Acupuncture and Heart Rate Variability

Radostina Stoycheva

Business Development Manager

408-656-5728

rado@sweetwaterhrv.com

beathealthy.com

Introduction

Stress is one of the most prevalent problems in our society and in health care. Stress costs billions of dollars a year in health care—and incalculable costs in terms of human suffering. According to the American Psychological Association, three-quarters of all Americans experience symptoms related to stress in a given month, and half of Americans report lying awake at night due to stress. Workplace stress costs more than $300 billion each year in health care costs, missed work and stress reduction.[1] Stress contributes to heart disease, hypertension, strokes and other diseases.

When we are stressed, our bodies shift into "fight or flight" mode as the body prepares to confront danger or flee from it. Adrenaline and other hormones flood our bodies, accelerating heart and lung action. We may flush or pale, and begin sweating. Many processes such as digestion slow or cease. None of this is good for our bodies or minds over a prolonged period of time. But stress–while not entirely avoidable– can be managed without resource to prescription medication. Any individual who wants to control stress can do so. Heart rate variability (HRV) is one of the ways stress can be monitored. By understanding HRV and monitoring it regularly, you can control and lower your clients' stress levels.

Acupuncture and Stress

Stress poses a problem to acupuncturists because it interrupts the smooth flow of energy through the body. When the body shifts into this mode, it creates a block, which acupuncturists have to work hard to remove. Many people who are stressed out complain of upper back, shoulder and neck pain. As you may know, stress causes tension in those areas, blocking the free flow of energy, causing pain, tightness, and often leading to headaches.

You may ask yourself, "How often do my clients report problems with stress?" More often than not, patients will blame their pain on stress in their lives.

Chronic stress can lead to cardiac problems. Because heart rate variability (HRV) is a measure of the body's ability to respond to stress, it has been proclaimed the single greatest indicator of cardiovascular health and/or death. Acupuncture synchronizes the sympathetic and parasympathetic nervous systems, thereby improving HRV. In a recent study, researchers found that Danzhong (acupoint CV17), but not Zhongting (acupoint CV16), decreases heart rate and increases the high-frequency component of the nervous system. This means it regulates the nervous system by increasing parasympathetic activity (also known as vagal activity or the rest-and-repair state), which can be helpful when you want to balance out your clients with chronic stress problems.[2]

Belief in Numbers

"Acupuncture significantly reduces levels of a protein in rats linked to chronic stress," researchers found in a 2011. They go on to say that, "if their findings are replicated in human studies, acupuncture would offer a proven therapy for stress, which is often difficult to treat."[3] Using our product to measure HRV and stress, you will produce materials for your own stress study. You will be able to prove that acupuncture reduces stress levels and influences positive change in heart rate variability.

The patients who come to your office may or may not be confident in the practice of acupuncture. While many believe in the efficacy of acupuncture, there are always the skeptics who say, "Where is the proof?" It may be a challenge for first-time patients to get past the uncertainty and come back for more treatments.

In addition, your regular patients will find new meaning in their acupuncture sessions by adding objective health measurement to their own subjective experience.

By measuring stress levels through HRV values, you can show your patients several things:

- How well the acupuncture treatment is working for their nervous system
- Which trigger points affect their bodies the most
- Real-time biofeedback *data* based on their sessions

This sophisticated but easy-to-use tool will differentiate your practice from other acupuncturists.Take a minute to learn about HRV and our product.

What is Heart Rate Variability?

HRV is the variation in the time interval between one heartbeat and the next. When we think of our heart rate, we generally think of a number between 60 and 90 beats per minute. This number represents an average heart rate. In fact, your heart rate changes from beat to beat. When you inhale your heart rate speeds up and when you exhale it slows down. So rather than referring to a fixed pulse of say, 60 beats per minute, the heart rate will actually vary between, say, 55 and 65 beats per minute. HRV is a measure of this naturally occurring irregularity in the heart rate.

Figure 1. Heart rate variability is the variation between heartbeats.
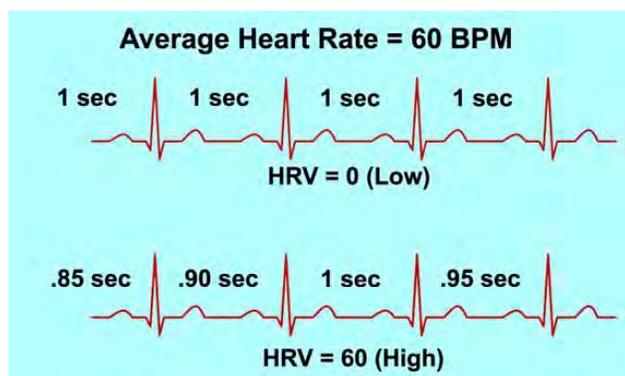
Source: SweetWater Health, LLC

HRV has been researched as a factor in heart health, stress, athletic training, emotional health, and fitness, to name just a few areas.

Nearly a quarter-century of clinical research has shown that when HRV is high, a person experiences low levels of stress and greater resiliency. When HRV is low, this is an indication of greater stress and lower resiliency.

The National Institutes of Health (NIH) have funded many studies on HRV, using HRV as a biomarker for disease or health. The NIH Clinical Center offers HRV monitoring to show patients how various stresses are affecting their bodies, and provide them with a biofeedback tool to help reduce stress by raising their HRV.

NIH is just one of the many institutions and individuals researching HRV and using HRV in the monitoring and treatment of patients. Mayo Clinic, Stanford University Hospital and Clinics, and Mount Sinai Medical

Center and School of Medicine are among the many prestigious research centers studying HRV and using it in clinical practice.

SweetBeat Description

In the past, HRV measurement required expensive hardware and software connected to your PC. Now SweetBeat, the stress management iPhone app from SweetWater Health, can measure HRV on your iPhone or iPad using off the shelf heart rate monitors.

The SweetBeat stress management system consists of the SweetBeat app and the MySweetBeat web portal. Sessions run on the app can be uploaded to a secure and private web portal for tracking and reviewing from any internet enabled computer or mobile device. Figure 2 provides a brief description of the SweetBeat app and Figure 3 shows some of the tracking tools available in MySweetBeat.

Figure 2: MySweetBeat App Description

The set mood and stress functions do not change the readings, rather they provide the user with contrast from how they are feeling (if they are chronically stressed they may think stress is normal) and what objective measurement is saying

HRV represents the state of the parasympathetic nervous system and ability to respond/react and recover from stressors. These stressors include orthostatic (standing and sitting), environmental and psychological.

HRV is a number between 0-100 and the higher the better. Most people are between 50 – 80.

The stress gauge is a representation of the balance of your nervous system. The two branches are sympathetic which represents fight or flight and parasympathetic which represents relaxation, repair and recover. Blue indicates that the parasympathetic is dominant and red that sympathetic is dominant. The colors in between represent varying dominance of the 2 branches

Source: SweetWater Health, LLC

Figure 3: MySweetBeat Tracking Tools

Session summaries and detailed graphical charts accessed from MySweetBeat calendar

Session calendar displayed using tags & color coded measured stress levels

Detailed graphical charts of recorded stress variables for session review, comparison, and analysis
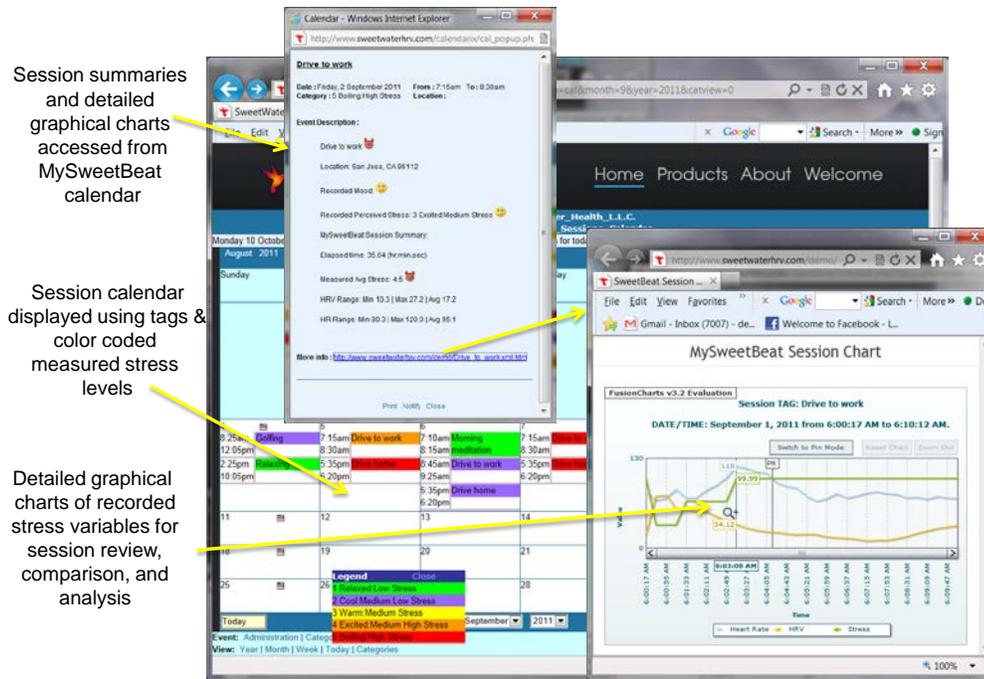
Source: SweetWater Health, LLC

Acupuncture and SweetBeat

Figure 4 shows a SweetBeat session recorded during one of Patient A's acupuncture appointments. As seen in this graph, SweetBeat measures HRV, stress and heart rate.

HRV is a reflection of the parasympathetic branch and is expressed as a number between 0-100. Note that the average person reads between 50 and 80 and a high HRV is desirable.

The stress level is a representation of the balance of the two branches of the nervous system. These two branches are the sympathetic branch, which represents fight or flight, and the parasympathetic branch, which represents relaxation, repair and recovery. A low stress value indicates that the parasympathetic is dominant. As the sympathetic branch become more dominant than the parasympathetic branch, the stress value increases. People who are always in a high-stress state may be chronically stressed.

Referring to Figure 4, the stable HRV value (green line) means that Patient A's parasympathetic branch was reasonably stable.

Her stress level (brown line) fluctuated according to what was going on in her environment and body. As you can see, about 30 minutes into the acupuncture treatment, Patient A's stress level dropped rather dramatically indicating that her sympathetic dominance began to go down.

Her heart rate (blue line) was reasonably stable throughout the session even though her HRV and stress levels (nervous system balance) varied quite a bit.

Figure 4. Patient A's Acupuncture Session
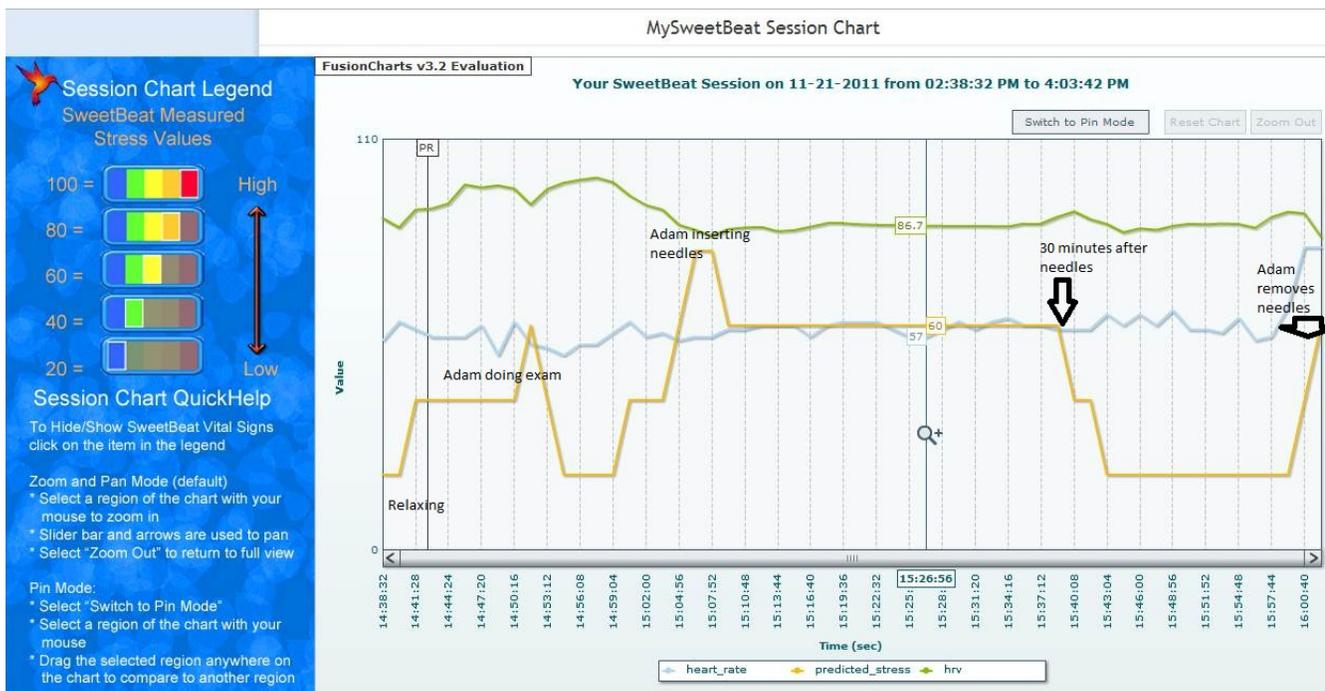
Source: SweetWater Health, LLC

In Figure 5, we compare a "nap" versus an acupuncture session. The left graph is a nap, and as you can see, Patient B's HRV (green line) fluctuates greatly, while the heart rate (blue line) is high. During the acupuncture session, the HRV increases and stays there, while the heart rate decreases.

Figure 5. Patient A's Acupuncture Session

Source: SweetWater Health, LLC

With the SweetBeat app and the secure MySweetBeat portal, you will be able to:
- Measure your patients HRV before and after the acupuncture session

- Recommend SweetBeat to your patients to measure HRV between acupuncture appointments, encouraging them to keep an eye on stress throughout the week
- Measure their HRV during an acupuncture session to measure efficacy of this particular needle placement
- Upload individual client HRV sessions to MySweetBeat for tracking and review
- E-mail your patients their session summaries from previous sessions

If patients wish to purchase their own heart rate monitors and apps, they can run their own sessions and upload to the same or separate account than their acupuncture account.

Research

Below is a short compendium of several studies done on acupuncture with the measurement of heart rate variability.:

"Using technology from western medicine, one can clearly measure the effects of acupuncture and acupuncture-like stimulation in the brain and periphery. Computer-based monitoring of heart rate (HR) and heart rate variability (HRV) as well as innovative pulse wave analysis allow for diagnosis and prognosis concerning the functional state of the arteries and the heart, which is modulated by different centres of the brain." In this same study, the volunteers' "heart" ear acupoints were stimulated by both vibrations and manual ear acupressure. The results show a large decrease in heart rate during both stimulations and a significant increase in HRV during manual ear acupressure.[4]

In the first-ever study of HRV measurements in post-stroke patients using acupuncture, researchers found a significant increase in HRV during and five to10 minutes after acupuncture. In the discussion at the end of the study, the study's authors state, "HRV is a widely accepted measurement method for the assessment of the patient's neurophysiological state. The better HRV, the healthier the patient."[5]

In a 2010 study on the "Comparative Effects of Acupressure at Local and Distal Acupuncture Points on Pain Conditions and Autonomic Function in Females with Chronic Neck Pain," the researchers found that "although acupressure did not change the LF and the LF/HF ratio of HRV, acupressure on the local acupuncture points significantly reduced HR and increased the HF of HRV," and "furthermore acupressure could influence the autonomic nervous system."[6]

When studying "The Influence of Acupressure at Extra 1 Acupuncture Point on the Spectral Entropy of the EEG and the LF/HF Ratio of Heart Rate Variability," researchers hypothosized that acupressure at the Extra 1 point would induce sedation and change sympatho-parasympathetic nerve balance. They applied acupressure at a sham point for the control group and the Extra 1 group received acupressure at the Extra 1 point. Recording the HRV for five minutes before and after the acupressure showed that "acupressure significantly decreased the LF/HF ratio of HRV in both groups."[7]

In a study on how "Acupuncture Modulates Resting State Connectivity in Default and Sensorimotor Brain Networks," the researchers stated in their introduced that "recent reports have suggested that ANS response to acupuncture (measured by heart rate variability, HRV, may be linked to clinical response for different chronic pain populations." This shows that HRV measurements are a direct look into how the autonomic nervous system is effected by acupuncture.[8]

SweetBeat Implementation

Implementing SweetBeat in your facility is easy. You must purchase equipment for every room you will be working. If you only have one room where clients are treated, you will need the following: One 8GB iPod

Touch ($187.99 and you will need wifi to upload sessions), one SweetBeat Application ($1.99), one heart monitor and one receiver/dongle ($59.99 - $99.99). To view your sessions online, you will need to subscribe to MySweetBeat ($29.99/month). You can find the links on our health sensor partner page at www.beathealthy.com/healthsensors. Buy the SweetBeat app on iTunes.com (one copy for each device) http://itunes.apple.com/us/app/sweetbeat/id492588712?mt=8.

Figure 5. SweetBeat is compatible with several widely available heart monitors, including Wahoo, 60Beat, and NuMetrix smart clothing.

For a first-time client, you will need to run a five-minute session before the adjustment to establish a pre-treatment baseline. Then, you run a five-minute session after the acupuncture. To run a session, you simply have the client put the heart rate monitor around their lower chest, wet the two pads on either side of the connector piece, and connect the receiver/dongle to the iPod Touch. Open the app and press "Start". For regular customers, you may want to only run a five-minute session after the session to track progress.

Create an account either on the app or through our website and upload sessions to the private and secure MySweetBeat database. If you wish, you may create separate accounts for each client. The other option is to "tag" the sessions as the client's name or email.

When you visit the calendar, you can view session details by clicking on the session to open a pop-up window. At the bottom of this window, you will find a link to your session graph.

Figure 6. Track through the MySweetBeat Portal, http://www.sweetwaterhrv.com
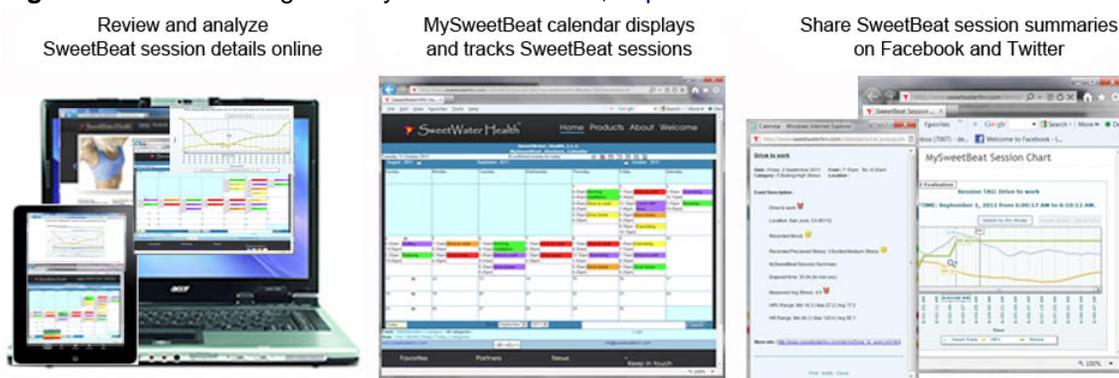
Source:

SweetWater Health, LLC

If customers wish to purchase their own heart rate monitors and apps, they can run their own sessions and upload to the same or separate accounts than their acupuncture account.

Kubios

If you are interested in using the data received from SweetBeat to analyze the data even further, we recommend the freeware, Kubios. You may obtain more information on HRV analysis by visiting the Kubios website at http://kubios.uku.fi. (Please note that SweetWater Health has no connection to the developer of this program.)

Coming Soon

We are working to provide you with an easy-to-use system for interpretation of the data from SweetBeat. We will be synchronizing a list of the R-R Intervals to the session summaries that are now available on the MySweetBeat calendar. Using this spreadsheet of R-R Intervals, you will be able to fully utilize the freeware, Kubios. In addition to this, we will offer a set of graphs that will help you interpret your data over time. We will provide you with a system of comparing your client's scores to the desired HRV, total power, and sympathovagal balance values. By simply entering the LF, HF, and rMSSD from a session summary, you will be able to view readable charts like the ones you see below. This will give you and your client a visualization of the work that needs to be done or has been done through your care.

Figures 7, 8, 9, 10. These are examples of the charts you will receive from simply entering your LF, HF and rMSSD information from a session summary.
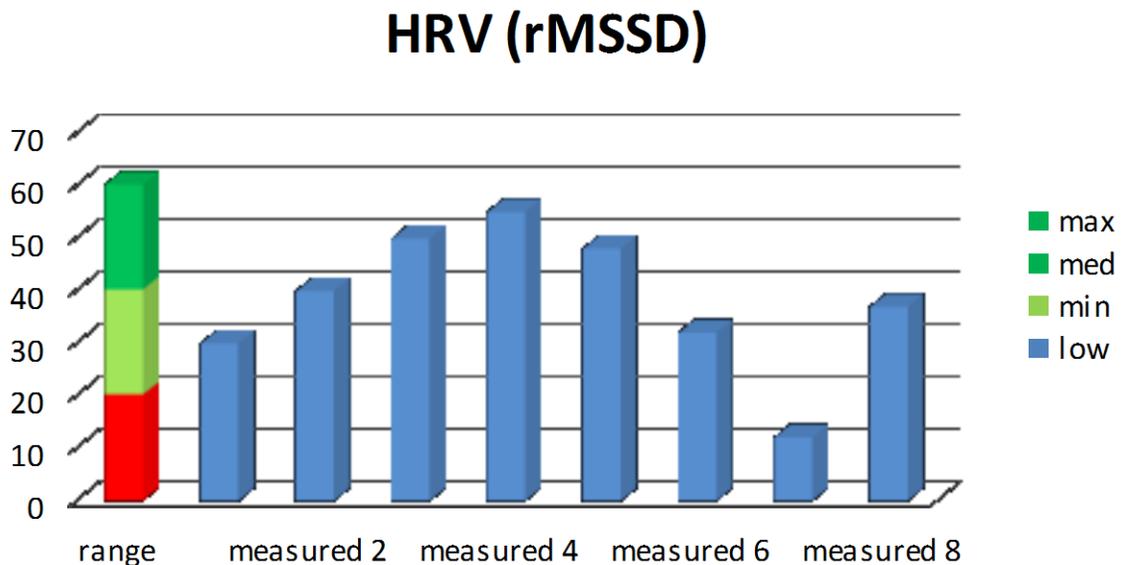
ANS Total Power
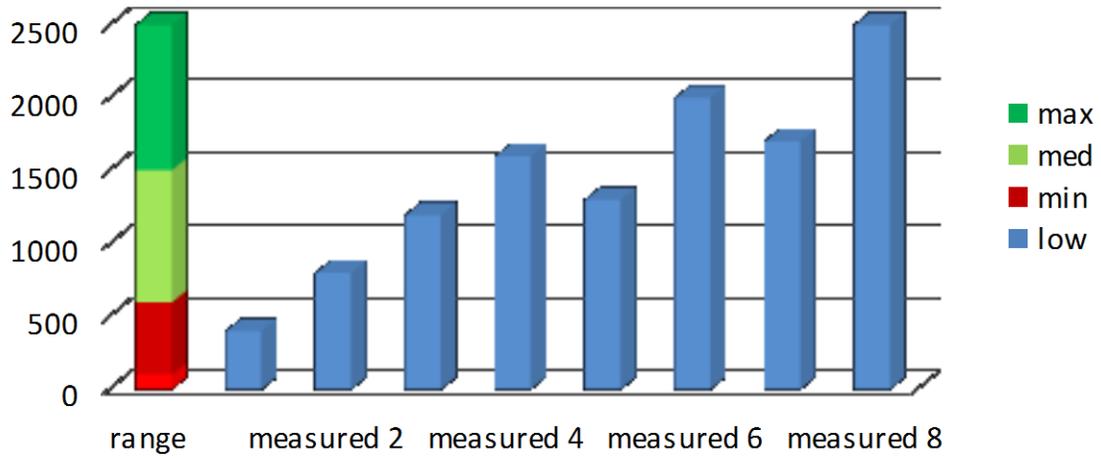
Measured Sympathetic/Parasympathetic Balance

Desired Sympathetic/Parasympathetic Balance

Legend:
- LF (blue)
- HF (red)
- HF (red)
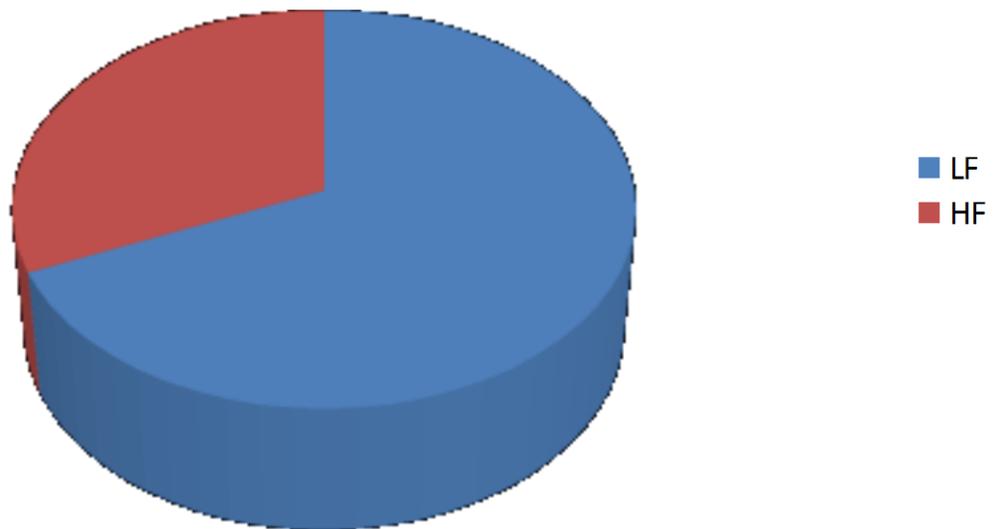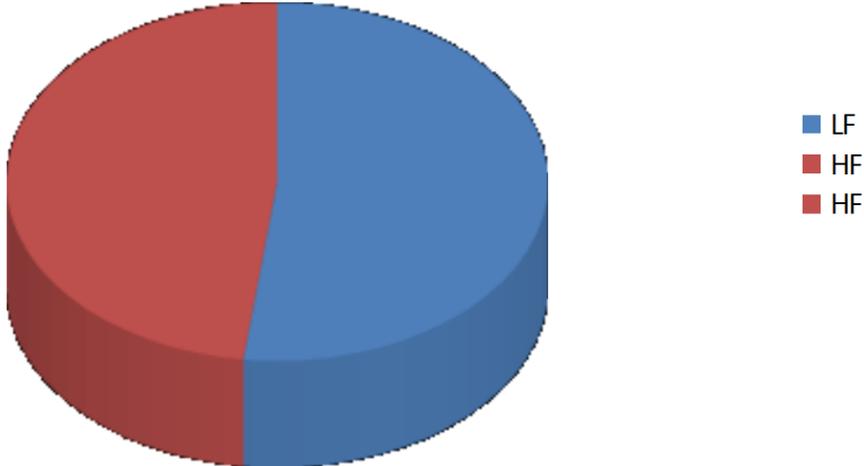
Source: SweetWater Health, LLC

References

[1] "The Analysis of Mental Stress Using Time-Frequency Distribution of Heart Rate Variability Signal," H.M. Seong; J.S. Lee; T.M. Shin; W.S. Kim; Y.R. Yoon; Y.R. Yoon; Proceedings of the 26th Annual International conference of the IEEE EMBS, September 2004.

[2] Kurono Y, Minagawa M, Ishigami T, Yamada A, Kakamu T, Hayano J. Auton Neurosci. Acupuncture to Danzhong but not to Zhongting increases the cardiac vagal component of heart rate variability. 2011 Apr 26;161(1-2):116-20. Epub 7 Jan. 2012.

[3] L. Eshkevari, R. Egan, D. Phillips, J. Tilan, E. Carney, N. Azzam, H. Amri, S. E. Mulroney. Acupuncture at ST36 prevents chronic stress-induced increases in neuropeptide Y in rat. Experimental Biology and Medicine, 2011; DOI: 10.1258/ebm.2011.011224

[4] Gao, Xin-Yan, Lu Wang, Ingrid Gaischek, Yvonne Michenthaler, Bing Zhu, and Gerhard Litscher. *PubMed Central*. Hindawi Publishing Corporation, 29 Aug. 2011. Web. 15 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3163402>.

[5] Wang, Lu, Jan Valentini, Kazuo Sugimoto, Weiping Cheng, Guangyu Cheng, Haoming Geng, Ingrid Gaischek, Haixue Kuang, and Gerhard Litscher. *PubMed Central*. Hindawi Publishing Corporation, 9 June 2011. Web. 17 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3132889/?tool=pubmed>.

[6] Matsubara, Takako, Young-Chang P. Arai, Yukiko Shiro, Kazuhiro Shimo, Makoto Nishihara, Jun Sato, and Takahiro Ushida. *Evid Based Complement Alternat Med. PubMed Central*. Hindawi Publishing Corporation, 2 Sept. 2010. Web. 15 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952311/?tool=pubmed>.

[7] Arai, Young-Chang P., Takahiro Ushida, Takako Matsubara, Kazuhiro Shimo, Hiroshi Ito, Yuko Sato, Yoshiko Wakao, and Toru Komatsu. *PubMed Central*. Hindawi Publishing Corporation, 17 Feb. 2011. Web. 16 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3135712/?tool=pubmed>.

[8] Dhond, Rupali, Calvin Yeh, Kyungmo Park, Norman Kettner, and Vitaly Napadow. PubMed Central. Hindawi Publishing Corporation, 11 Mar. 2008. Web. 16 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2440647/?tool=pubmed>.