Zeitschrift für Gefäßmedizin

Bildgebende Diagnostik • Gefäßbiologie • Gefäßchirurgie • Hämostaseologie • Konservative und endovaskuläre Therapie • Lymphologie • Neurologie • Phlebologie

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Oguy O, Bykov E, Litvichenko E

Zeitschrift für Gefäßmedizin 2022; 19 (1), 9-15

Krause & Pachernegg GmbH • Verlag für Medizin und Wirtschaft • A-3003 Gablitz

Vibroacoustic impact effect of singing bowls over the cardiovascular system work

V. O. Oguy, E. Bykov, E. Litvichenko

Abstract: The paper presents a two-stage study result of the author's method of vibroacoustic massage using singing bowls application. The assessment of a single effect on the psychological state was carried out using three WAM scales (well-being, activity, mood), the Zung test (screening for depression), and the Spielberg-Khanin anxiety scale.

At the first stage, the effect of vibroacoustic massage single application over psycho-emotional characteristics was studied. At the second stage, 62 volunteers were divided into two groups. The first group underwent a vibroacoustic massage session according to the patented author's method. The second group received only acoustic exposure using only singing bowls. The study of the psycho-emotional sphere showed that after the vibroacoustic massage procedure the indicators of "well-being" and "activity" of the WAM test significantly improved. Differences in the Kerdo index were revealed in the dynamics, and in the first group, the changes were less significant than in the second one.

It was concluded that the vibroacoustic massage using singing bowls improves the psycho-emotional state, reduces the level of depression and anxiety, and increases parasympathicus (autonomic nervous system) activity.

Key words: vibroacoustic massage, psycho-emotional state, hemodynamics, adaptation, singing bowls

Kurzfassung: Vibroakustischer Effekt von Klangschalen auf das kardiovaskuläre System. Die Arbeit stellt ein zweistufiges Studienergebnis der Methode des Autors der vibroakustischen Massage unter Anwendung von Klangschalen vor. Die Bewertung einer Einzelwirkung auf die psychische Befindlichkeit erfolgte mit drei WAM-Skalen (Wohlbefinden, Aktivität, Stimmung), dem Zung-Test (Screening auf Depression) und der Spielberg-Khanin-Angstskala.

In der ersten Phase wurde die Wirkung der einmaligen Anwendung einer vibroakustischen Massage auf psychoemotionale Eigenschaften untersucht. In der zweiten Phase wurden 62 Freiwillige in zwei Gruppen eingeteilt. Die erste Gruppe unterzog sich einer vibroakustischen Massagesitzung nach der patentierten Methode des Autors. Die zweite Gruppe erhielt nur eine akustische Exposition, wobei nur Klangschalen verwendet wurden. Die Untersuchung der psycho-emotionalen Sphäre zeigte, dass sich nach dem vibroakustischen Massageverfahren die Indikatoren „Wohlbefinden" und „Aktivität" des WAM-Tests signifikant verbesserten. Unterschiede im Kerdo-Index zeigten sich in der Dynamik, wobei in der ersten Gruppe die Veränderungen weniger signifikant waren als in der zweiten.

Es wurde der Schluss gezogen, dass die vibroakustische Massage mit Klangschalen den psychoemotionalen Zustand verbessert, das Ausmaß von Depressionen und Angstzuständen reduziert und die Aktivität des Parasympathikus (autonomes Nervensystem) erhöht. **Z Gefäßmed 2022; 19 (1): 9–15.**

Schlüsselwörter: vibroakustische Massage, psycho-emotionaler Zustand, Hämodynamik, Anpassung, Klangschalen.

Abbrevations:

BFEC: blood flow efficiency coefficient
DBP: diastolic blood pressure
ECG: electrocardiography
HF: high-frequency
HR: heart rate
HRV: heart rate variability
LF: low frequency
OMV: oxygen minute volume
RMSSD: root mean square of successive differences
SBP: systolic
SD: standard deviation
TINN: triangular interpolation of NN interval histogram
VIK: Kerdo vegetative Index
VLF: very low frequency
WAM: well-being, activity, mood

Introduction

The beneficial effect of sound has been used for a long time by mankind in practice. Music therapy can have a corrective effect on a number of pathological conditions, including mental disorders and pain syndrome [1–4]. Researchers also note the positive effect of meditative states on some physiological parameters and learning ability [5, 6]. The combination of meditation and sound exposure can provide additional synergistic effects. Singing bowls use can be such an integrative influence variant. Experimental meditation with singing bowls (n = 62) led to a decrease in tension, anger, fatigue, depression, and an increase in spiritual well-being feeling ($p < 0.001$). For participants who had not previously practiced these methods, the effect was even greater [7]. Similar data on singing bowls effects on distress, anxiety, depression, fatigue, stress were obtained in another study [4]. This work also indicated the ability of exposure to Tibetan bowls to normalize blood pressure, heart rate, oxygen saturation in peripheral capillaries, cutaneous conduction, and restore alpha rhythms in a brain anterior frontal region.

Another study evaluated singing bowls effect versus relaxation on the back. The heart rate variability (HRV) parameters were used as assessment criteria, including heart rate (HR) and standard deviation of the RR interval (RMSSD), which correlates with parasympathetic activity. The singing bowls use resulted in significant reductions in stress index, heart rate and an increase in RMSSD, indicating improved adaptation processes [8].

Singing bowls were first used in the 5th century BC in the fire cult in the Himalayas. Later they were used in meditation and

Received June 14, 2021; accepted August 18, 2021

From the Department of Sports Medicine and Physical Rehabilitation, Ural State University of Physical Culture
Chelyabinsk, Russian Federation
Correspondence to: Victor O. Oguy, Department of Sports Medicine and Physical Rehabilitation, Ural State University of Physical Culture 454091, 1 Ordzhonikidze Str., Chelyabinsk, Russian Federation; e-mail: doktornn@yandex.ru

religious rituals. The exact composition of the Tibetan bowls is not regulated. Usually their alloy consists of bronze with inclusions of silver, zinc, iron, gold and nickel [9]. The Tibetan bowl is a standing bell, when struck a complex composition sound is formed. When the bowl is filled with water, ripples and surface waves are formed on its surface upon impact. If the impact is very strong, then the breakage of the waves creates droplets rising into the air. The vibrations frequency generated by the bowl depends on the material it is made of, and the shape of the waves generated depends on the bowl geometry [9].

The ability of singing bowls to generate wave effects in liquid upon singing bowl contact with the body, most likely, can determine their biological effect on cells, containing 70–80% water. Each physical system has its own resonant frequency. Resonance is defined as a phenomenon in which an oscillating system can absorb energy from an external source with certain efficiency at only one specific frequency. Bio-resonance produced by sound works on two levels: mechanical-acoustic and electromagnetic. Cells can also produce their own sound vibrations, the characteristics of which may be the result of gene expression and associated metabolic processes. Specially selected vibrations of a specific frequency can modulate cellular activity [10]. One study attempted to use acoustic sonification using singing bowls to diagnose blood pressure [11].

One pilot study examined the effects of Tibetan singing bowls on 12 patients with metastatic cancer, both non-contact and body contact. The vibroacoustic effect was carried out during 6 sessions. At the end of the course of vibroacoustic massage according to the Bagno Armonico method, there was a decrease in the conduction level, an increase in heart rate variability, an increase in α-, β-, and inter-hemispheric coherence. Reductions in anxiety, agitation, involuntary mental alertness, and stress were noted [12].

Exposure to quartz singing bowls in patients (n = 54) with back pain had a nonspecific effect. Despite a significant reduction in pain intensity compared with the zero group, there were no significant differences compared with the placebo group. Thus, it was not possible to prove the analgesic effect of singing bowls [13]. A study of the combined effect of singing bowls and relaxation found significant reductions in blood pressure, heart rate and improvement in emotional state compared to relaxation [14].

The study hypothesis was that a single exposure to singing bowls according to the author‘s method (EA201900263A3, 2018: https://patents.google.com/patent/EA201900263A3/en?oq=EA201900263A3; WO2019240622A1, 2019: https://patentimages.storage.googleapis.com/f5/e7/5b/2035a5f57596d5/WO2019240622A1.pdf; RU2687006C1, 2020: https://patents.s3.yandex.net/RU2730940C1_20200826.pdf), combining minimal non-contact and main contact effect, on the cardiovascular and autonomic nervous systems work and psycho-emotional state is more effective than isolated acoustic exposure with singing bowls. A singing bowl made of bell bronze was used for the session. The dimensions of the bowl were as follows: diameter 25 cm; height 11 cm; bottom diameter 13 cm. The bowl was placed directly on the subject‘s body and, holding it with one hand, hit the bowl with a special stick with a wooden handle and a rubber tip. In each position, the bowl was struck 9 times with an interval of 1 second between strikes, then it was moved to the next position and the procedure was repeated. The session lasted for 50 minutes.

The aim of this work is to study the effect of a single exposure to singing bowls over the parameters of psycho-emotional well-being, the depression and anxiety levels, hemodynamic parameters, including the minute volume of oxygen, Kerdo index, WAM scale, and HRV characteristics.

Materials and Methods

The study of the physiological effects of the influence of the author‘s method of vibroacoustic massage by the method of "singing bowls" was carried out in two stages – on the basis of the Ural State University of Physical Culture (UralSUPC), Chelyabinsk, Russian Federation (the first stage), and Yoga Studio "Mint" ("Myata") in Dzerzhinsk, Nizhegorodskaya region, Russian Federation (Yoga-Studio "Mint") (second stage). The studies were carried out in accordance with the rules of the 1975 Declaration of Helsinki, revised in 2013. The study was approved by the ethics committee of Ural SUPC. All subjects signed informed consent for its conduct.

At the first stage, a group of 19 volunteers was randomly selected: 15 women and 4 men. The age range ranged from 19 to 58 years. The average age was 30.36 ± 13.94 years. At the second stage, the number of people in the group was 62: 43 men and 19 women. The experimental (first) group included 31 people; the control (second) group 31 people. In the experimental group, a session of vibroacoustic massage by singing bowls was performed, and in the control group an isolated acoustic effect by singing bowls was performed, in which the bowl was located within auditory accessibility, but at a distance of about two meters from the subject. The average age (± SD [Standard Deviation]) in the first group was 38.65 ± 9.28 years, in the second – 35.55 ± 4.75 ($p > 0.05$).

The assessment of a single effect on the psychological state was carried out using three WAM scales (well-being, activity, mood), the Zung test (screening for depression), and the Spielberg-Khanin anxiety scale. The WAM test contains 30 questions, which are divided into 3 clusters: health, activity, mood [15]. The answer to each question ranges from 1 to 7 points. The answers are summed up by clusters and divided by 10. The final result above 4 for each cluster indicates a favorable state of the subject. Zung‘s test consists of 20 questions, each of them is scored in a 1–4 point range [16]. The degree of depression was assessed as follows: 25–49: normal; 50–59: mild depression; 60–69: moderate depression; 70 and above: severe depression. The Spielberg-Khanin scale contains 40 questions, equally divided into 2 clusters: situational anxiety and personal anxiety [17]. The answer to each question is weighted on a 4-point scale. The anxiety level is determined by the sum of points: less than 30 points: low; 30–44: moderate; 45 or more: high anxiety.

At the second stage of the study, to assess the effect of vibroacoustic massage before and after the procedure, each subject was taken an ECG for 10 minutes in the supine position, and measured blood pressure and heart rate. Also, before and after the procedure, an orthostatic test was performed: a subject rose from a lying position to a vertical one. During the orthostatic test before and after the procedure the ECG (Electrocardiography) was recorded for 10 minutes. Each subject was measured heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP). To clarify the nature of the autonomic nervous system functioning and the blood circulation regulation, the following indicators were calculated: Kerdo's vegetative index (conventional units), minute blood volume (ml/min) and the coefficient of blood circulation efficiency (conventional units). The Kerdo vegetative Index (VIK) was calculated using the formula:

$VIK = 100 + (1-\frac{DBP}{HR})$

(DBP: diastolic blood pressure, HR: heart rate)

The oxygen minute volume (OMV) was calculated using the formula:

$OMV = SV \times HR$

(SV = systolic volume)

Determined by the formula:

$SV = 90.97 + 0.54 \times PP - 0.57 \times DBP - 0.61 \times Age$

(PP = pulse pressure)

The blood flow efficiency coefficient (BFEC) was calculated using the formula:

$BFEC = (SBP–DBP) \times HR$

VIK reflects the balance of the sympathetic and parasympathetic divisions of the autonomic nervous system. The OMV indicates the volume of blood passing through the heart in 1 minute. BFEC is indicative of the heart load degree. The electrocardiography (ECG) results were also used to assess heart rate variability (HRV), which was carried out using a USB attachment to a PC "ECG Lite" (version "AIT Cardio", Russia) and analyzed using the Kubios HRV software (on a PC with Windows), on which the artifacts were corrected in manual mode and a five-minute interval was selected for further analysis. As a result, a report was generated for these five-minute intervals, the results of which were loaded for calculations, processing and further statistical analysis.

When assessing HRV indicators, the following indicators were studied:

- Mean RR (ms): the RR-interval average value in milliseconds;
- STD (standard deviation) RR (ms): standard deviation of all RR-intervals;
- Mean HR (1/min): average heart rate per minute;
- STD HR (standard deviation heart rate) (1/min): standard deviation of instantaneous heart rate values;
- RMSSD (ms): square root of the average sum of squares of the differences between adjacent RR-intervals;
- (count): the number of neighboring RR-intervals pairs differing by more than 50 ms during the entire recording;
- pNN50 (%): NN50 value divided by the total number of RR-intervals;
- RR triangular index: the total number of RR intervals divided by the height of all RR intervals histogram with a step of 7.8125 ms (1/128 ms);
- TINN (triangular interpolation of NN interval histogram) (ms): width of the root-mean-square triangular Interpolation base of the highest peak of the histogram built over all RR-intervals;
- VLF (Very low frequency) (ms^2): power of the very low frequency range in milliseconds squared;
- LF (Low Frequency) (ms^2): power of the low frequency range in milliseconds squared;
- HF (High-Frequency) (ms^2): power of the high-frequency range in milliseconds squared;
- VLF (very low frequency) (%): power of the very low frequency range in percent;
- LF (%): power of the low-frequency range in percent;
- HF (%): power of the high-frequency range in percent;
- Total power (ms^2): total power of spectral components in milliseconds squared;
- LF/HF ratio vegetative balance: LF/HF power ratio.

Statistical processing of the results was carried out using the Statistica 10.0 software. The significance of differences for psychological tests was assessed using the paired Wilcoxon test for related samples. The results of calculating VIK, OMV, and BFEC were compared across groups using paired t-test (before and after the procedure) and Student's independent t-test (comparison between groups). The main method for assessing HRV results was calculations using the Mann-Whitney U-test (comparison between groups) and the Wilcoxon test (dynamics within groups for dependent variables) for non-parametric data. The significance level p = 0.05 was taken as a threshold.

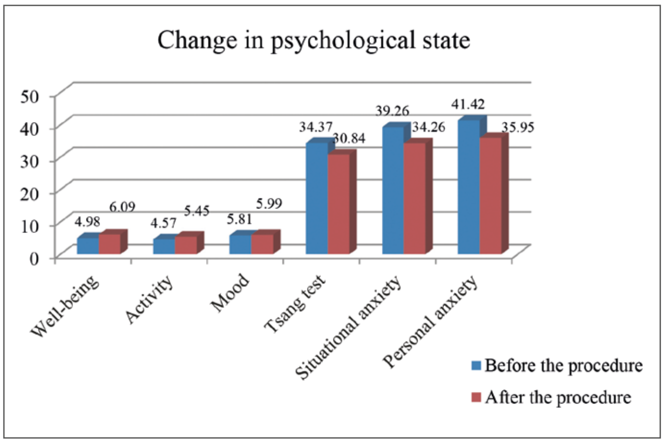

Figure 1. Change in psychological state after vibroacoustic massage

Table 1. The results of the questionnaire survey on the scales of psycho-emotional well-being.

Questionnaire cluster	n	Before the procedure (M±SD)	After the procedure (M±SD)	p-value
Scale WAM				
Well-being	17	4.98 ± 1.16	6.09 ± 0.68	0.002
Activity	17	4.57 ± 1.01	5.45 ± 0.73	0.002
Mood	17	5.81 ± 0.73	5.99 ± 0.98	0.244
Zung Test				
–	19	34.37 ± 7	30.84 ± 8.30	0.006
Spielberg-Khanin-Scale				
Situational anxiety	19	39.26 ± 9.12	34.26 ± 6.79	0.028
Personal anxiety	19	41.42 ± 7.52	35.95 ± 8.82	0.004

Table 2. Assessment of indicators in the first and in the second group.

Indicators	Before the procedure Average Value	Median	SD	After the procedure Average Value	Median	SD	T	p-value
First group								
HR	66.37	65.40	8.85	59.99	58.60	6.57	30	0.001
VIK	–5.68	–5.46	16.30	–17.81	–17.40	14.57	36	0.001
OMV	3390.35	3444.34	878.17	2961.49	2959.35	622.56	74	0.001
BFEC	2853.53	2778.16	560.47	2501.25	2469.09	468.48	106	0.005
Second group								
HR	66.77	66.57	10.12	61.78	61.31	8.07	13	0.001
VIK	–5.32	–3.89	18.64	–13.92	–10.10	18.22	51	0.001
OMV	3442.62	3429.44	666.92	3122.27	3195.56	571.95	50	0.001
BFEC	2641.36	2678.61	503.38	2357.70	2396.55	415.10	81	0.001

Table 3. Assessment of the difference in indicators (Δ) in both groups.

Indicators	Group 1 Average Value	Median	SD	Group 2 Average Value	Median	SD	T	p-value
ΔHR	–6.39	–6	6.93	–5	–3	5.17	–0.89	0.375
ΔVIK	1.58	2	0.50	3.06	3	0.57	–10.84	0.001
ΔMBF	–428.87	–385	613.75	–320.34	–241	357.76	–0.85	0.398
ΔCER	–352.28	–485	684.46	–283.66	–207	395.18	–0.48	0.631

Note: ΔHR, ΔVIK, ΔOMV, ΔBFEC: difference between mean values before and after the procedure.

Results

The study of the psychoemotional state using the WAM test showed that the vibroacoustic massage use causes a significant improvement in the "well-being" and "activity" indicators, but in comparison with the subjects' state before the procedure, there were no changes in the "mood" scale (Tab. 1, Fig. 1).

Zung test scores indicated a significant decrease in the level of depression in the group from 30.84 ± 8.30 points to 34.37 ± 7.54 points ($p = 0.006$). The beneficial effect of vibroacoustic massage was also manifested in a decrease in situational ($p = 0.028$) and personal anxiety ($p = 0.004$).

Cardiovascular system and HRV indicators analysis reflected a number of changes occurring after the procedure, as well as when comparing changes in the first and second groups (Tab. 2).

Thus, in both groups, significant changes in HR, VIK, OMV and BFEC were noted when comparing the values after the vibroacoustic massage session with the values before the procedure ($p > 0.05$). To assess the reliability of changes between the experimental and control groups, we generated new data series, which represented the difference (Δ) of the parameters of the same name after the procedure and before the procedure and compared by groups (Tab. 3).

For the values of ΔHR, ΔOMV and ΔBFEC, the greatest amplitude of changes was observed in the experimental group, however, the differences between the groups were not significant ($p > 0.05$). The difference in the Kerdo vegetative index (ΔVIK) in the experimental group was lower than in the control group (1.58 mmHg*min vs. 3.06 mmHg*min; $p = 0.001$), which is possibly associated with the subjects' emotional tension under the unusual procedure. This assumption is consistent with work in which it was noted that the singing bowls effect was stronger if the person was already familiar with the procedure [7].

A separate analysis for women and men showed that men experienced more significant changes in all indicators after the procedure compared to the values before it. So the parameters in men after the procedure and before it significantly differed for HR indicators 57.99 ± 5.27 beats/min vs. 63.86 ± 6.08 beats/min ($p = 0.001$); VIK –23.25 ± 14.94 conventional units vs. –10.94 ± 14.25 conventional units ($p = 0.001$); OMV 2829.88 ± 656.29 ml/min vs. 3223.66 ± 821.17 ml/min ($p = 0.001$); BFEC 2562.58 ± 476.92 conventional units vs. –2926.31 ± 529.96 conventional units ($p = 0.018$).

For women, similar parameters were as follows: HR 62.75 ± 7.38 beats/min vs. 69.85 ± 11.00 beats/min, ($p = 0.013$); VIK –10.30 ± 10.42 conventional units vs. 1.61 ± 16.65 conventional units, ($p = 0.013$); OMV 3143.70 ± 544.80 ml/min vs. 3621.15 ± 934.50 ml/min ($p = 0.046$); BFEC 2416.34 ± 461.53 conventional units vs. 2752.76 ± 607.05 conventional units ($p = 0.087$).

However, changes amplitude comparison in men and women did not reveal any differences. The values of these changes in men and women, respectively, were equal for the parameters: ΔHR –5.89 ± 4.16 beats/min vs. –7.08 ± 9.73 beats/min, ($p = 0.645$); ΔVIK 1.61 ± 0.50 mmHg*min vs. 1.54 ± 0.52 mmHg* min, ($p = 0.698$); ΔOMV –393.78 ± 501.20 ml/min vs. –477.45 ± 762.52 ml/min ($p = 0.715$); ΔBFEC –363.74 ± 653 conventional units vs. –336.42 ± 751.96 conventional units ($p = 0.915$).

Table 4. Sample results for both groups before and after the procedure.

	Background sample					Orthostatic test				
	Before the procedure		After the procedure			Before the procedure		After the procedure		
Options	Mean	SD	Mean	SD	p	Mean	SD	Mean	SD	p
					First group					
Mean RR (ms)	915.27	132.94	993.94	168.01	0.001*	781.75	100.82	796.64	85.74	0.070
STD RR (ms)	51.47	22.31	57.36	25.14	0.096	49.43	38.69	50.69	23.62	0.001*
Mean HR (1/min)	67.32	11.35	59.80	5.70	0.001*	78.06	8.65	76.46	7.73	0.052
STD HR (1/min)	3.79	1.56	3.52	1.16	0.299	4.17	1.39	4.80	1.83	0.007*
RMSSD (ms)	36.02	19.15	47.51	27.21	0.006*	23.99	16.40	25.06	15.26	0.085
NN50 (count)	51.16	48.15	73.23	61.16	0.059	20.52	31.43	20.97	33.02	0.216
pNN50 (%)	16.63	16.97	25.48	21.42	0.003*	6.03	10.90	5.98	10.53	0.494
RR triangular index	12.23	4.07	13.29	4.72	0.468	10.15	3.77	11.97	4.12	0.001*
TINN (ms)	164.68	69.68	129.68	63.59	0.002*	188.39	62.50	221.94	66.97	0.001*
VLF Power (ms^2)	982.94	1305.33	1736.13	2479.91	0.022*	725.36	642.80	1576.32	2160.91	0.001*
LF Power (ms^2)	862.26	691.81	921.07	814.37	0.281	1065.19	1429.52	1369.13	1610.28	0.025*
HF Power (ms^2)	747.74	1314.21	1209.16	1638.06	0.030*	277.87	356.86	274.58	360.93	0.537
Total (ms^2)	2593.32	2341.02	3808.77	3754.81	0.052	2068.48	2064.43	3026.68	3461.15	0.003*
LF/HF Power (ms^2)	3.29	4.75	1.86	3.87	0.445	6.03	7.15	6.56	6.29	0.248
VLF Power (%)	36.42	23.73	43.69	21.12	0.158	39.77	22.57	48.15	18.91	0.013*
LF Power (%)	38.16	20.97	26.59	11.40	0.088	44.58	21.34	41.61	18.65	0.092
HF Power (%)	25.42	18.63	29.69	17.93	0.814	15.63	12.34	10.23	7.02	0.005*
					Second group					
Mean RR (ms)	921.93	146.71	982.44	157.60	0.001*	707.30	140.25	735.46	137.43	0.001*
STD RR (ms)	46.76	22.18	54.35	24.69	0.001*	38.74	21.40	47.28	24.30	0.001*
Mean HR (1/min)	66.78	10.12	63.04	11.98	0.001*	87.11	17.10	84.44	14.34	0.001*
STD HR (1/min)	3.30	1.21	3.55	1.67	0.067	4.55	1.99	5.13	2.07	0.002*
RMSSD (ms)	40.86	27.09	46.55	26.13	0.002*	21.20	17.66	24.87	19.26	0.004*
NN50 (count)	57.26	56.41	78.84	89.55	0.008*	20.00	37.08	26.71	40.36	0.023*
P NN50 (%)	19.04	19.63	24.43	21.84	0.003*	6.04	13.33	7.88	13.58	0.020*
RR triangular index	12.89	13.45	12.55	4.88	0.001*	9.78	4.62	10.92	4.48	0.025*
TINN (ms)	146.13	73.02	129.36	75.00	0.891	163.23	84.07	202.10	83.37	0.001*
VLF Power (ms^2)	903.68	935.39	1251.52	1665.28	0.055	632.13	859.69	892.97	962.45	0.004*
LF Power (ms^2)	728.71	963.62	807.90	754.34	0.362	764.74	891.44	1319.52	1250.18	0.001*
HF Power (ms^2)	1016.81	1765.63	969.61	1259.54	0.037*	396.58	853.33	429.68	775.52	0.399
Total (ms^2)	2649.84	2973.55	3030.13	3161.81	0.075	1793.61	2126.83	2642.55	2641.73	0.001*
LF/HF Power (ms^2)	1.13	0.89	1.59	2.07	0.695	5.75	5.65	8.57	8.08	0.006*
VLF Power (%)	39.15	19.13	38.18	17.94	0.829	38.65	14.46	35.40	13.11	0.203
LF Power (%)	27.59	14.93	29.54	17.43	0.695	44.20	18.72	49.51	14.52	0.063
HF Power (%)	33.22	16.39	32.25	17.93	0.984	17.15	14.44	14.11	13.97	0.019*

*limited number of significant differences

HRV results for both groups reflect a number of significant differences for a large number of parameters before and after the procedure (Tab. 4).

Both in the second and in the first group, similar changes were noted, reflecting an increase in parasympathetic influences and a decrease in the influence of the autonomic nervous system

Table 5. Values before and after the procedure.

	Before the procedure						After the procedure					
	Group 1		Group 2				Group 1		Group 2			
Options	Mean	SD	Mean	SD	U	p	Mean	SD	Mean	SD	U	p
Resting state (horizontal position)												
Mean RR (ms)	915.27	132.94	921.93	146.71	461	0.789	993.94	168.01	982.44	157.60	419	0.387
Mean HR (1/min)	67.32	11.35	66.78	10.12	462	0.800	59.80	5.70	63.04	11.98	407	0.304
VLF Power (ms²)	982.94	1305.33	903.68	935.39	451	0.683	1736.13	2479.91	1251.52	1665.28	354	0.076
LF/HF Power (ms²)	3.29	4.75	1.13	0.89	321	0.025*	1.86	3.87	1.59	2.07	437	0.545
VLF Power (%)	36.42	23,73	39,15	19,13	413	0.342	43,69	21,12	38,18	17,94	416	0,368
HF Power (%)	25.42	18.63	33.22	16.39	337	0.044*	29.69	17.93	32.25	17.93	446	0.627
Orthostatic test												
Mean RR (ms)	781.75	100.82	707.30	140.25	273	0.004*	796.64	85.74	735.46	137.43	293	0.01*
Mean HR (1/min)	78.06	8.65	87.11	17.10	278	0.004*	76.46	7.73	84.44	14.34	293	0.01*
VLF Power (ms²)	725.36	642.80	632.13	859.69	403	0.275	1576.32	2160,91	892.97	962.45	335	0.04*
LF/HF Power (ms²)	6.03	7.15	5.75	5.65	471	0.894	6.56	6.29	8.57	8.08	430	0.48
VLF Power (%)	39.77	22.57	38.65	14.46	450	0.673	48.15	18.91	35.40	13.11	284	0.01*
HF Power (%)	15.63	12.34	17.15	14.44	463	0.805	10.23	7.02	14.11	13.97	443	0.60

*limited number of significant differences

sympathetic division after the vibroacoustic massage procedure. In particular, in both groups there was an increase in RMSDD, NN50 and pNN50 values, which indicate parasympathetic activation after the procedure. However, comparison between groups before and after the procedure showed a limited number of significant differences (Tab. 5).

The comparison between groups reflects differences in the high frequency HF waves power ($p = 0.044$) and the LF/HF ratio ($p = 0.025$) before the procedure, which indicates a stronger activation of the sympathetic nervous system in the first group before the procedure. However, after the procedure, these differences were almost smoothed out, and the range of changes was much larger in the first group than in the second.

Differences in the values of mean RR and mean HR were noted both before and after the procedure, and, probably, this is not related to the procedure itself, but only to group characteristics. When performing orthostatic loading, the differences between groups in the power of very low frequency waves ($p = 0.04$ and $p = 0.01$) significantly increased, which increased much more in the first group than in the second one.

Discussion

Conducting a single vibroacoustic massage session led to a significant improvement in many physical and psychological well-being parameters. Significant favorable changes in the psycho-emotional background state were noted. This was manifested in an improvement in well-being, activity and mood according to the WAM test. However, in the «mood» cluster, the changes were unreliable. Screening in the Zung test showed a significant decrease in the depression level, and the results of assessing the anxiety state on the Spielberg-Khanin scale indicate a decrease in both personal and situational anxiety. Thus, the mental sphere state after a single session of massage by singing bowls has improved significantly as a whole. Hemodynamic parameters (HR, OMV and BFEC) and VIK after the procedure changed markedly in both groups ($p < 0.05$ for all parameters). To determine the severity of differences in the indicators dynamics between groups, we compared the amplitudes of changes in parameters between groups (Δ). Despite the fact that most indicators had large amplitude of changes for the first group, for the ΔVIK parameter in the first group, the changes were less than in group 2.

Thus, in the first group, a lesser increase in the parasympathetic nervous system influence was determined in comparison with the group 2. The reason for this may be that the subjects first encountered an unusual procedure for vibroacoustic exposure to singing bowls, and it did not allow them to achieve the necessary relaxation. The minute volume of blood flow and HR in the first group decreased more, and it leads to a decrease in the load on the heart. A decrease in BFEC in both groups (but more in the first) indicates a decrease in the difference between systolic and diastolic blood pressure and a decrease in sympathetic influences in the autonomic nervous system. The severity of these changes for men turned out to be much stronger than for women, which is probably due to the greater nervous system lability in women, who reacted less calmly to the new procedure for them. However, comparison of these changes amplitude did not reveal significant differences between men and women.

Changes in the heart rate variability parameters between the groups turned out to be similar in direction. In particular, there was a decrease in the TINN value in the horizontal position and its increase under orthostatic loading after the procedure.

Triangular index RR, correlated with sympathetic effects, changed in a similar way. Such dynamics, most likely, is evidenced by adaptation to environmental conditions, reflecting a decrease in sympathetic regulation at rest, and its enhancement during orthostatic load. At the same time, there is an increase in parasympathetic markers RMSSD, NN50 pNN50, mainly in the horizontal position, and the amplitude of these changes is greater for the first group (Tab. 4).

Thus, the adaptive processes improve in both groups, but they are more pronounced in the first group. An additional confirmation of the revealed tendency is the increase in the power of HF waves after the procedure of vibroacoustic massage in the first group, reflecting mainly parasympathetic influences. Intergroup comparisons of HRV parameters before and after the procedure showed that even before the procedure, there were differences between the groups in the parameters LF/HF, HF, Mean RR and Mean HR (Tab. 5). However, the differences in Mean RR and Mean HR levels are apparently not related to the protocol of the procedure, since the values changed unidirectionally and the differences persisted after the procedure. Higher LF/HF levels and lower HF values in the supine position in the first group compared to the second one before the procedure indicate higher background sympathetic influences in the first group. However, after the procedure, these differences were smoothed out mainly due to changes in the first group, which reflects an increase in the contribution of parasympathetic influences at rest and normalization of the sympathetic-vagal balance. At the same time, during the orthostatic test, a tendency towards a decrease in HF power was observed, which was more pronounced in the first group.

We consider a significant increase in the power of VLF waves in the first group compared to the second one during the orthostatic loading performance as the main change associated with the procedures. The power of VLF oscillations is associated with the influence of neuro-humoral regulation mechanisms and the rennin-angiotensin-aldosterone system, which form circadian rhythms and cortisol release peaks [18–20]. Apparently, vibroacoustic massage can increase the activity of the body's adaptive response to stress.

Conclusions

The study of the vibroacoustic massage using singing bowls effects demonstrated that this technique is capable of exerting a variety of effects on a person's psychological characteristics and physiological parameters. We have reliably established that with a single exposure by bowls, such indicators as the state of health, activity and an increase in the level of personal and situational anxiety improve, which indicates a decrease in neurotization degree. Analysis of hemodynamic changes showed that additional effects are associated with a decrease in the load on the heart and an increase in parasympathetic influences. Nevertheless, the amplitude of these changes for ΔVIK was less in the first group, and this may be due to the lack of experience with vibroacoustic massage in the past in these subjects. Changes in hemodynamic indicators in women were lower than in men, but no significant differences in the amplitude of changes were found. The main difference between the groups, due to the procedural protocol when measured under orthostatic loading, is a significant increase in the power of very low frequencies associated with the operation of adaptive mechanisms. Thus, we can conclude that the author's method of vibroacoustic massage using singing bowls is a promising wellness procedure, although its effects need to be tested on a wider population.

Acknowledgments

The authors are grateful for the technical support of the management of Ural State University of Physical Culture and Yoga Studio "Mint" ("Myata").

Conflict of interest

The authors declare no conflict of interest.

Financing

The study was performed without external funding.

References:

1. Porter S, Mcconnell T, Mclaughlin K, Lynn F, Cardwell C, et al. Music therapy for children and adolescents with behavioural and emotional problems: A randomised controlled trial. J Child Psychol Psychiatry 2017; 58: 586–94.

2. Landis-Shack N, Heinz AJ, Bonn-Miller M.O. Music therapy for posttraumatic stress in adults: A theoretical review. Psychomusicology 2017; 27: 334–42.

3. Stegemann T, Geretsegger M, Phan Quoc E, Riedl H, Smetana M. Music therapy and other music-based interventions in pediatric health care: an overview. Medicines 2019; 6: 1–12.

4. Stanhope J, Weinstein P. The human health effects of singing bowls: A systematic review. Complement Ther Med 2020; 51: 1–7.

5. Routhier-Martin K, Roberts SK, Blanch N. Exploring mindfulness and meditation for the elementary classroom: intersections across current multidisciplinary research. Childhood Education 2017; 93: 168–75.

6. Ponte Márquez PH, Feliu-Soler A, Solé-Villa MJ, Matas-Pericas L, Filella-Agullo D, et al. Benefits of mindfulness meditation in reducing blood pressure and stress in patients with arterial hypertension. J Hum Hypertens 2019; 33: 237–47.

7. Goldsby TL, Goldsby ME, Mcwalters M, Mills PG. Effects of singing bowl sound meditation on mood, tension, and well-being: An observational study J Evid Based J 2017; 22: 401–6.

8. Trivedi GY, Saboo BA. Comparative study of the impact of himalayan singing bowls and supine silence on stress index and heart rate variability. J Behav Ther Ment Health 2019; 2: 40–50.

9. Terwagne D, Bush JWM. Tibetan singing bowls. Nonlinearity 2011; 24: 51–66.

10. Muehsam D, Ventura C. Life rhythm as a symphony of oscillatory patterns: electromagnetic energy and sound vibration modulates gene expression for biological signaling and healing. Glob Adv Health Med 2014; 3: 40–55.

11. Barrass S. Diagnosing blood pressure with acoustic sonification singing bowls. Intern J Human-Computer Studies 2016; 85: 68–71.

12. Bidin L, Pigaiani L, Casini M, Seghini P, Cavanna L. Feasibility of a trial with Tibetan Singing Bowls and suggested benefits in metastatic cancer patients: A pilot study in an italian oncology. Eur J Integr Med 2016; 8: 747–55.

13. Wepner F, Hahne J, Teichmann A, Berka-Schmid G, Hördinger A, Friedrich M. Treatment with crystal singing bowls for chronic spinal pain and chronobiologic activities – a randomized controlled trial. Forsch Komplementmed 2008; 15: 130–7.

14. Landry JM. Physiological and psychological effects of a Himalayan singing bowl in meditation practice: A quantitative analysis. Am J Health Prom 2014; 28: 306–9.

15. Doskin VA, Lavrentyeva NA, Miroshnikov MP, Sharay VB. Differentiated self-assessment test of the functional state. Psychology Issues 1973; 6: 141–5.

16. Zung WWK. A self-rating depression scale. Arch Gen Psychiatry 1965; 12: 63–70.

17. Khanin YL. A brief guide to the use of the scale of reactive and personal anxiety. Ch.D. Spielberger, Leningrad, 1976.

18. Huikuri HV, Niemelä MJ, Ojala S, Rantal A, Ikäheimo MJ, Airaksinen KE. Circadian rhythms of frequency domain measures of heart rate variability in healthy subjects and patients with coronary artery disease. Circulation 1994; 90: 121–6.

19. Kleiger RE, Stein PK, Bigger JTJr. Heart rate variability measurement and clinical utility. Ann Noninvasive Electrocardiol 2005; 10: 88–101.

20. Akselrod S, Gordon D, Ubel F, Shannon D, Berger A, Cohen R. Power spectrum analysis of heart rate fluctuation: a quantitative probe of beat-to-beat cardiovascular control. Science 1981; 213: 220–2.

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