



# ATHLETE'S BASIC PHYSIOLOGICAL PARAMETERS ENHANCED BY PRACTICING BREATHE TECHNIQUES OF YOGA IN DAILY LIFE SYSTEM

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## Abstract

The physiological data of a swimmer were compared to the phases of the yogic breathe exercises he used to practice daily. According to the hypothesis the longer retention of breathe creates hypoxia that causes the consequent compensation of the body and creation of new red blood cells (RBCs) and hemoglobin (Hb). The hypothesis were supported by a development that occurred in the hematological results of the athlete especially in the values of the RBCs, Hb, and hematocrit. Such results are similar to the observations of the trainings in high altitude where natural hypoxia supports better oxygen transport by creating more RBCs and Hb. Subjective report from the athlete showed the calming effect of the breathwork on the psyche and resulted in the quicker coping.

## Key words

Yoga breathe, breathe retention, hypoxia, athlete's performance, hematological result, training on high altitude

## 1 INTRODUCTION

### 1.1 Athlete's parameters

Different parameters depict the conditions of an athlete. The weight and height of the athlete does not give a precise picture of the constitution of the sportsman. The more precise data includes BMI that is to quantify the tissue mass including muscle, fat, and bone. BMI ranges are underweight: under 18.5, normal weight: 18.5 to 25, overweight: 25 to 30, obese: over 30. Body mass index is calculated as the body mass divided by the square of the body height, expressed in  $\text{kg}/\text{m}^2$  (Banfi-DelFabbro 2006). Naturally age and gender are important information.

According to skinfold-thickness measures the body fat percentage can defined. That is an important factor among the data showing the possibility of the shift of the ratio of useful and burdening tissues of the body composition meaning the amount of fat and muscle. Together with BMI skinfoldthickness measurement supports of creating a more exact picture of the body composition.

Laboratory testing aimed to define blood cell counts. Measures included hemoglobin (Hb), hematocrit (Hct), and red blood cell count (RBC).



## **1.2. Physical parameters**

### **1.2. 1 Red blood cells in the blood**

Red blood cells (RBCs) are the most common in human blood corpuscles responsible for delivering oxygen ( $O_2$ ) and carbon-dioxide ( $CO_2$ ) between lungs and body tissues via blood flow. The RBCs constitute about 45% of whole blood by volume. Average amount in males are 130-170 g/L (Uppsala University 2008).

### **1.2.2 Hemoglobin in medicine and sportphysiology**

Hemoglobin (Hb) is a metalloprotein mostly in the red blood cells (RBC) of humans including iron-containing part that is responsible for oxygen-transportation. Hb in the blood carries  $O_2$  from the lungs' tissues to all other tissues and cells of the body where it releases the  $O_2$  that is used in the metabolism of the peripheral tissues and cells. Hb carries about 20-25% of the total  $CO_2$  from the body tissues back to lungs where the cycle closes after releasing  $CO_2$ . Hb concentration is used to determine medically the ability of delivering  $O_2$  by RBCs. Anemia is defined as insufficient number of RBCs and therefore the lack of  $O_2$  in the body tissues. Anemia is present if the Hb is below the 95% confidence interval in the normal population (Elghetany et al. 2011). Medicine is interested mostly in anemic states and pathologies.

Apart from the disease called polycythemia vera (Hb greater than 18.5 g/dL in men), when the bone marrow creates too many RBCs, the elevated level of erythrocytes can be caused by burns, dehydration, heavy smoking, living at a high altitude, lung disease, excessive vomiting, and extreme exercising. Some of these states appear as the compensation of relative lack of  $O_2$  in the tissues. The same phenomena can be provoked by certain regularly practiced breathe techniques creating hypoxia in the body tissues. Regular hypoxia can induce also the level of RBCs similar to heavy smoking, living at a high altitude, etc. (Rietjens et al. 2002)

## **2 METHODS**

This case study was a byproduct of a fortunate coincidence namely that the blood results taken from a swimmer were not planned to fit to the breathe exercises regime he practiced daily. Although the unplanned event the athlete used to give blood samples in the laboratory for a general checking. These 3 blood results could be fitted to the breathe exercises and fitted to the diary of the athlete about the breathe regime. Post factum the athlete's biodata were evoked and attached to the results of blood and breathe diary.

The athlete was an amateur swimmer but he had daily once 2.5 hours training when he swam usually 4.5-6 km in different styles. During his trainings there were no important races that could change his training regime. There was no remarkable change in his nourishment.

## **3 RESULTS**

### **3.1 Biodata**

Age of the athlete at the start of the breathe exercises was 24 years and 4 months. The first



blood result were taken at the age of 24 years and 3 months that could be accepted as the starting result for breathe exercising. The second blood sample was taken at the age 24 years and 9 months after practicing 5 months of pranayama (breathe exercise). The third sample was taken at the age 25 years and 3 months after practicing 11 months of pranayama.

Height of the athlete was 183 cm, his weight at the beginning was 77.7 kg that grew to 78.3 kg at the second measurement of the blood and remained the same at the third measurement. Calculated BMI was 23.2 and 23.35 kg/m<sup>2</sup>. According to skinfold-thickness measures the body fat percentage was defined 3 times together with blood results, and skinfold-thickness was 12.4% and did not change during the longitudinal study.

### 3.2 Laboratory testing

Blood cell counts were gained by using an automated cell counter measuring the results of hemoglobin (Hb), hematocrit (Hct), red blood cell count (RBC).

	1 <sup>st</sup> blood result	2 <sup>nd</sup> blood result	3 <sup>rd</sup> blood result
hemoglobin g/L	147	151	155
hematocrit	0.45	0.47	0.48
red blood cell count T/L	4.89	5.17	5.37

### 3.3 Breathe regime

Breathe exercises were adopted from Yoga in Daily Life System (YiDL) of Paramhans Swami Maheshwarananda. The System YiDL offers a complete spectrum of yogic breathe techniques starting from the beginners level built up gradually to the advanced techniques. Starting from complete yoga breathing and the basics of breathe exercises the athlete learned to utilize the differentiation of the abdominal and chest breathes utilizing the diaphragm and intercostals muscles respectively. The next step of the regime was to learn the technique of alternate nostril breathing usually called anuloma viloma. From this stage the athlete gradually reached the level of breathwork when phases of retention were included. From the basic ratio of 1:1:1:1 when the 4 stages of breathe (inhaling, retention, exhalation, retention) are equal, the ratio became 1:4:2:4 emphasizing the retention parts both with full air and without air in the lungs. The length of one breathe cycle started from 25 seconds gradually increased and lengthened till 66 seconds after 8 months of practice and it remained the same after 7 more months of practice. The length of the whole practice each day took a 60 minutes time mostly the same time of the day (before lunch 13.00 am.) but sometimes moved from this particular time (Maheshwarananda 2000).

At the time of blood tests the breathe were 25 seconds with 1:1:1:1 ratio, 55 seconds with 1:4:2:3 ratio, and 66 seconds with 1:4:2:4 ratio. It means that the end of the process became approximately 6 second per unit that was for one cycle of the breathe 11 times 6 seconds (66 seconds).



#### 4 DISCUSSION

Although a case study cannot give a general conclusion for majority of athletes but can be used as a pilot study and can be developed as a useful practical method for future generations. In this paper the connection of breathe and physiological parameters were emphasized. It was a lucky coincidence that a swimmer starting his breathwork at the time when he had blood results measured.

Three major

factors were stressed among blood results, other data like erythrocyte sedimentation rate, white blood cells, platelet, bilirubin, etc. were the same in the three samples.

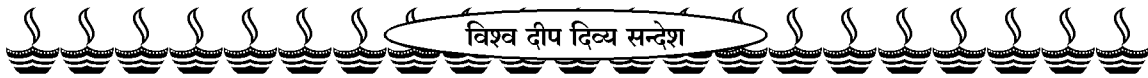
	Change from 1 <sup>st</sup> to 2 <sup>nd</sup>	Change from 2 <sup>nd</sup> to 3 <sup>rd</sup>
hemoglobin g/L	2,7%	5,4%
hematocrit	4,4%	6,7%
red blood cell count T/L	5,7%	9,8%

Results suggest that there is a remarkable difference between the first and third blood results although it cannot be named significant since there was no group results only a study of a single case. The regular breath exercises resulted an elevation of the RBCs, Hct and Hb as well. According to our hypothesis the breathwork was connected by hypoxia to the changes of blood results. Although the quantity of the breathes were not measured by spirometer but during practice mostly abdominal breathe were used by the athlete that is not the vital capacity of the lung. We can suppose an average 3-4 liters per breathe that is far lower of the amount of the average intake of air per minute of a normal person. (Normally you inhale a 0.5 liter air 16 times per minute.) This tendency of shortage of the air and oxygen intake during 60 minutes each day can create the hypoxia that facilitates the production of the RBCs and Hb to compensate the shortage of oxygen (Derby-deWeber 2010).

The historical blood doping since the late 1960s used similar methods that remained till today as a legal enhancement of the performance of athletes when training camp is on higher altitude. The smaller pressure of the air on higher altitude results the drop of oxygen in the lungs, blood, and body cells. Similar process takes place when hypoxia is generated through long retention phases of breathe that creates the same hypoxia and consequent creation of new RBCs and Hb. A subjective remark is worth to mention from the athlete in this case study. He mentioned that this type of yogic breathwork supported both his mental and physical regeneration. He reported a quicker and more effective coping with daily social stress and he reached a deeper level of peaceful state of mind.

#### 5 CONCLUSIONS AND FURTHER POSSIBILITIES

The regular breath exercises of an athlete resulted an elevation of the red blood cells, hematocrit and hemoglobin as well. According to our hypothesis the breathwork was connected by hypoxia to the changes of hematological results. These findings are similar to the trainings on higher



altitudes (over 2500 meters) that create the same adaptation of the person to the lower pressure of air and oxygen. These results can be used for higher performances of any athletes, especially for those who face regular acidity by the type of their training.

It is also a question if the breathe exercises influence the VO2 max. and other parameters of blood that could be obtained for further researches. An extra useful information can be in similar cases the measurement of the vital capacity of the lungs and other data using spirometer. The precise results of the oxygen intake and the level of hypoxia could be a useful data that could give a possible direction for further ideas in the subject. Another future direction could be the measurement of the breathe effecting on the performance of the athlete on the field of sport including speed, endurance and other sections as ability of regeneration.

Further studies can build up a method to measure ECG and EEG results of an athlete with this type of yogic breathwork and an elevated regeneration time and coping capacity can be counted.

The ability of enduring hypoxia can bring better results during the higher phases of the tiredness of an athlete.

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