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Effect of Buteyko Breathing Technique on Cardiorespiratory Parameters in Obese Young Adults: A Pretest Post Test Quasi-Experimental Pilot Study

H. Vaish[1*], D. Sharma[2]

[1] Dept. of Cardiopulmonary Physiotherapy, MMIPR, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana, India
[2]UIHS, CSJM University, Kanpur, Uttar Pradesh, India

[*]*Corresponding Author: hina22vaish@gmail.com, Tel.: +919450124758*

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Abstract—Background: Obesity is risk factor for several chronic illnesses. The respiratory complications of obesity encompass of an increased demand for ventilation, increased work of breathing, respiratory muscle inefficiency. Higher BMI is a predisposing factor of hypertension. BBT (Buteyko breathing technique) is a breathing strategy that is used to treat different symptoms
Objective: The study aimed to evaluate the effect of BBT on cardio-respiratory parameters in obese young adults.
Methodology:15 asymptomatic obese (BMI$\geq$29.9 Kg/m^2 and $\leq$ 39.9Kg/m^2), adults (18-30years) were recruited were enrolled for this preliminary one group pre-test post-test quasi-experimental study. Subjects practiced Buteyko Breathing twice daily for one week. Baseline heart rate (HR), BP, rate of perceived exertion (RPE) and lung function were noted at pre-test evaluation. Post-BBT, evaluation was done for outcome measures.
Result and conclusion There was significant improvement in HR, systolic BP and RPE The impact on BP, heart rate are similar to slow breathing but improvement in various pulmonary functions is need to be explored in obese subjects.

Keywords—Breathing exercise, body mass index, lung function, physiological variables

I. INTRODUCTION

The prevalence of obesity has increased globally in recnet years. Obesity is risk factor for several chronic illnesses. The respiratory complications of obesity encompass of an increased demand for ventilation, increased work of breathing, respiratory muscle inefficiency [1]. The effect of obesity on spirometry is complex and affected by the grade of obesity, kind of body fat distribution and age. Obesity is modifiable risk factor of hypertension as well. Higher body mass index (BMI) is a predisposing factor of hypertension [2].

Buteyko breathing technique (BBT) is a breathing strategy named after its originator, Dr. Konstantin Pavlovich Buteyko and is used to treat different symptoms and conditions including asthma, diabetes, sleep apnea, anxiety, depression which is related to dysfunctional breathing [3].

Obese individuals may possibly develop breathing difficulties and also have susceptibility for upsurge in blood pressures. To the best of our awareness not any study till date has assessed the outcome of Buteyko breathing on obese subjects. The study was thus aimed to assess the effect of BBT on cardio-respiratory parameters in obese young adults.

Rest of the paper is organized as follows, Section II contain the related work of Buteyko breathing technique, Section III contain the methodology, Section IV describes the statistical analysis, Section V describes results and discussion, Section VI concludes research work with future directions.

II. RELATED WORK

Courtney R et al has discussed about strengths, weaknesses, theories and possibilities of the Buteyko Breathing Method [4].
Bowler S D et al. has studied the effect of Buteyko breathing technique in asthma in a randomized control trial and reported the BBT is effective in improving symptoms of asthma patients [5]

III. METHODOLOGY

The study protocol was approved by the institutional ethical committee and was done in accordance with the Declaration of Helsinki (revised 2013) and National

Ethical Guidelines for Biomedical Research and Heath involving Human Participants (ICMR 2017).

The sample size of 12 is sufficient to meet the sample size prerequisites of pilot study [6]. Hence, 15 asymptomatic obese subjects (6 females, 9 males) aged 18-30 years were enrolled for this preliminary one group pre-test post-test quasi-experimental study.

Subjects were included if they were of BMI $\geq$ 29.9 Kg/m^2 and $\leq$ 39.9 Kg/m^2 [7] with stable vital, nonsmoker, absence of any acute disease in the 6 weeks preceding the study and any difficulty to perform physical exercise or walking. Criteria for exclusion: resting heart rate (HR)$\geqslant$100 beats per minute, systolic blood pressure(BP)>139 mmHg and diastolic BP>89 mmHg, individuals involved in regular exercise or sports, pregnant and lactating females.

All the selected subjects were informed in detail about the study. The subjects were requested to sign the consent form prior to the study. Body weight (kg) and height (cm) were measured and BMI=Weight/Height^2 (kg/m^2) was calculated.

Baseline heart rate, BP (HEM7111, Omron, Tokyo, Japan), spirometry variables [Forced expiratory volume in first second (FEV_1), Forced Vital Capacity (FVC), FEV_1/FVC, were taken at rest. Rate of perceived exertion (Modified Borg Scale) was recorded after the six minute walk test (6MWT). 6MWT was performed according to the ATS guidelines on a 30m indoor track with hard surface [8]. Spirometry was done following the standardized guidelines for spirometry and FEV_1 (forced expiratory volume in first second), FVC (Forced vital capacity) and FEV_1/FVC were recorded.[9]. Three readings of BP were recorded and mean value was taken for analysis.

Subjects were familiarized with BBT [4]. Participants were instructed to sit quietly in a chair, relaxed and breathe normally. They were then asked to breathe gently in and out in time and at the end of a normal exhalation to pinch their nose and hold the breath. The Control Pause time was noted for the particular individual followed by normal inspiration and expiration. They were then asked to breathe gently in and out in time and at the end of a normal exhalation to pinch their nose. Maximum Pause involves holding the breath after a gentle exhalation. They were then asked to breathe gently in and out in time followed by a control pause.

The BBT was given twice daily to all the subjects for one week under supervision of the researcher. After one week HR, BP, lung functions were recorded. 6MWT was conducted again and RPE was recorded.

IV. STATISTICAL ANALYSIS

Normality of data was assessed by Shapiro wilk test. Data was presented as mean and standard deviation for all continuous variables. Comparison of pre and post variables was done by using paired t test. A p value < 0.05 was considered as statistically significant. All the analysis was done using Microsoft Excel 2007 (Microsoft Corporation , Washington) and software SPSS 16 (SPSS, Inc, Chicago, Illinois)

V. RESULTS AND DISCUSSION

All 15 subjects performed BBT for one week and there were no drop outs. The demographic characteristics of the subjects are described in table 1.

Table 1: Demographic characteristics of the subjects

Characteristics	Mean ± SD
Age (years)	25.73±2.04
Height (m)	155.28±6.46
Weight (Kg)	80.28±9.98
Body Mass Index (Kg/m^2)	33.27±2.39

SD = standard deviation

There were significant changes in systolic BP, HR and RPE after performing one week of BBT in obese subjects. The results of effect of BBT on cardiorespiratory parameters are shown in table 2.

Table 2: Pre and post intervention effect of Buteyko breathing technique on cardiorespiratory parameters

Variable	PRE TEST Mean ± SD	POST TEST Mean ± SD	p
Heart Rate (bpm)	89.56 ± 4.19	84.64± 3.93	0.04*
Systolic BP (mmHg)	130.55± 6.23	124.67± 5.45	0.001*
Diastolic BP (mmHg)	84.62 ± 4.13	83.86 ± 3.42	0.72
RPE	2.53± 0.27	1.04± 0.31	0.002*
FEV_1 (lit/sec)	2.67± 0.56	2.79± 0.49	0.59
FVC(lit)	3.19 ± 0.41	3.29± 0.38	0.64
FEV_1/FVC (%)	83.84±4.65	84.43±3.55	0.44

*Significant at P < 0.05 (2-tailed).SD = standard deviation; FVC = forced vital capacity; FEV_1 = forced expiratory volume in 1 second; BP = blood pressure; RPE = rate of perceived exertion

Slow breathing improves arterial baroreflex senstivity and decreases BP [3] Slow device guided breathing lowers respiratory rate, modifies respiratory pattern and lowers BP.

There was significant effect of BBT on RPE and heart rate in obese subjects. The Buteyko Method teaches to voluntarily follow a small lack of air sensation during breathing exercise, and this might consequence in a positive change in the individual's response to breathing difficulty when it ascends spontaneously during exercise [4]. Repeated use of extended breath holds increases the body's production of endogenous antioxidants and raises the anaerobic threshold, thus increasing capacity to exercise at higher levels of exertion [5].

The other possible biochemical mechanism of BBT for improvement in variables may be through its effect on nitric oxide (NO). BBT insists on nasal breathing and a great percentage of the body's NO levels are made in the paranasal sinuses [10]

The probable reason for no change in spirometric variables may be short period of protocol. Also, studies with the Buteyko Method have found that resting carbon dioxide levels do not change after Buteyko training despite reported improvement in symptoms [6].

The limitation of the study should be acknowledged while interpreting the results. The sample of convenience was taken though utmost care was taken through strict inclusion and exclusion criteria. Also the study was of short duration with no follow up so it is difficult to say how long the effect of BBT would be retained.

VI. CONCLUSION AND FUTURE SCOPE

The impact of Buteyko breathing technique on blood pressure, heart rate are similar to slow breathing which has beneficial effects on long term but improvement in various pulmonary function is not well established and needs further exploration.
Long term researches are needed to search the effect of Buteyko breathing technique on various lung functions in obese subjects.

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AUTHOR CONTRIBUTIONS
H Vaish and D Sharma designed the study, conducted the research work, provided research material. H Vaish collected the data. Both authors reviewed and approved the manuscript.

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AUTHORS PROFILE

H Vaish has pursued BPT from CSJM University, Kanpur, India and MPT (cardiopulmonary) from Jamia Hamdard University, New Delhi, India in 2009 and 2012 respectively. She is currently working as Assistant Professor in MMIPR, MM(DU), Mullana, Ambala, Haryana, India. She is a life member of IAP. She has published in reputed international journals including Thomson Reuters (SCI & Web of Science). She is a member of Mendeley Advisor Community.Her main research work focuses on Physiotherapy, obesity, women health and exercise testing.

D Sharma had pursued PhD in Physiotherapy in 2019. He is working as faculty at UIHS, CSJM University, Kanpur, India since 2004. He is member of IAP, Singapore Association of Physiotherapy and Red Cross Society of India. He has organised six conferences and has got several papers published in national and international journals. His main research work focuses on musculoskeletal conditions

