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A COMPARATIVE STUDY OF INFLUENCE OF BODY MASS INDEX ON BREATH HOLDING TIME IN YOUNG ADULTS

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ABSTRACT

Body Mass Index assessment, also known as the Quetelet's index is commonly used as a practical means to assess body fatness. Breath Holding Time (BHT) is a simple method to assess lung function. Relationship of anthropometrical parameters & sex to Breath Holding Time is not reported in any studies done so far. So a cross-sectional study was carried out among healthy young adults of both sexes to assess BHT as an index of central ventilatory response. On sexwise comparison, there was a statistically significant decrease of Height, Weight with insignificant differences in BMI & resting RR in females. There was highly significant increase in BHT of both sexes after the deep breathing session (deep inspiration & expiration). There is proportionate & significant decrease in BHT of females compared to males as observed in both recordings of breathing session.

KEYWORDS : Body Mass Index, breath holding time, index of central ventilator response, quetelet's index

INTRODUCTION

Two separate neural mechanisms regulate respiration. One is responsible for voluntary control and the other for automatic control. The voluntary system is located in the cerebral cortex and sends impulses to the respiratory motor neurons via the corticospinal tracts.[i] The automatic system is driven by a group of pacemaker cells in the medulla. Impulses from these cells activate motor neurons in the cervical and thoracic spinal cord that innervate inspiratory muscles.[i] Respiration can be voluntarily inhibited for some time, but eventually the voluntary control is overridden. The point at which breathing can no longer be voluntarily inhibited is called the breaking point.[i] Breaking is due to the rise in arterial PCO_2 and the fall in PO_2. Individuals can hold their breath longer after removal of the carotid bodies. Breathing 100% oxygen before breath holding raises alveolar PO_2 initially, so that the breaking point is delayed. The same is true of hyperventilating room air, because CO_2 is blown off and arterial PCO_2 is lower at the start. Reflex or mechanical factors appear to influence the breaking point. Psychological factors also play a role, and subjects can hold their breath longer when they are told their performance is very good than when they are not.

At present, sedentary life style raises various health issues due to lack of physical activity and food habits. Obesity is one of the major concerns among them. Apart from pollution and hereditary, obesity has become one of the major factor which affect the lung function. Body Mass Index (BMI) is one of the simple methods to assess oneself about their fat distribution. Relationship of anthropometrical parameters & sex to Breath Holding Time(BHT) is not reported in any studies done so far. Moreover, Pattern of fat distribution is different in Males and Females, which shows variation in lung functions. BHT is simple procedure to assess the lung function. So BHT [at TLC] & Respiratory rate together may act as an index of central ventilator response, in turn the sensitivity of respiratory center. So can BHT be used as a simple clinical sign? In an effort to answer, a comparative study was carried out which aims to estimate the influence of Body mass index on breath holding time as an index of central ventilator response in young adults of both sexes.

Material & methods

A cross-sectional study was carried out among healthy young adults ranging in age from 18 to22 years of both sexes. The purpose of the study and techniques to be used were explained to each subject. Those who volunteered and gave consent were studied. Total of eighty healthy young adults, both males & females were part of the study.

All the study subjects then underwent detailed history taking regarding any present complaints, past history of any other associated disease, family history, personal history as well as any treatment history if present. Thorough general examination and systemic examination was done.

Anthropometric and physiological measurements:

Anthropometric measurements were taken using standard protocols. Stature was taken with the help of anthropometer in the standard arm hanging position; body weight was measured by using weighing scale with minimum clothing. Measurements were conducted by trained anthropologists. Breath holding time (BHT) was assessed using a stop watch. BMI was classified according to WHO[2], BMI less than 18.5 as underweight and more than 24.9 as overweight/obese.

RESULTS:

On sexwise comparison, there is a statistically significant decrease of Height, Weight with insignificant differences in BMI & resting RR in females. There is highly significant increase in BHT of both sexes after the deep breathing session ($p<0.0001$).There is proportionate & significant decrease in BHT of females compared to males as observed in both recordings of breathing session (deep inspiration & expiration).

	MALES	FEMALES	P VALUE
BMI	20.64±3.04	20.63±3.44	0.98907
BHT-REST	42.58±10.46	35.29±5.71	0.000448
BHT-deep inspiration	52.73±13.17	42.58±7.58	0.000138
BHT after expiration	32.44±10.88	28±5.75	0.033821

The anthropometrical parameters, resting RR [breaths/min] & BHT [seconds] after deep inspiration upto break point were recorded before & after deep breathing session. It is observed that BHT did not show any correlation to anthropometrical parameters like Height [cms], Weight [Kgs], BMI [kg/m2] either in females or males on separate analysis. The proportionately decreased BHT in females (figure 1&2), in both recordings taken before & after deep breathing session, indicates increased sensitivity of respiratory center in females, attributable to oestrogen primed progesterone action.

Figure 1: Comparison of BHT with BMI in Males

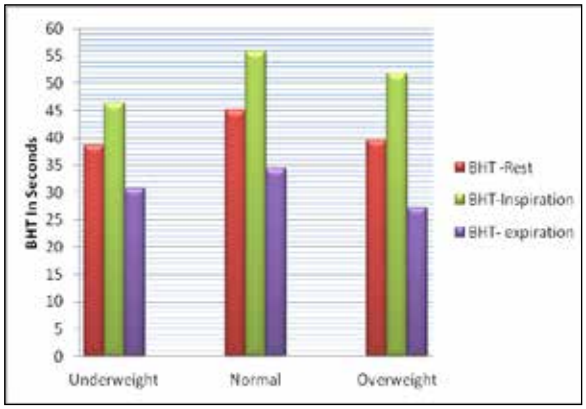
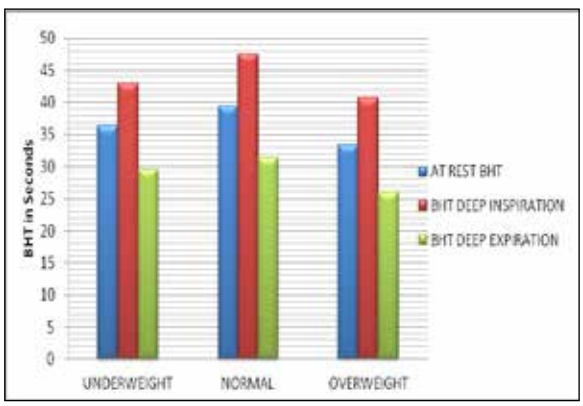


Figure 2: Comparison of BHT with BMI in Females



DISCUSSION:

BMI assessment is a powerful tool for categorizing adiposity and body composition among adults. It is also known as the Quetelet's index and is commonly used as a practical means to assess body fatness. Breath Holding Time (BHT) is a simple method to assess lung function. In our comparative study on subjects of 18 -20 years [male n =45; female n =34] did not show any correlation between BHT & anthropometrical parameters like Ht [cms], Wt [kgs], BMI [kg/sq.m] in both the sexes. But proportionately decreased BHT in females, in both recordings taken after deep inspiration & expiration session noted. The statistically significant decrease of BHT in females in the present study is comparable to the earlier study[3]. Another study on the effect of gender on BHT concluded that despite gender differences in physiological and anthropometrical traits, Breath hold ability was not different between males and females[4].

BHT decreases in overweight due to deposition of fat in thoracic cage and mechanical effects on the diaphragm can lead to increase in the metabolic demands and work-load of breathing. In obesity, the function of respiratory muscles is impaired and tends to decrease the PEFR[5]. In case of Undernourishment contraction of diaphragm and muscle mass reduces the lung functions and exercise efficiency which leads to muscle wasting and low Fat Free Mass[6]. Both low and high BMI were associated with poor lung functions which results in combination of airway narrowing and decreased lung recoil[7].

The highly significant [unpaired 't' test ;p=0.0001] decrease in the BHT of females is maintained even after the deep breathing session. This might be due to the increased sensitivity of the respiratory center in young females, increasing the central ventilatory response.

Muxworthy [8] demonstrated breath-holding time has the direct effect on lung volume in 1951. BMI are used as the measures of overall adiposity. Many studies had been done on various types of obesity-induced dysfunctions, disorders and diseases. Gibson et al., and Rubinstein et al., stated that obesity impairs the Respiratory functions by inducing airway hyper-responsiveness in adults[9,10], whereas Young et al., linked it with the development of asthma [11]. Many studies have been conducted in obesity and pulmonary function in the youngsters with the age group of 5 to 16 years or in the older people above 50 years of age[12]. But the age group of 18 to 25 years is the crucial adolescent age that is highly susceptible for obesity.

There appears to be a sincere effort from Doctor Buteyko and his medical colleagues who have summarized available western data over a period of 90 yrs [from 1919 to 2009] regarding average breathe holding time for normal and healthy people. They also took recordings of BHT in millions of normal & diseased cases & tried to correlate the gradation of BHT to health condition. He opined that the simple test of Breath holding time, known by him as body-oxygen test, can be used to measure the central ventilatory response[13].

The sample size of the present study was less. Future studies with more number of samples may be required to investigate whether there is any other interrelationship between the variables used in the study. It is suggested that further studies on BHT & PFT at Total lung capacity can be done with 2 sets of recordings, with exercise or without exercise effects.

CONCLUSIONS

We can say that the significant difference was observed between BMI and BHT, which were reduced in underweight and overweight on comparing with normal (P<0.001). Comparing between males and females, this study showed a significant fall in BHT in females than males (P<0.05). The proportionate decreased BHT in females, in both recordings taken before & after the deep breathing session, indicates the increased sensitivity of the respiratory center in females, attributable to oestrogen primed progesterone action.

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