

Title: A STUDY OF EFFECT OF SWIMMING ON BREATH HOLDING TIME**Dr.Devanshi Upadhyaya* , Dr Janardan V Bhatt** ,****Corresponding author Dr Janardan V Bhatt** ,**

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Abstract: -Introduction: - swimming is a kind of sport which involves the movement of most of the muscle of human body in an environment different from other sports activity. Swimming is a kind of exercise which requires brief or long durations of breath holding in water. Aims and objective:-The purpose of this study was to find the effect of swimming on breath holding capacity of the swimmers. Approach: - We carried out a comparative study of breath holding in swimmers of Ahmedabad city and the persons of sedentary life style. The data obtained were compiled, statistically analyzed and compared with the control group using unpaired 't' test. Results:-Our results showed statistically significant higher breath holding time in the swimmers than sedentary person. Conclusion: - our study reaffirms the advantages of swimming; it is an advisable exercise to improve respiratory efficiency.

Key-words: swimming, Breath holding

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Introduction: Breathing technique is the most important part of swimming. Swimmers try to inhale after every three or four strokes. Jane Cappaert, a sports science bio-mechanist with the Olympic swimming team, says that swimmers will improve their training by staying underwater for as long as they can. "It will help them maximize their oxygen consumption from each breath" This is called hypoxic training and it seems to translate into better performance when a swimmer is low

on oxygen during a race or another hypoxic exercise is to swim freestyle, holding your breath for six strokes, then increasing it to seven, on up, in order to put you in that hypoxic state^I. Swimming is unique kind of exercise and a sport which is carried out in a different environmental condition than other forms. The effect of gravity, shifting of centre of mass of human body and the buoyancy of water play a major role. Human body by achieving muscular efficiencies naturally accomplish this act of swimming^{II}.

Exercise like swimming is of low intensity but of long duration produces increase in the number of mitochondria in the muscle fibers that are recruited in it. In addition there is increase in the number of capillaries around these fibers. All such changes lead to increase in the capacity for endurance activity with minimum of fatigue^{III}. Swimming differs than other sports activity due to horizontal position of the body, higher amount of humidity, restricted ventilation under water and increased external pressure. Heat loss from the body is also very fast due to higher specific heat and conductivity of water. The pressure exposed to diaphragm is also greater during swimming than running^{IV}.

Considering these facts we tried to check the positive effect of swimming on breath holding capacity of the swimmer by comparing with those of the sedentary person.

Material and Methods::In the present study 35 subjects selected were residents of Ahmedabad city who had been swimming for last 2- 6 years or more, who routinely performed for 2-3 hours a day, minimum of 5 days a week. The study was carried out at the eklavya sports complex situated at thaltej, Ahmedabad before starting their routine warm up before swimming^V; i.e. in resting state. The control population was represented by untrained persons.

All the subjects were male between the age group of 20 – 38 years. The subjects were explained the purpose and importance of study. Only those who were motivated consented and without past history and family history of Diabetes Mellitus, HTN, IHD, TB, Asthma etc. were included in the present study. Also the subjects were not having any personal history of tobacco and alcohol consumption. They were free from any disease and were not taking any medicine at the time of evaluation.

With the similar criterion 35 male persons of same age group of Ahmedabad city who were not involved in any sports activity or regular daily exercise like walking, cycling, jogging etc. were taken as controls.

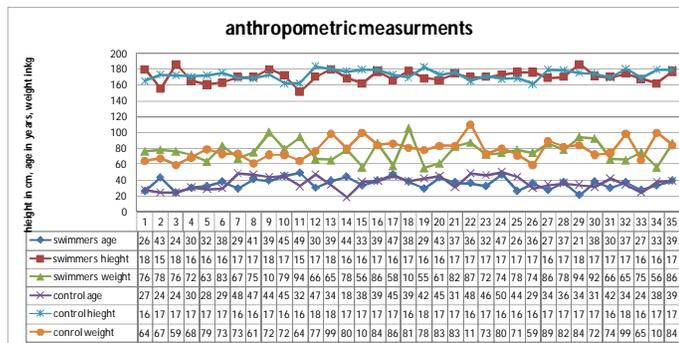
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Proper clinical examination and anthropometric measurements were taken before starting the breath holding tests to avoid human error.

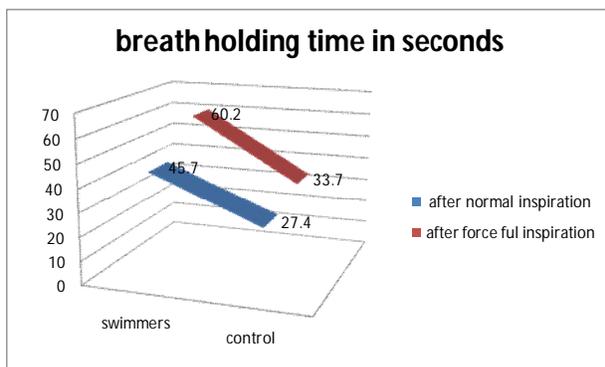
All the participants were explained the methodology. Respiratory parameters were taken in the morning time 8 am to 10 am in the month of September-October 2015 to avoid diurnal variations.

The subjects were instructed to perform following maneuvers using stop watch in sitting position.^{VI,VII} Breathe holding for the maximum duration which is possible i.e break point (unable to hold more than that).^{VIII} Breath holding was done after normal inspiration, normal expiration, maximal possible deep inspiration and maximal possible expiration. Recording was done using stop watch in seconds.

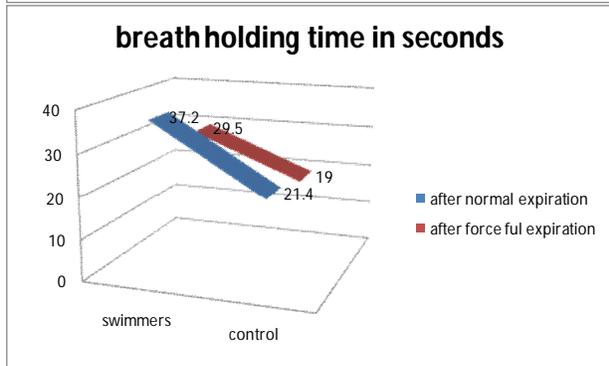
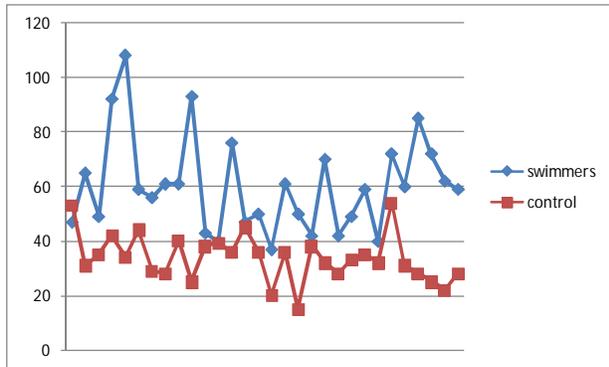
The data was analysed using unpaired 't' test and the results were consider statistically significant where p values were less than 0.001.



Result:



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Breath holding time	swimmers		control		unpaired 't' test
	mean	sd	mean	sd	pvalue
After normal inspiration	45.7	7.1	27.4	5.4	<0.001
After force full inspiration	60.2	12.1	33.7	8.3	<0.001
After normal expiration	37.2	5.6	21.4	4.1	<0.001

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After force full expiration	29.5	3.7	19	3.1	<0.001
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Discussion: on analyzing the results in our study we found that there was no significant difference in the anthropometric measurement. Breath holding tests showed the results as per above charts, which clearly shows significantly higher mean values in swimmers than that of control subjects.

Vijendra rathi found similar results in his study in swimmers of Gwalior both male and female. He attributed it to larger lung volumes.^{VI}

Bowers and foss^{IX} in his book "The physiological of physical education and athletics" and Mehrotra et al showed that regular exercise has proved to be beneficial for the human body and the lungs are no exception. The results of his study indicate that all the sportspersons had a higher value of lung functions compared to the Controls^{IV}. They attributed it to release of lung surfactant and prostaglandin in to the alveolar space which increases the lung compliance and decreased bronchial smooth muscle tone due to maximal and prolonged inflation and deflation.

Similar results were found in swimmers of different studies carried out in different places^{X,XI}. They have explained it on the basis of longer duration of underwater swimming and breathing exercise.

Armour J et al contradicted the above suggestion in different studies but suggested that elite swimmers develop physically wider chest containing an increased number of alveoli rather than increased size^{XIV}.

Another similar activity of breathing exercise is yoga and it different modalities. R Aravind ET al^{VII} in their study on medical students for breath holding had found similar results suggested of increased breath holding after normal inspiration. Wallace RK et al explained the reason as decreased oxygen consumption.^{XII}

M j parkes in his article explained break point is a condition in which voluntary breath holding is overridden by the involuntary act of breathing. He explained that it is not only because of chest movements, partial pressure of gases or peripheral chemo receptors;

it is also related to change in metabolic rate, central respiratory rhythm and feedbacks from diaphragm^{VIII}.

Ethnic, genetic, climatic, social, mental and various other condition also play a significant role in the performance and out-come of the test.^{XIII,XIV}

Conclusion: our study reaffirms the fact that regular swimming has a positive effect on the breath holding and can be of help to improve the respiratory reserves. But to have deeper understanding further studies with multiple parameters must be carried out.

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References:

- I. Jane cappaert: biomecal engineering principles in sports: first edition New York, springer science+buseines media,2004:P-435-36
- II. Arthur T Johsonl: Biomechanics and exercise physiology: first edition New York,john wiley&sons,INC,1991:P-54.
- III. E Widmaier, H Raff, K strang: human physiologyThe mechanisms of Body function: ninth edition New York,The Mcgraw-Hill,2004:P-298.
- IV. Mehrotra PK, Varma N, Tiwari S, Kumar P.Pulmonary functions in Indian sportsmen playing different sports. Indian J PhysiolPharmacol. 1998 Jul; 42(3): 412-6.
- V. Sable M, Vaidya, S M&sable,S S. comparative study of lung functions in swimmers and runners. Indian J Physiol Pharmacol.2012; 56(1):100-104.
- VI. Rathi, Vijender (2014). Relationship of breath holding with vital capacity among swimmers. *Internat. J. Phy. Edu.*, **7** (2) : 71-74.
- VII. R. Aravind kumar,T ganesan, S ravindar, S sbhasini. A study of effect of yoga on breath holding time in medical students. J Biol Sci Opin 2013; 1(2): 56-58
- VIII. M j parkes. Breathe holding and its break point. Exp Physiol 91.1 2006: p1-15
- IX. Bowers,fox and foss. The physiological of physical education and athletics. 1998
- X. Kesavachandran, C., Nair, H.R. and Shashidhar, S. (2001). Lung volumes in swimmers performing different styles of swimming. *Indian J. Med. Sci.*, 55(12): 669-676

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- XI. Inoue, Hiroshi, Kobayashi, Hitoshi, Nakamura, Yutaka, Kohno, Nibuoki and Sasaki, Hidetada (2009). A new breath-holding test may noninvasively reveal early lung abnormalities caused by smoking and/or obesity. 136: 545-553
- XII. Wallace Rk. A wakefull hypo-metabolic physiologic state American journal of physiology 1971: 796-799.
- XIII. Lakhera SC, Mathew L, Rastogi SK, Sen Gupta J. . Pulmonary function of Indian athletes and sportsmen: comparison with American athletes. Indian J PhysiolPharmacol. 1984 Jul-Sep; 28(3): 187-94
- XIV. Armour J, Donnelly PM, Bye PT. The large lungs of elite swimmers: an increased alveolar number? EurRespir J. 1993 Feb; 6(2): 237-47.