

Yoga Techniques and Thermal Activity of Head, Neck and Chest

Branko Ilić*

University of Technical Engineering, Belgrade, Serbia

Abstract: *The main subject of this work are changes in heat emission of practitioner's certain body regions before and after performing yoga pranayama techniques, with focus on changes in head, neck and chest. Participants have been tracked individually and effects were recorded upon each practice, after which the results were statistically processed and analyzed. Yoga pranayama techniques are important means for achieving the higher states of consciousness, clearing the energy channels inside the body, strengthening the energy layers. Practice of yoga pranayama techniques leads to achievement of physical, emotional and spiritual benefits.*

Key words: *yoga, pranayama, kapalbhathi, bhastrika, jalandhara bandha, thermal activity*

Introduction

Yoga breathing, usually practiced during yoga exercising and meditation, is a subject of many scientific studies. In literature, pranayama is defined as a willful energy management using breathing techniques which refers to inhalation, retention of breath and exhalation, rotating in faster or slower rhythm. Regarding that, yoga breathing is considered to be a "transition" between prana (energy) and its effect on body functions that release the energy. Cell metabolism (production of energy on the cellular level) directly depends on the amount of oxygen provided by breathing. There is a clear evidence that yoga breathing techniques can affect the oxygen consumption and metabolism.

The goal of yoga breathing, as highlighted by scientific research, is to move the autonomous nervous system (ANS) away from domination of the sympathetic nervous system (SNS). Yoga breathing positively affects the immune system, hypertension, asthma, ANS disorders, psychological problems and stress related problems. Authors consider that researches related to stress and psychological benefits support the evidence that pranayama changes the way of information processing in the brain, leading to improvement of psychological profile of an individual (Bhavanani, 2010; Janjušević, 2010). It is stressed that yoga breathing (*pranayama*) increases the consciousness and understanding of relations between cognitive states, physical functioning and ways of breathing.

Yoga breathing slows down heart rate and blood pressure (Bhole, 2010; Gramann, 2011). Calming of mental functions and concentration to a breathing process lead to a clear perception of one's own possibilities and focus on goals. The practitioner achieves calmness of mind, becomes aware of own creative abilities, connects with the inner being and opens up the possibility to express the creativity. Creativity naturally increases in states

* Coresponding author: branko.ilic.ks@gmail.com

of peace and presence, when artist gets the possibility of clear insights. Yoga breathing is an efficient way to memory and concentration improvement. Proper breathing rhythm leads to a state of deep peace and revitalization, and constant influx of oxygen revives brain activity. The information acceptance flows faster and easier. Relieving of mental tension opens up a possibility of better memorizing and sorting out information, and directing of mind processes helps mind to focus and to connect knowledge from previous experiences much faster.

Numerous medical research studies have proven that different yoga breathing techniques contribute strengthening of vital functions of organism, general health and functioning of all body organs. Vital functions of organism, such as the breathing rhythm and a heart rate, are getting balanced, the practitioner achieves harmonization of the metabolic process, effectiveness of digestive system, improvement of different organs and glands functions (kidneys, pancreas, bowel, lungs, heart, diaphragm etc.), efficient excretion of body toxins, strengthening of the immune system, regulation of states of depression, anger, anxiety, improved blood circulation, nervous system relaxation (Novaković, 2011; Veerabhadrapa, 2014).

All this points to the multiple benefits that yoga breathing can produce codes of practice, which is to preserve health, but also to improve the overall psychological and physical condition of the individual. All of this shows multiple benefits that yoga breathing brings to individuals who practice it for health preservation and more, for improvement of general psychophysical state.

This is a pilot research study of the effects of practicing pranayama and bhandas on thermal activity of chest, neck and head regions. The chosen yoga breathing techniques are kapalbhathi and bhastrika and also, jalandhara bandha.

Subject, object and methods of research

The goal of this research is to determine a connection between pranayama techniques - kapalbhathi, bhastrika and jalandhara bandha, and temperature changes of certain body regions, presumed to be under the influence of these techniques.

Term *kapalbhathi* is made up of two words – *kapal*, which means skull, and *bhati*, meaning shining, illuminating, and therefore is translated as the *skull shining breath*. It is a rapid breathing, consisted of active exhalation with the use of abdominal muscles, and passive inhalation after relaxation. Experiments have shown that kapalbhathi technique stimulates biochemical processes in organism. It has a positive effect on cognitive function and central nervous system (CNS). This breathing technique massages and strengthens lungs, diaphragm, heart, brain and abdominal muscles, improves digestion and bowel movement, has a therapeutic effect on cold, sinusitis and asthma, mitigates depression and migraine (Novaković, 2011; Veerabhadrapa, 2014). Also, it rejuvenates the nervous system, prepares mind for meditation, improves concentration and increases the activity of SNS, while decreasing the influence of the vagus nerve (Sharma, 2014).

Term *bhastrika* origins from word *bhast*, meaning bellows, which is why it is known as the *bellow's breath*. This technique massages and strengthens organs of respiratory and digestive systems. It improves anaerobic abilities and increases vital lung capacity. It positively affects heart rate, decreasing the number of heart beats per minute. It has a clear effect on concentration and prepares mind for meditation. Combined with some other breathing techniques, it mitigates anxiety, depression, everyday stress, posttraumatic stress and stress related to medical diseases.

Term *Jalandhara bhanda* origins from words *jalan* – net, and *dhara* – stream, flowing fluid. This practice locks the flow of prana, diverting it between energetic centers where prana is directed to sushumna nadi. It also slows down a heart rate and massages the thyroid gland. Contraction of the throat prevents the fall of divine nectar (*amrit*) into stomach (digestive region).

Based on results of previous researches, there are following hypothesis:

1. There is a significant difference in thermal activity (heat emission) of chest, neck and head regions, before and after practice of kapalbhati yoga breathing.
2. There is a significant difference in thermal activity (heat emission) of chest and neck regions, before and after jalandhara bandha technique practice.
3. There is a significant difference in thermal acitivity (heat emission) of chest region, after bhastrika technique practice, comparing to thermal acitivity before practicing kapalbhati yoga breathing.

The pilot study included 6 participants, healthy yoga instructors (4 male and 2 female, median age $40,57 \pm 21$ years). Each candidate has practiced pranayama techniques in this way: 3 cycles of 12 kapalbhati movements, then 3 cycles of 12 bhastrika movements and, at the end, 3 cycles of jalandhara bandha. The temperature of all regions was measured before the beginning of practice, and after each technique.

Temperature of head, neck and chest regions was measured with thermovision camera *FLIR SC620*, during which bodies of examinees were naked from waist to head. After that, the results were gathered and processed with the *t-test* statistical method for dependent samples in statistical package *IBM SPSS Statistics 20.0*.

Results and Discussion

Table 1 shows average temperature of certain body parts of all participants before and after practice, while standard deviation points to credibility of this measure of average. Regarding that values of standard deviation are approximate, the arithmetic mean can be used as a measure of average, and regarding the approximate values of standard errors we can consider data to be reliable for forming of the conclusion.

Table 1. Descriptive statistics

		Arithmetic mean (°C)	Standard deviation	Standard error
Kapalbhati				
Head	Before max.	34.97	.415	.156
	After max.	35.17	.368	.139
	Before min.	26.82	2.060	.778
	After min.	25.57	1.316	.497
	Before mean	32.44	.528	.199
	After mean	32.31	.433	.163
Neck	Before max.	34.82	.502	.189
	After max.	35.10	.294	.111
	Before min.	32.48	.463	.175
	After min.	32.38	.487	.184
	Before mean	33.62	.505	.191
	After mean	33.70	.472	.178
	Before max.	35.10	.588	.222
	After max.	34.80	.516	.195

Chest	Before min.	30.87	1.509	.570
	After min.	30.48	1.290	.487
	Before mean	33.27	.819	.309
	After mean	32.94	.711	.268
Jalandhara bandha				
Neck	Before max.	34.82	.502	.189
	After max.	35.14	.293	.110
	Before min.	32.48	.463	.175
	After min.	33.24	.287	.108
	Before mean	33.62	.505	.191
	After mean	34.11	.437	.165
Chest	Before max.	35.10	.588	.222
	After max.	34.52	.521	.197
	Before min.	30.87	1.509	.570
	After min.	29.84	1.487	.562
	Before mean	33.27	.819	.309
	After mean	32.61	.705	.266
Bhastrika				
Chest	Before max.	35.10	.588	.222
	After max.	34.57	.488	.184
	Before min.	30.87	1.509	.570
	After min.	30.17	1.348	.509
	Before mean	33.27	.819	.309
	After mean	32.71	.784	.296

* No. of examinees =7

Table 2 shows parameters of *t-test* for dependent samples. *T-test* is used because temperature values of the same participants were measured before and after practice, so such data must be observed simultaneously.

Table 2. The significance of temperature differences

		<i>Df</i> (No. of examinees -1)	Significance (2-tailed)	T-test
Kapalbhati				
Head	Max.	6	.099*	-1.954
	Min.	6	.006*	4.085
	Mean	6	.175	1.536
Neck	Max.	6	.099	-1.949
	Min.	6	.111	1.871
	Mean	6	.310	-1.109
Chest	Max.	6	.022*	3.074
	Min.	6	.093	1.996
	Mean	6	.153	1.636
Jalandhara bandha				
Neck	Max.	6	.072	-2.185
	Min.	6	.021*	3.114
	Mean	6	.001*	-6.584
	Max.	6	.021*	3.114
	Min.	6	.011*	3.618

Chest	Mean	6	.049*	2.460
Bhastrika				
Chest	Max.	6	.038*	2.647
	Min.	6	.039*	2.628
	Mean	6	.068	2.223

*

Degrees of freedom (Df) is a measure depending on the size of a sample and it serves as an orientation in the final **calculation**. The bigger the sample, the easier the calculation is. Considering the number of examinees in this case was 6, conclusions must be taken with caution. The significance in the other column is of the *t-test*, which **examines** differences between arithmetic mean of measures before and after practice, compared to measured average value before practice.

Asterisk marks significant differences in temperature for certain variables. Based on table 3, and observing values for arithmetic mean in table 1, we can conclude the following:

1. After kapalbhati practice:

a) There is a significant change in head temperature, more precisely:

- i) maximum temperature has increased by 0.2 °C in average,
- ii) minimum temperature has decreased by 1.25 °C in average.

b) There is no significant change in neck temperature.

v) There is a significant change of maximum value of chest temperature by 0.28 °C

2) After jalandhara bhanda practice:

a) There is a significant change of neck temperature, more precisely:

- i) minimum temperature has increased by 0.76 °C in average,
- ii) mean temperature has increased by 0.49 °C in average.

b) There is a significant change in chest temperature, more precisely:

- i) maximum temperature has decreased by 0.58 °C in average,
- ii) minimum temperature has decreased by 1.03 °C in average,
- iii) mean temperature has decreased by 0.66 °C in average.

3) After bhastrika practice:

a) There is a significant change in chest temperature, more precisely:

- i) maximum temperature has decreased by 0.53 °C in average,
- ii) minimum temperature has decreased by 0.70 °C in average.

Conclusion

This pilot study has shown that pranayama techniques kapalbhati and bhastrika, as well as jalandhara bandha, have certain effect on thermal activity of head, neck and chest. However, considering the number of examinees was relatively small, this conclusion should be taken with caution.

Received: November 5, 2015

Accepted: December 4, 2015

References:

1. Bhadoria, B. P. S. (2011). Effect of pranayama on selected physiological variables and co-ordinative abilities among engineering students.
2. Bhavanani, B.B. Normalizacija krvnog pritiska jogom (2010). U: P. Nikić, ur. *Zbornik radova "Joga-svetlost mikrouniverzuma" sa Međunarodne interdisciplinarne naučne konferencije "Joga u nauci-budućnost i perspektive"*, 195-200.
3. Bhole M. (2010). Joga pranajama – značaj sistematičnog pristupa disanju, U: P. Nikić, ur. *Zbornik radova "Joga-svetlost mikrouniverzuma" sa Međunarodne interdisciplinarne naučne konferencije "Joga u nauci-budućnost i perspektive"*, 139-142
4. Gramann, P. R. (2011). Pranayama in the Function of Life Transformation. *International Scientific Yoga Journal*, 145-150.
5. Janjušević, B. (2010). Uticaj praktikovanja joga tehnika na prevazilaženje stresa. U: P. Nikić, ur. *Zbornik radova "Joga-svetlost mikrouniverzuma" sa Međunarodne interdisciplinarne naučne konferencije "Joga u nauci-budućnost i perspektive"*, 23-24.
6. Novaković, B., Pavlović, S., & Milovanović, B. (2011). Autonomous Control of Cardiovascular Function in Yoga Instructors and Effects of Energetic Renewal on Modulation of Autonomic Function. *International Scientific Yoga Journal*, 99-109.
7. Sharma, V. K., Rajajeyakumar, M., Velkumary, S., Subramanian, S. K., Bhavanani, A. B., Madanmohan, S. A., & Thangavel, D. I. N. E. S. H. (2014). Effect of fast and slow pranayama practice on cognitive functions in healthy volunteers. *J Clin Diagn Res*, 8(1), 10-13.
8. Tomić T., Avramović A., Smiljanić, J. (2010). Efekti koji se postižu praktikovanjem joga Asana i pranajame kod osoba sa bronhijalnom astmom. U: P. Nikić, ur. *Zbornik radova "Joga-svetlost mikrouniverzuma" sa Međunarodne interdisciplinarne naučne konferencije "Joga u nauci-budućnost i perspektive"*, 185-189
9. Veerabhadrapa, S. G., Herur, A., Patil, S., Ankad, R. B., Chinagudi, S., Baljoshi, V. S., & Khanapure, S. (2011). Effect of yogic bellows on cardiovascular autonomic reactivity. *Journal of cardiovascular disease research*, 2(4), 223-227.