

Original Research Article

Estimation of Breath Holding Time (BHT) among dental students

Running title: Measuring BHT among dental students

ABSTRACT:

Background: Breath holding time is the time taken by an individual to hold his/her breath as long as they can. During voluntary breath holding, tissues continue to utilize oxygen and liberate carbon dioxide. Therefore, during breath holding arterial pO_2 falls and pCO_2 rises. Normal Breath holding time (BHT) is 45-55 seconds which is estimated in 2014. The main aim of this study is to assess the breath holding time among healthy dental students.

Materials and methods: A minimal number of sample sizes has been taken into account with regards to their BMI. The sample size was divided into two groups as gender comparison. Students were detaily explained about the procedure and breath holding time has been measured. The statistical analysis was done by ANOVA test in SPSS Software-23 and an independent t-test was calculated.

Results: BHT was found to be significantly low among females compared to males. A statistically significant negative correlation was observed when BHT is correlated with gender because BHT differs in both the gender.

Conclusion: The present study revealed that breath holding time is less in females compared to males. Therefore, males are healthier than females.

Key words: Breath holding time, gender comparison, BMI, Oxygen, Carbon Dioxide, Innovation techniques

INTRODUCTION:

Breath holding time is the time taken by an individual to hold his/her breath as long as they can(1). Breath holding involves the tissues which use oxygen and then produce carbon dioxide(2). Breath holding increases carbon dioxide in the arterial region resulting in vasodilation of resistance arterioles which increases cerebral blood flow (3).Evaluation of breath holding time has a significant increase in sensitivity of peripheral chemoreflex, which was noted regarding arterial hypertension, chronic heart failure, etc (4).

Respiratory motion is an abnormal rate of breath due to which causes chest pain and brain tumor(5). Breath holding for short intervals is a widely applied method to reduce respiratory motion(6). In standard clinical practise, patients are instructed to hold their breath (7). In addition to Positron Emission Tomography and Computed Tomography (PET-CT) Scans and radiotherapy have been used in an MR setting recently (8). Breath hold challenge is used in the clinical setting for assessment of cerebrovascular reactivity (9).

Hypoxia is a condition in which a certain body part suffers from a decreased rate of partial pressure of oxygen levels whereas Hypercapnia is an increased rate of partial pressure of carbon dioxide levels(10). Hypercapnia is commonly measured as a surrogate for the increased arterial carbon dioxide levels (11). Hypoxia of oxygen were seldom used to account for Cerebral blood flow(CBF) changes during breath holding due to the belief that vasodilatory effect of increased artery partial pressure of carbon dioxide dominates that of decreased arterial partial pressure in oxygen (12). The role of both hypoxia and hypercapnia in breath holding deserves to be examined because arterial PCO_2 and PO_2 have been reported to work synergistically to interact with chemoreceptors (13).

Some studies described the potent vasodilatory nature of arterial carbon dioxide in humans (14) which can be manipulated using inhalation of air with increased carbon dioxide (15) (16). The present study mainly stimulates individuals' behaviour in healthy volunteers. This allows more flexibility in the experiment duration and removes the confounds of age-related changes in order to isolate the effects of poor breath hold performance on the Blood Oxygen Level Dependent (BOLD) measurements (17). Coronavirus is being viral all over the world, this study has the main role to compare breath holding time between males and

females to check whether they have proper lung functioning so that they don't get affected by any external parameters (18) (19). The main aim of this study is to explore the gender comparison of Breath Holding Time among dental students.

MATERIALS AND METHODS:

A cross-sectional study was conducted in a private dental college among first years with a sample size of 100 students. The participants are selected randomly. Breath holding time was recorded among each individual by allotting them a nose piece after them holding their breath. The breath holding duration and the measurement of distress tolerance which denotes the maximum experienced distress and the participants were instructed to hold their breath as long as they can. To calculate breath holding timings, participants were instructed to hold their breath as long as they could. To calculate BHTs, participants were assessed to record the starting time from the time they held their breath. The time is calculated using a stopwatch and the readings of BMI are collected by calculating the individual's height and weight. Data was collected and analysed using SPSS software version 23 and independent t-test was calculated.

RESULT:

From the present study, BMI mean value in males is 23.1086 ± 4.6270 and in females is 22.5981 ± 4.3723 (Figure 1). BHT mean value in males is 42.17 ± 39.64 and in females is 26.96 ± 9.435 (Table 1). Since male population has a high mean value, it is evident that male have more breath holding time than females under this sample size (Figure 2).

	GROUPS	N	Mean	Std. Deviation	Std. Error
BMI	MALE	29	23.1086	4.62700	.85921
	FEMALE	70	22.5981	4.37237	.52260
BHT	MALE	29	42.17	39.640	7.361
	FEMALE	70	26.96	9.435	1.128

TABLE 1: Mean, SD and SE of BMI and BHT. Females have participated in this survey rather than Males. The Mean, Standard Deviation and Standard Error Mean values are more for males than females.

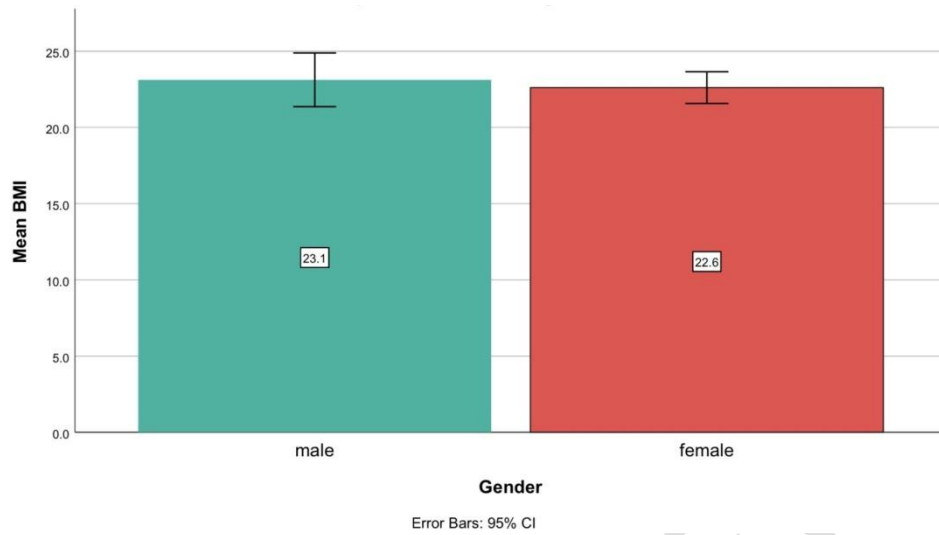


Figure 1: The bar graph represents the mean value of BMI of both genders. X axis represents gender and Y axis represents mean values of BMI of the participants. Green denotes males and Red denotes females. Males have more BMI than Females.

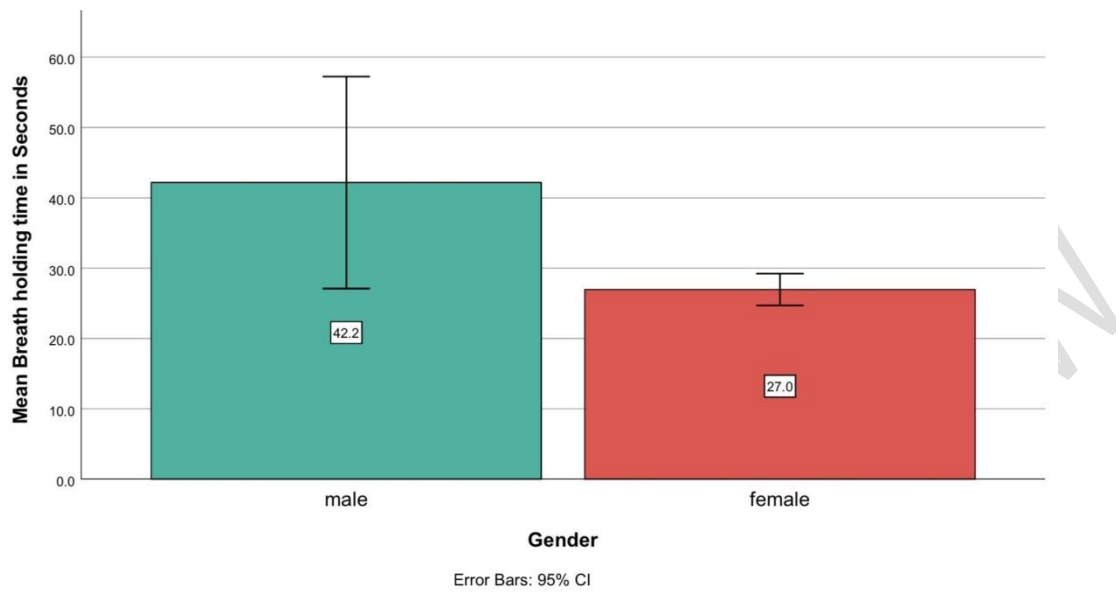


Figure 2: The bar graph represents the mean value of BHP of both genders. X axis represents gender and Y axis represents mean values of BHP of the participants. Green denotes males and Red denotes females. Males have more BHP than Females.

DISCUSSION:

Breath holding is a safe and reliable method for assessing the sensitivity of peripheral chemoreflexes to carbon dioxide in patients with heart failure(20). A normal breath holding capacity in an untrained individual is 30 sec to 2 min (21). In this study, the maximum limit of breath holding capacity of a person was very challenging to measure(22). Therefore by understanding how these mechanisms interact to determine the break point of a breath hold which remains a challenging area of integrative physiology(23). By comparing the previous studies which are done similar to the present study(1), the breath holding spells of pediatrics have more significance towards breath holding capacity in children (24). Then the evaluation of breath holding tests for peripheral chemoreflex sensitivity in patients was performed and also about the chronic heart failure (25).

The study correlated well with breath holding with post bronchodilator(26,27), forced expiratory volume (FEV)(28), forced vital capacity (FVC)(29), peak expiratory flow rate (PEFR) is normal which was similar to the findings observed in the current study (25,30). Mariappan *et al* conducted a study on the effect of physical training among Indian people (31), it enhances the respiratory efficiency by increasing the strength of diaphragm and intercostal muscles which were similar to the findings that male have more breath holding time than females in this study (32). It also increases vital capacity and prolongs the breath holding time(33). Then by comparing the impact of linear vestibular stimulation in respiratory endurance which is a vestibular stimulation by the participants to swing from back

to front direction(26) (34). The consensus faced by the overall previous literature is by the impact of peripheral chemoreflex related to chronic heart failure, obesity, etc (25) (35).

Based on these findings, conclude that males have more breath holding time than females. The number of alveoli per unit area and alveolar volume do not differ between males and females, but it is scientifically proven that males have larger lungs and thoracic cages than females.

LIMITATIONS:

This study has less sample size. But this research can be done on a wide scale with a larger sample size and with different age groups and populations due to the fact that this study was only conducted among dental practitioners so that the values of the tests can differ and also awareness of breath holding can easily spread throughout the public.

CONCLUSION:

This study was conducted only for normal students in order to check whether they can with stand covid-19. This study clearly shows that males are much healthier than female students since they have more breath holding capacity and further studies should happen on a large scale for better results in the future.

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