLFMMG3 (11-20 years experienced)FAG3 ↑LF ++ | The less experience there is and the higher the RR is. With the experienced subjects, the RR oscillate more. |
| Wielgosz, J., Schuyler, B. S., Lutz, A., & Davidson, R. J. (2016). Long-term mindfulness training is associated with reliable differences in resting respiration rate. *Scientific reports*, *6*, 27533. | Méditation Mindfulness n =31 experienced minimum 3 years with a daily practice of 30 min. + have participated in at least 3 retreats. n = 34 Control Group | 3 lab sessions spaced by 4.5 months .24h-Lab session The 2 and 3 sessions were preceded by a session of 8 hours of training the day before. 6 min recording at rest with plethysmography. Time domain analysis | Collecting RR data at restQuestionnaire, demographic, physiological, behavioral and neuroimage data | Relation between respiratory rhythm at rest and years of experience in meditationCompare meditating and non-meditatingCompare effect of intensive retreat and daily practice of short duration | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Inverse Relation: 1- year-experience corresponds to a decrease of 0,16 bpm ↓ RRRR rest of experienced beginnersVs: -1.6 cpm+ Effect of an intensive retreat Vs daily practiceDouble hour of retreatwith a decrease of 0, 7 bpm |
| Studies showing very few effects on HRV |
| Chu, I. H., Wu, W. L., Lin, I. M., Chang, Y. K., Lin, Y. J., & Yang, P. C. (2017) Effects of Yoga on Heart Rate Variability and Depressive Symptoms in Women: A Randomized Controlled Trial. *The Journal of Alternative and Complementary Medicine*. | n = 26 depressive women beginners -n=13 trainned in yoga-n=13 control group | 2 sessions: ECG recording of 20 minutes Laying down! | 8 weeks of training 2 times a week, 60 min.5 min breathing exercises5 min warm up40 min posture10 min meditation | Depression and HRV Before and After Yoga Training | -RC does not change -SDNN not significant ↑ HF ↓ LF ↓ LF / HF ratio | Not taken into account |
| Lumma, A. L., Kok, B. E., & Singer, T. (2015). Is meditation always relaxing? Investigating heart rate, heart rate variability, experienced effort and likeability during training of three types of meditation. *International Journal of Psychophysiology*, *97*(1), 38-45. | n = 160 beginners n = 80 started with a module n = 80 started with another module Each module over 3 months | Longitudinal study (9 months) Training in a type of meditation for 3 months for each group HF-HRV analysis as parasympathetic and RC as sympathetic | Collecting data at week 3 and 13 of each module. During each module, training minimum 5 times / week with a 20 minute audio guide. + 2h weekly session | Compare RC and HF-HRV and level of effort during 3 types of meditation: breathing, compassion, open to thoughts | Lower RC during breathing meditation than compassion or open to thoughts. RC ↑ and ↓ HF-HRV decreases with training for these same 2 meditations | Not taken into account. |
| *Steinhubl SR, Wineinger NE, Patel S, Boeldt DL, Mackellar G, Porter V, Redmond JT, Muse ED, Nicholson L, Chopra D and Topol EJ (2015) Cardiovascular and nervous system changes during meditation. Front. Hum. Neurosci. 9:145.*  | n=20 experienced : regular practice for 3 months: + - 32 min / day n = 20beginners  | 2 session: 1 day of retreat and after retirement (7 days) meditation mantra ECG, EEG, HR, RR, HRV | . 26 min silent mantra meditation . 20 min listening talks .4 min: Guided Breathing Exercises | observe individual variations via continuous EEG monitoring, blood pressure, CR and HRV in novices and experienced | RC: No change↓ RMSSD experienced -Meditation: no change HRV -Slow breathing ↓ nu HF (experienced and novices | RR no significant change although a little slower in both groups during meditation. |
| Nijjar, P. S., Puppala, V. K., Dickinson, O., Duval, S., Duprez, D., Kreitzer, M. J., & Benditt, D. G. (2014). Modulation of the autonomic nervous system assessed through heart rate variability by a mindfulness based stress reduction program. *International Journal of Cardiology* *177*(2), 557-559. | n= 18 beginners | Mindfulness Meditation Class of 2-3h weekly during 8 weeks + daily practice. | -5 min. rest -5 min. breathing 6cycles per minute -5 min. meditation, sitting with K7 audio | Compare the change before and after the Mindfulness program based stress program | No change in RC -TP, HFP, LFP no change -After 8 weeks and during meditation↓ Nulf ↑ HFnu -Slow breathing↑nuLF↓nuHF, LFP,↑ | ↓ Respiration during meditation versus rest |
| Kim, D., Kang, S. W., Lee, K. M., Kim, J., & Whang, M. C. (2013). Dynamic correlations between heart and brain rhythm during Autogenic meditation. *Frontiers in human neuroscience*, *7*, 414.

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 | n=12 beginnersof a local autogenic meditation community | Autogenic meditationEEG, ECGSitting, Closed eyes.5 min sitting rest. .5 to 15 minutes of meditation | Training of 8 weeks followed by a month of daily meditation. Photoplethsmography EEG | EEG and ECG change before and after | Global HRV has not changed. HF did not change compared to rest. Cardiac coherence changes rather than LF |  |
| Pittig, A., Arch, J. J., Lam, C. W., & Craske, M. G. (2013). Heart rate and heart rate variability in panic, social anxiety, obsessive–compulsive, and generalized anxiety disorders at baseline and in response to relaxation and hyperventilation. *International journal of psychophysiology*, *87*(1). | 89 subjects with primary anxiety disorders according to DSM-IV 39 control subjects | One session with 2 interventions Relaxation and Hyperventilation 30 min | -5 min at rest -15 min relaxation -1 min in hyperventilation 76cpm CO2 taken during hyperventilation to lower them by 50% CO | Compare the HF-HRV At rest Relaxation hyperventilation Compare the HF-HRV between the control group and people with anxiety | HF-HRV does not change significantly between rest and relaxation. ↑ HF-HRV during hyperventilation |  |
| Oxygen consumption during medtitation |
| Tyagi, A., Cohen, M., Reece, J., & Telles, S. (2014). An explorative study of metabolic responses to mental stress and yoga practices in yoga practitioners, non-yoga practitioners and individuals with metabolic syndrome. *BMC complementary and alternative medicine*, *14*(1), 445. | .YP (n = 16) Practicing yoga for at least 6 months, 90 min / day. NY (n = 15). MS (n = 15) Patient with metabolic problem | 1 session with 9 sequences:4 interventions (5min.) interspersed with rest period | -Induction of stress by arrhythmic exercices -Rest Respiration by a nostril -Rest -Fast Breathing: 48rpm -Rest -Meditation (mantra) Laying down | Effect of yoga on recovery from stress and on O2 consumption during breathing or meditation Comparison of the three groups. | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ | YP have a lower O2 consumption at rest compared to the other 2 groups. YP has greater variability in O2 consumption in different equations. YP has a better recovery compared to induced stress |
| Attentional tasks reduce the HRV |
| Keller, J., Bless, H., Blomann, F., & Kleinböhl, D. (2011). Physiological aspects of flow experiences: Skills-demand-compatibility effects on heart rate variability and salivary cortisol. *Journal of Experimental Social Psychology*, *47*(4), 849-852. | 8 students from University | HRV assessment and other questionnaire measures One session with 3 different conditions: 3 min at rest5min condition15 min condition2 5 min Condition 3 | A task of knowledge is requested, answer to questions of general knowledge. 3 conditions: -Boredom -under level adapted at S level- Above the level of S | Comparison of HRV behavior during the 3 conditions | More task involves attention and commitment and more HRV ↓ | Not taken into account |
| Effects of slow breathing or HRV biofeedback |
| Author | Population | Study Design  | Intervention | Comparison | HRV |
| Giardino, N. D., Chan, L., & Borson, S. (2004). Combined heart rate variability and pulse oximetry biofeedback for chronic obstructive pulmonary disease: preliminary findings. *Applied psychophysiology and biofeedback*, *29*(2), 121-133. | n=20 COPD (Gold II) | 9 training sessions: -5 weekly sessions.  HRV-biofeedback seated - 4 weekly sessions. : walking + Biofeedback Saturometer (+ Respi) | HRV Biofeedback: ECG electrodes, saturometer, velcro strap abdo. Walk : With saturometer and encouragement respi biofeedback | Comparison before / after-Test of 6 min walk.-Questionnaire of Saint-Gilles Respiratory on quality of life | ↑ HRV ↑ LF -Test of 6 min walk: Significant improvement -Questionnaire Saint-Gilles ↑ -Dyspnea ↓ -R spontaneous R at rest |
| Paul, M., & Garg, K. (2012). The effect of heart rate variability biofeedback on performance psychology of basketball players. *Applied Psychophysiology and Biofeedback*, *37*(2), 131-144. | n = 30 basketball players n = 10 HRV / B n = 10 placebo group n = 10 control group | 10 consecutive days HRVB training. questionnaires | 3min dribble, pass and shoot. Then plethysmographic evaluation with digital sensor and abdominal belt for HRV and RR measurements | Compare before after and one group to another: anxiety and performance of athletes | HRVB Group↑ HRV ↑ LF↓ HFIncreased performance in the 3 physical tests. |
| Tsai, H. J., Kuo, T. B., Lee, G. S., & Yang, C. C. (2015). Efficacy of paced breathing for insomnia: enhances vagal activity and improves sleep quality. *Psychophysiology*, *52*(3), 388-396. | n = 14 subjects with insomnia Pittsburgh Sleep Quality Index (PSQI) questionnaire n = 14 good sleep subjects | 2 sessions spaced a week | 5 min at rest 20 min of breathing imposed at (0.2Hz = 12 cpm) / (0.1Hz = 6cpm) 5 min rest just before sleeping.  One week at 0.2Hz and the other week at 0.1Hz | Compare insomniac group and control group: HRV and quality of sleep. Evaluate the effect of slow breathing on sleep quality and HRV | During slow breathing 0.1Hz (6cpm) at insomniac VS normal breathing and + significant Vs group control. ↑ HRV  ↑ TP ↓ nuHF ↑ nuLF |
| Howorka, K., Pumprla, J., Tamm, J., Schabmann, A., Klomfar, S., Kostineak, E., ... & Sovova, E. (2013). Effects of guided breathing on blood pressure and heart rate variability in hypertensive diabetic patients. *Autonomic Neuroscience*, *179*(1), 131-137. | n = 32 n = 16 treatment subjects n = 16 control group | 8 weeks slow breathing training (<10cpm) 15 min / day | HRV recording sequence of 15 min in different positions (lying, sitting, standing).24-hour BP recording | Medium-term effects of slow breathing device on PS and HRV in hypertensive diabetic patients | HRV ↑ SDRR no change ↑ TP ↓ nuHF ↑ nuLF↓ BP |
| Sowder, E., Gevirtz, R., Shapiro, W., & Ebert, C. (2010). Restoration of vagal tone: a possible mechanism for functional abdominal pain. *Applied psychophysiology and biofeedback*, *35*(3), 199-206. | n = 20 children with abdominal pain n = 10 children with pain control group | Mobile acquisition unit to wear 4h / day for 8 weeks. 6 sessions HRVBiofeedback + 10 min slow breathing / day | 5 min. recording several times a day for 8 weeks | Compare before-after treatment: HRV and intensity and frequency of symptoms | For the group with pain and HRVBiofeedback treatment,  ↑ nuLF during treatment. Decreased intensity and frequency of pain with better regulation of vagal tone after 8 weeks |
| Hallman, D. M., Olsson, E. M., Von Schéele, B., Melin, L., & Lyskov, E. (2011). Effects of heart rate variability biofeedback in subjects with stress-related chronic neck pain: a pilot study. *Applied psychophysiology and biofeedback*, *36*(2), 71-80. | n = 21 subjects with neck pain and stressn = 11 treatmentn = 10 control (just breathing) | 10 weeks of weekly HRVB sessions + slow breathing (15min / day) | HRV Recording -10 min at rest Stress tests: -Hand stress grip -Cold Pressure test -Deep breathing test | Before and after protocol | For the treatment group:HRV at rest↑ HRV↑ LF-During the Hand grip test:↑ SDRR-Cold Pressure test:↑ HRV better test response |