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Effect of hypopressive exercise on peak expiratory flow rate and breath holding time: An observational study

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Abstract
Objective: Aim of the study is to observe the effect of the Hypopressive exercise on peak expiratory flow rate and breath holding time.
Method: This is an observational study with young females aged between 18-22 years, with no musculoskeletal or systemic conditions. We analyzed effect of HE in sitting, on PEFR and BHT to establish relation of HE with the lung functions. HE was performed for one month by the subject's daily 3 sets with 8 repetitions each.
Results: Significant increase in values of peak expiratory flow rate and breath holding time of the subjects, who performed hypopressive exercise for a month, was observed when compared with the values measured before performing hypopressive exercise.
Conclusion: The results suggested that HE can have positive influence over the PEFR and BHT, when performed for one month daily.

Keywords: hypopressive exercise (HE), peak expiratory flow rate, breath holding time

Introduction

Hypopressive Exercise (HE) is a group of breathing and postural exercise developed in 1980's by a physical therapist named Dr. Marcel Caufriez, and is widely known and used in countries including France, Italy, Spain, Canada and countries of South America [1]. HE can be defined as a set of postural technique that can be synergistically activates the muscle of pelvic floor and abdomen [2]. Thus, this method has been used in the treatment of Urinary Incontinence (UI), Fecal Incontinence (FI), Pelvic Organ Prolapse (POP) and for postpartum perineal strengthening [2]. The PFM's, Gluteal, Abdominal's and Adductor muscles are activated during the performance of HE [9]. HE is an alternative technique for strengthening abdominal (AM) and pelvic floor muscles (PFM) in the postpartum period (Caufriez, 1889; Craufriez *et al*., 2007, 2006; Caufriez,1988).

HE promotes reflex activation in these muscle groups in response to negative IAP which results from contraction of the accessory muscles of respiration i.e. diaphragm, intercostals muscles, scalene muscles and sternocleidomastoid may play role during HE [5]. The breathing technique of HE involves a series of controlled breathing cycles followed by a low pulmonary volume breath hold performed with full rib cage expansion [8]. Hypopressive maneuver is performed by asking the individual to fully exhale such that their diaphragm is fully elevated, and then close their glottis and expand their rib cage and abdomen such that, theoretically IAP drops [9].

This is the case of the straining maneuver, which consists of an expiratory effort with air in the lungs against a closed glottis has demonstrated to increase IAP and ICP [8]. During pulmonary ventilation, the agonists and accessory breathing muscles influence the internal pressure of thoracic and abdominal cavity [8,4]. As mentioned in one of the study, it is possible that the maneuver can affect the Elastic forces of the chest wall as well as the neurological control of breathing, due to apnea and its maintenance in the residual volume [4].

HE has also been found to increase tidal volume during the standing and the seated postures as well as activation of the accessory breathing muscles such as scalene, SCM and serratus anterior compared to the rest in healthy females [8]. HE was capable to activate accessory respiratory muscles in the supine, sitting and orthostatic postures.

Thus, this technique possibly improves the process of pulmonary ventilation, without interfering in the respiratory rate [4]. As respiration is one of the most important issues for life conservation and its significance have mentioned in many studies [2]. Thus, possible effects of HE on respiratory muscles and lung function should also be explored, since HE results primarily from accessory inspiratory muscle activation associated to expiratory apnea [5].

Therefore, the aim of the study was to observe the effect of HE on PEFR and BHT. PEFR is one of the important and widely used lung function tests as it is very easy, reliable and reproducible; it is also very sensitive and accurate index of airway obstruction and the strength of respiratory muscles [6].

Breath holding test is used as a rough index of cardiopulmonary reserve, where a subject holds his/her breath for as long as he/she can [7]. However, despite of abovementioned data, to the best of our knowledge, the effect of HE on lung functions have not been much studied. Therefore, the present study was undertaken.

Methodology

An Observational Study was conducted on 30 females of age group 18-22 years, who were willing to participate in the study. The following exclusive criteria were adopted; absence of any systemic conditions e.g.; CVA, MI, valvular defects, hypertension, etc. or musculoskeletal conditions and

pregnancy (Caufriez *et al*., 2011, 2007, 2006). All the participants were informed about the purposes and the procedure of the study.

Population was selected using convenience sampling method. Informed consents were obtained from each participant prior to data collection. This study was approved by the ethical committee of Chanakya College of Physiotherapy, Bhuj- Kutch. The parameters recorded as an outcome measure of the study are PEFR and BHT.

All the subjects were thoroughly explained about the study and detailed consent was obtained from each of the 30 subjects and the institute where the study was undertaken. Each subject PEFR and BHT was assessed in the beginning of the study as explained in following headings.

PEFR Protocol

All the recordings were done while the subjects were standing. They were instructed to breath as deeply as possible and then place the mouth piece of peak flow meter shown in figure (2) in the mouth and blow out as hard as possible in a short sharp blast. Three recordings of PEF were obtained and the highest reading was recorded as the subjects PEF.

The anthropometric parameter were recorded of all the subjects. Earlier studies have revealed that PEFR is correlated with age, height, and weight. In both men and women age showed negative correlation whereas height showed positive correlation with pulmonary functions. Taking these studies under consideration the anthropometric parameters were recorded [3].

BHT Protocol

The subject was asked to pinch the nostrils with thumb and index finger before starting to hold the breath. The subject was instructed to hold his breath as long as possible at the end of quiet inspiration and at the breathing point time was noted using a stopwatch. [Breaking point is a point at which the breathing can no longer be voluntarily inhibited [7].

As the test was performed in sitting posture following chair was used for the BHT measurement shown in. BHT readings were noted down in the assessment form

The study was conducted in three parts; (1) Measuring PEFR and BHT of the subjects before assigning the HE. (2) Subjects performs HE (as per they were taught) for 4 weeks at their convenient place and time (3) Measuring PEFR and BHT after 4 weeks.

Data of PEFR and BHT was collected using assessment form. All the individuals have their own assessment form and the data collected was analyzed for the result purpose.

HE Protocol

Proper explanation to the subjects were provided. In brief HE involves: (1) Diaphragm inspiration. (2) Total air expiration and (3) Gradual contraction of transverse abdominal and intercostals muscle with the rise of the haemidiaphragm and aponea [1].

The technique was demonstrated as follow [8];

Spine elongation with neutral pelvis while sitting

⇩

Ankle dorsiflexion

⇩

Slight knee flexion

⇩

Shoulder girdle muscle activation

⇩

Three breathing cycles of controlled deep latero-costal inhalation followed by slow deep exhalations (ratio 2:1)

⇩

After the third exhalation upto residual pulmonary volume, a breath-hold was performed during a controlled rib-cage expansion.

⇩

The breath-hold lasted a total of 10 seconds.

⇩

The cues given were "expand the rib-cage while holding your breath", “inhale deeply through the nose” and exhale slowly through the mouth”

⇩

An observable abdominal draw-in of the abdominal wall and expansion of the rib-cage is seen.

⇩

Three sets of eight repetitions (24 repetitions total) were performed with a 1- minute rest interval between sets. The total duration of the exercise intervention was of 10-minutes followed by 20- minutes of recovery period. (Participants were instructed to seat comfortably and breathe normally for the recovery period).

Subjects were asked to perform HE for 4 weeks one time a day. PEFR and BHT are measured after performing HE for 4 weeks. According to the data received from pre and post PEFR and BHT it would be analyzed and scoring will be done. PEFR and BHT protocol was again performed after 4 weeks in the same way as before.

Tabel 1: Statistical analysis

PEFR pre HE	PEFR post HE	BHT Pre H.E.	BHT Post H.E.
270	340	17	30
330	370	24	26
330	390	20	22
260	320	21	24
350	430	17	20

380	450	8	23
340	420	20	25
350	430	24	28
390	450	24	30
360	420	24	29
280	350	21	30
350	430	15	21
250	300	11	18
310	390	23	29
300	430	20	31
320	410	15	24
360	420	15	20
240	350	16	20
270	330	12	17
450	540	12	15
400	450	20	27
470	530	19	24
300	400	20	24
350	410	15	21
350	450	22	36
350	450	25	34
350	420	24	43
420	500	23	33
440	520	31	42
280	350	25	31

PEFR Data **BHT Data**

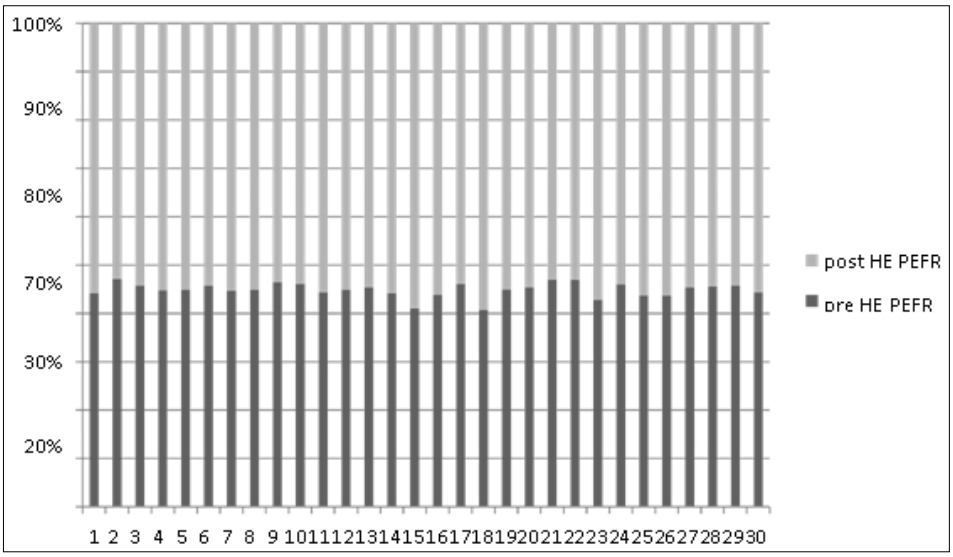

Fig1: Peak expiratory flow rate data graphical representation

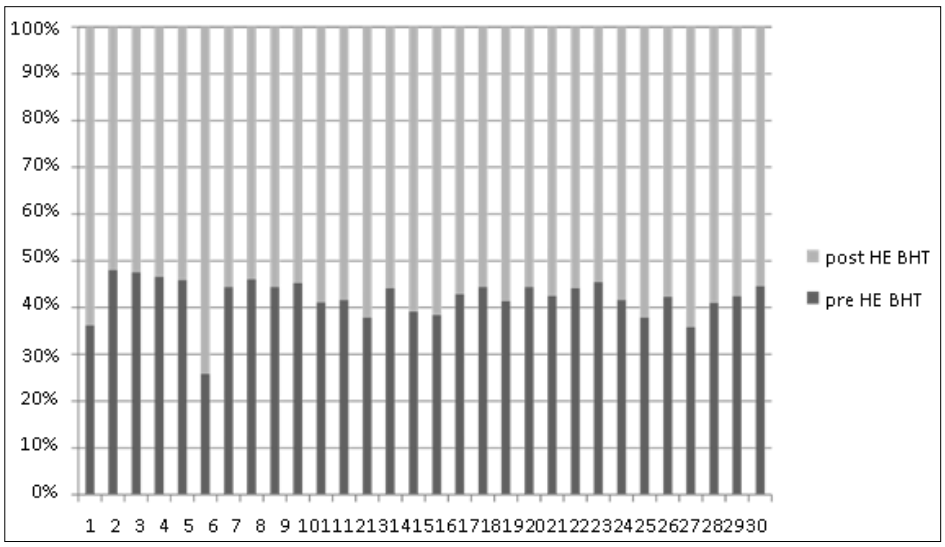

Fig 2: Breathe holding time data graphical representation.

Table 2: Masterchart

Values	PEFR	BHT
Mean (1)	340 L/min	19.43 second
Mean (2)	415 L/min	26.56 second
SD (1)	58.95	5.09
SD (2)	60.33	6.78
t-score	-4.87	-4.60

Mean (1) = mean value of PEFR and BHT before performing HE.
Mean (2) = mean value of PEFR and BHT after performing HE.
SD (1) = standard deviation value of PEFR and BHT before performing HE.
SD(2) = standard deviation value of PEFR and BHT after performing HE.

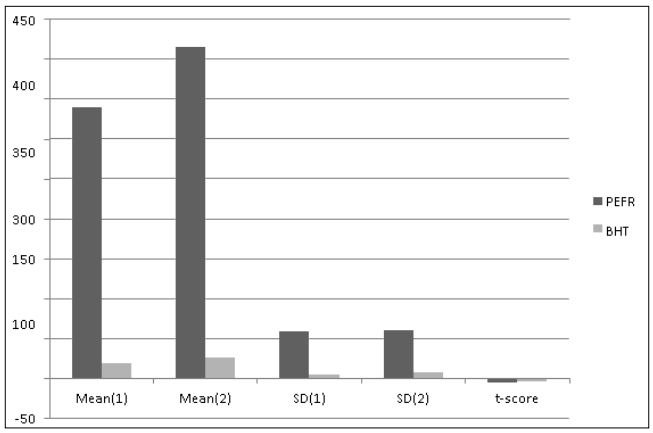

Fig 3: Masterchart

Results

Thirty females from Kutch Gujarat, ageing from 18-22 years. With mean height 1.53 meter, mean weight 53.04 kilogram, and mean basal metabolic index (BMI) 21.09 kilogram/meter^2; took part in the study that was conducted from 26th march 2021 to 3rd may 2021 at Chanakya college of physiotherapy, Bhuj Kutch.

- **PEFR**

Normally PEFR in females ranges from 320-470 liter/minute [6]. Subjects practicing HE for one month showed significant improvement in PEFR.

- **BHT**

Normally BHT is 45-55 seconds [7]. The average BHT before performing HE was 20 second and after one month practicing HE there was significant improvement in BHT

Discussion

The results of the present study showed that, there is marked improvement in the PEFR and BHT of the subjects who performed HE for one month.
Respiration is one of the most important issue for life conservation, and its significance has mentioned in many studies [2]. Thus, the current study was conducted to observe the effect of HE on respiration, a new developing technique.
The diaphragm, one of respiratory muscles, plays a key role in the respiratory pump, it influences respiratory function of controlling breathing as well as human posture [13,14]. Breathing strategies have been considered an important component of pulmonary rehabilitation and refer to a range of techniques which includes diaphragmatic breathing [3]. Diaphragm and other important respiratory muscles, such as intercostals muscles, scalene muscles and sternocleidomastoid muscles plays role during HE [5].
During HE there is a significant increase in PFM and abdominal neuromuscular activation during the 10 seconds task [9]. Briefly HE involves; diaphragmatic inspiration, total air expiration and gradual contraction of the TrA and intercostal muscles with the rise of the hemi diaphragm and apnea [1].
It is possible that the HE can affect the elastic forces of the chest wall as well as the neuro chemical control of breathing, due to apnea and its maintenance in residual volume. This technique possibly improves the process of pulmonary ventilation, without interfering in the respiratory rate. HE demonstrated mobilization of lung volume without interfering the duration of respiratory cycles, as a future perspective, HE should be useful as an adjunctive therapy in treatment of patients with obstructive lung diseases and others [4].
PEFR is one of the lung function tests, is mainly dependent on the strength of respiratory muscles and the resistance of the airways. PEFR is a well-
Established screening test for upper airway obstructive disease and is used as a direct index of assessing airway obstruction [10].
Breath holding test is used as a rough index of cardiopulmonary reserve, BHT less than 20 seconds indicates diminished cardiac or pulmonary reserve [7]. Thus, PEFR and BHT was opted as an outcome measure for this study. Thus, current study was conducted to observe whether there is any positive effect of HE on lung function or not using PEFR and BHT as an outcome measures.
There was approximately 15.95% increase in the PEFR and approximately 10.91% increase in the BHT was noted in the subjects that participated in the study. HE helps in increase in PEFR presumably due to conditioning and strengthening of respiratory and abdominal muscles.
Purpose of this study was to find correlation of HE with the lung function so it may further be tested for pulmonary conditions and can further be helpful in designing treatment for respiratory pathology.

Conclusion

This study demonstrated that HE in sitting is capable to increase PEFR and BHT in the females aging 18-22 years, when performed for one month regularly. And the data collected from sampling and calculating result, we have concluded that there is quite significant increment in PEFR and BHT of the subjects. Thus, there is positive effect of HE on the respiration and lung functions.
PEFR increased from mean 340 L/min before HE performance to 415 L/min on an average after performing HE. Thus, there were approximately 75 L/min of increment in the subjects.
Similarly, BHT increased from on an average 19.43 seconds to 26.56 seconds. Showing an average increment in breath holding ability of subjects upto 7.13 seconds.
All the above result leads the study to conclude in the favor of alternative hypothesis which is been proved correct; which was stated as “There will be effect of one month HE on the PEFR and Breath holding time”. Furthermore the effect of HE in different postures were not observed in this study, and can be undertaken in similar future studies.

The current study is able to establish relation of HE with the lung function as suggested by V. Machado, A. Doenelas de Andrade *et.al*. (2015) Leire Juez, Jorge M. Núñez Córdoba and *et al* (2019) in their respective studies.

Future studies should assess the influence of HE in males and more wide range of samples. HE in different postures should be tested to establish its relation with respiration. Furthermore, considering the current study HE can be tested on patients with respiratory pathology. Measurement of PEFR is of value for the identification of chronic obstructive bronchitis and for the assessment and follow-up of patients with asthma [15].

Conflict of Interest: None.

Funding: Nil.

References

1. Saúl Martín-Rodríguez, 1 Kari Bø2. Is abdominal hypopressive technique effective in the prevention and treatment of pelvic floor dysfunction? Marketing or evidence from highquality. (BJSM), 2017.
2. Min-Sik Yong PT, Ph D1, Hae-Yong Lee, PhD1 PT *et al*. Effects of diaphragm breathing exercise and feedback breathing exercise on pulmonary function in healthy adults. (The journal of physical therapy sciences), 2016.
3. Praveen Bhardwaj*, Jayanti Pant1, Reena Bhardwaj2. Effect of one month diaphragmatic breathing on peak expiratory flow rate and breath holding time. (National journal of medical and allied sciences), 2013.
4. V Machado1 A, Dornelas de Andrade 1 *et al*. Effects of abdominal hypopressive gymnastics in the volume distribution of chest wall and the electromyographic activity of the respiratory muscles. **(**The study was approved by Human Research Ethics Committee form Universidade Federal de Pernambuco, Recife, Brazil), 2015.
5. Lucas Ithamar, MSc1 Alberto Galvão de Moura Filho, PhD1 *et al*. Abdominal and pelvic floor electromyographic analysis during abdominal hypopressive gymnastics. (Journal of Bodywork & Movement Therapies), 2017.
6. Reshmarani1, Shilpa N2, Veena HC3**.** Peak flow meter and digital spirometer: A comparative study of peak expiratory flow rate values. (National Journal of Physiology, Pharmacy and Pharmacology), 2020.
7. Bagavad Geetha M, Roopa S *et al*. Effect of physical training on breath holding time in Indian subjects. (The official journal of the association of physiologists and pharmacologists of India, 2014. (Current issue ISSN 0019-5499).
8. Erick Guilherme Peixoto de Lucenaa, Luis Felipe Milano Teixeirab *et al.* Hypopressive Exercise in Normotensive Young Women: 1 A Case Series**. (**Journal ofBodywork & Movement Therapies), 2020.
9. Beatriz Navarro Brazalez PT, PhD[1] Beatriz Sanchez Sanchez PT, PhD[1] *et al*. Pelvic floor and abdominal muscle responses during hypopressive exercises in women with pelvic floor dysfunction. (Neurology and Urodynamics), 2020, 1-11.
10. Bandopadhyay P, Vermat SS *et al*. Age and height as predictors of peak expiratory flow rate in Indian girls. (Annals of human biology,1993:20(2):147-53.
11. Ji Won Han, Young Mi Kim*. Effect of breathing exercises combined with dynamic upper extremity exercises on the pulmonary function of young adults. Journal of back and musculoskeletal rehabilitation -1, 2017, 1-5.
12. Soriano[1] L, Carmona [2] L. The abdominal hypopressive technique be used to treat low back pain? (Health Professionals in Rheumatology Abstracts), 2018.
13. Eunyoung Kim PhD, PT[1] Hanyong Lee PhD[2]*. The Effects of Deep Abdominal Muscle Strengthening Exercises on Respiratory Function and Lumbar Stability. (J. Phys. T her. Sci, 2013, 25(6).
14. Banu Kalpakcioglua, Turgay Altınbilekb, Kazım Senelc. Determination of spondylolisthesis in low back painbyclinical evaluation. (Journal of Back and Musculoskeletal Rehabilitatio,2009:22:27-32.
15. Ian Gregg, Nunn AJ. Peak Expiratory Flow in Normal Subjects (British Medical Journal,1973:3:282-284.
16. Caufriez M, Techniques abdominales hypopressives et rééducation urogynécologique. Kinésithérapie Sci, 1995:1:53-55.
17. Bellido-Fernández L, Jiménez-Rejano JJ *et al*. 'Effectiveness of Massage Therapy and Abdominal Hypopressive Gymnastics in Nonspecific Chronic Low Back Pain: A Randomized Controlled Pilot Study'. (Evidence-Based Complementary and Alternative Medicine Article ID 3684 194), 2018.
18. Leire Juez, Jorge M, Núñez Córdoba *et al*. 'Hypopressive technique versus pelvic floor muscle training for postpartum pelvic floor rehabilitation: A prospective cohort study'. (Neurourology and Urodynamics. Wiley Periodicals.inc), 2019.
19. Beatriz Navarro-Brazález, Virginia Prieto-Gómez *et al*. 'Eectiveness of Hypopressive Exercises in Women with Pelvic Floor Dysfunction: A Randomised Controlled Trial'.(J. Clin. Med),2020:9:1149.
20. Skinner JS. Exercise testing and exercise prescription for special cases: theoretical basis and clinical application. Lippincott Williams & Wilkins, 2005.