Original Article

Access this article online

Quick Response Code:

Website: www.bldeujournalhs.in

DOI: 10.4103/bjhs.bjhs_46_22

A preliminary randomized, single-blinded, placebo-controlled clinical dose–response study to elucidate the effect of ongoing isometric contraction of muscles on the vital capacity of lungs on administering *Blatta orientalis*

Usha Kushwaha[1], G. Supriya[1], Balakrishnan Nair[2], Kathika Chattopadhyay[3], Ashwini Nair[4], Sanjay Vishwakarma[1]

[1]Department of Physiology, Bakson Homoeopathic Medical College and Hospital, Noida, Uttar Pradesh, India, [2]Faculty of Health and Environmental Sciences, Auckland University of Technology (AUT), Auckland, New Zealand, [3]Department of Psychiatry, Bakson Homoeopathic Medical College and Hospital, Noida, Uttar Pradesh, India, [4]Department of Materia Medica, Bakson Homoeopathic Medical College and Hospital, Noida, Uttar Pradesh, India

Address for correspondence:
Dr. Balakrishnan Nair, Auckland University of Technology, Auckland, New Zealand.
E-mail: bnair@aut.ac.nz

Received: 25-03-2022
Revised: 23-05-2022
Accepted: 02-06-2022
Published: 14-11-2022

Abstract:

INTRODUCTION: *Blatta orientalis* is an indicated remedy for asthma and other chronic obstructive pulmonary diseases in homeopathic medicine. Preclinical studies indicate that *B. orientalis* shows anti-asthmatic properties in animals when induced with bronchospasm using acetylcholine through nonselective anticholinergic and antihistaminic activities. However, no studies have explored the changes in the vital capacity of the lungs on administering the homeopathic remedy, *B. orientalis*. It is shown that isometric contraction of pectoral muscles enhances the vital capacity of lungs by increasing ventilation and decreasing alveolar partial pressure of carbon dioxide. It can act as a valuable tool for monitoring the vital capacity of the lungs before and after administration of *B. orientalis*.

AIM: This preliminary research takes the first step toward exploring vital capacity through a randomized, placebo-controlled study elucidating the effects of ongoing isometric contraction of muscles on the vital capacity of lungs of healthy individuals on the administration of *B. orientalis* in different potencies. It aims to compare changes in the vital capacity of lungs in healthy participants during an acute bout of isometric contraction by handgrip dynamometer after administration of *B. orientalis*.

MATERIALS AND METHODS: Eighteen participants who fulfilled the inclusion criteria gave voluntary consent to participate in this research study. The research team measured the Tmax (measured by handgrip dynamometer) and the vital capacity (measured by a vitalograph) of these participants at the baseline. The participants were then placed into three-medicine arms to administer medicine orally: Arm 1 – *B. orientalis Q,* Arm 2 – *B. orientalis 30C,* and Arm 3 – placebo, following allocation of six participants in each medicine arm. Lottery method was used for grouping participants randomly to each medicine arm. The participants were numbered from 1 to 18 using the lottery method, and it was made sure that each arm had one male and five females to have similar gender distribution. The research team blindfolded the participants with a cloth bandage (*dupatta*) before categorizing them into different medicine arms. The team measured each participant's Tmax and vital capacity, and then administered one dose of the assigned medicine. The team measured the Tmax and vital capacity of the participants after 10 min of administering the medicine. The process was repeated after every 24 h for 3 consecutive days.

RESULTS: The effect of ongoing isometric contractions of the skeletal muscles on the vital capacity

How to cite this article: Kushwaha U, Supriya G, Nair B, Chattopadhyay K, Nair A, Vishwakarma S. A preliminary randomized, single-blinded, placebo-controlled clinical dose–response study to elucidate the effect of ongoing isometric contraction of muscles on the vital capacity of lungs on administering *Blatta orientalis*. BLDE Univ J Health Sci 0;0:0.

acted as a great tool to measure improvement in vital capacity. The vital capacity of the lungs was significantly decreased after oral administration of *B. orientalis Q* and *B. orientalis 30C*, whereas there was no significant effect found in the arm that received a placebo.

CONCLUSION: This preliminary study shows that *B. orientalis* decreases the vital capacity of lungs in healthy subjects and calls for further exploration of its action in higher potencies and with wider experimental parameters. Following the Law of Similimum, this inference also adds to the research scope on the potential of this homeopathic medicine in patients with restrictive lung diseases where the vital lung capacity gets significantly decreased.

Keywords:

Anti-asthmatic, *Blatta orientalis,* isometric contraction, lung capacity, vital capacity

The literature on homeopathy rightly recognizes the potential of *Blatta orientalis* for its quite distinctive therapeutic usefulness in respiratory illnesses. *B. orientalis* is an indicated remedy for asthma and other chronic obstructive pulmonary diseases (COPDs) 19. Preclinical studies suggest that *B. orientalis* shows anti-asthmatic properties in animals when induced with bronchospasm using acetylcholine through nonselective anticholinergic and antihistaminic activities.[1] *B. orientalis* also showed anti-anaphylactic properties by stabilizing mast cells, lowering elevated IgE antibodies, and reducing eosinophils.[2]

Nasal gel formulation of *B. orientalis* in milk aspiration induced eosinophilia in animals due to its strength *in vivo* inhibitory effects on IgE production and eosinophil granulocytes.[2] The occurrence of dyspnea and asphyxia convulsions was delayed in guinea pigs treated with the drug due to decreased eosinophils and inhibition of IgE production.[1] A study on the hemolymph of *B. orientalis* showed antibacterial activities against *Staphylococcus aureus*, *Proteus mirabilis*, *Salmonella typhi*, *Pseudomonas aeruginosa,* and *Escherichia coli*.[3] The study reported that the chemical constituents of hemolymph were triazoles, thiophenes, secondary sulfonamide, vinyl halides, sulfinic acid, secondary amide, bromo compounds, cycloheptane, aldehyde/ketone group, and methylene groups.[3] In asthmatic patients, these microorganisms can cause airway hyperresponsiveness and inflammation which can lead to increased bronchospasm.[3]

The findings on an isometric contraction of pectoral muscles enhancing vital capacity and the ability of *B. orientalis* to treat respiratory illness like COPD have influenced the current research, paving a path toward a less explored area of investigating the ability of the medicine to treat respiratory diseases in humans. This finding expands the scope of current research, thus establishing this method of investigation as safe and non-invasive.[4] This first step toward its exploration was taken by this preliminary study which attempted to elucidate the effects of ongoing isometric contraction of muscles on the vital capacity of lungs of healthy individuals on the administration of *B. orientalis* in different potencies through a randomized, placebo-controlled study. This preliminary single-blinded dose–response study also compared changes in the vital capacity of lungs in healthy participants during an acute bout of isometric contraction with the handgrip dynamometer after administration of *B. orientalis Q* and *B. orientalis 30C*.

Isometric contraction is the muscular contraction against resistance in which the muscles' significant physical shortening is observed when the muscle contracts against a strong spring during gripping. In such isometric contractions, this rise in tension is abrupt and commences early with a more extended period of contraction and gradual relaxation.[5] Studies report that isometric handgrip exercises activate the autonomic nervous system to increase adrenaline, noradrenaline, and adrenomedullin in healthy individuals.[6] These contractions increase individuals' heart rate and mean arterial blood pressure, modestly increasing their cardiac output. Isometric contraction of skeletal muscles causes a marked increase in ventilation with decreased alveolar partial pressure of carbon dioxide,[7] thus acting as a valuable tool for increasing the vital capacity. Vital capacity is the air volume that an individual can breathe out by maximal expiratory effort after a maximum inspiration.[8]

Studies have reported that higher levels of physical activities are associated with improved lung function in healthy adults[9] and, therefore, found a positive association between physical activities and spirometric indices.[10,11] This association attributes to the muscle strength of individuals, primarily measured by their handgrip strength,[12] the force produced due to joint activities of the deep and superficial hand and forearm muscles during gripping.[13] Handgrip strength test is an inexpensive, noninvasive, and objective indicator of an individual's health status and muscle strength,[14] commonly used in studies to monitor isometric contractions.[15] This tool can discriminate between the presence/absence of lung diseases and even between intermittent and moderate persistent asthma in children, therefore, used as a complementary tool in daily clinical practice to monitor asthma.[16]

Based on a systematic review of the literature around *B. orientalis*, although studies have investigated the effectiveness of the medicine in the treatment of bronchial asthma,[17] there is a dearth of studies on human beings that measure changes in vital capacity with ongoing isometric contraction on oral administration of this homeopathic medicine. In the current research, the team monitored the vital capacity of the lungs – before and after administering *B. orientalis Q and B. orientalis 30C* and compared them with placebo. The changes in vital capacity were measured with the aid of a noninvasive device called a vitalograph while the individual maintained an ongoing handgrip strength. This preliminary study explored *B. orientalis* capacity to improve the vital capacity of lungs and calls for its further exploration. It attempts to further expand on the potential of such homeopathic medicine in patients with diseases where the vital capacity of the lungs gets significantly affected.

Materials and Methods

The research was conducted on the campus of the Homoeopathic College. The research information was shared with 100 students present on the campus when the study was advertised. Twenty-seven out of 100 students showed interest in participating, 18 fulfilled the inclusion criteria, while 9 were excluded due to smoking habits, previous medication, and history of illnesses in the exclusion criteria. The 18 participants signed the consent form to get included in this research. These participants were healthy young adults between the age group of 18 and 25 years. It was assumed that young adults within this age range would have mature lungs and hence have normal vital lung capacity.[18]

The health status for inclusion in the study was also determined based on their blood counts, urinalysis, and chest X-rays. The age, height, and arm circumference of participants were measured at baseline. Once found eligible, they were randomly divided into three arms with six participants for each arm. Each participant was given one number from 1 to 18 as a pseudonym [Table 1]. The participants were blinded by tying a piece of cloth (*dupatta*) around both their eyes. They were then allotted to one of the three investigational arms as described in the below sections. The study was conducted, and the measurements were taken on October 13, 2020, October 14, 2020, and October 15, 2020.

Inclusion criteria

a. Healthy participants from any gender
b. Age group between 18 and 25 years
c. Anthropometric upper arm circumference between 23.5 cm and 31 cm
d. Willing to participate voluntarily and have signed consent.

Exclusion criteria

a. History of bronchial asthma
b. History of emphysema
c. History of space-occupying lesions of the chest
d. History of lower respiratory tract infection in the past 6 months
e. Participants who were ever diagnosed with coronavirus infection
f. History of paralysis
g. History of chronic bronchitis
h. History of congenital heart disease
i. History of rheumatic heart disease
j. History of seizure disorders
k. History of acute flaccid paralysis
l. History of mental illness
m. History of any visible limitation in either hand, surgery in hand or wrist in the last 3 months
n. History of smoking in the past 1 year
o. Not willing to participate in the study.

Investigational medicines and administration

The *B. orientalis Q* and *B. orientalis 30C* each of 30-ml sized bottles were purchased from a local homeopathic pharmacy. Placebo was constituted of "rectified spirit" with alcohol of 95% v/v. The placebo was also poured into a 30-ml glass vial with a similar dropper

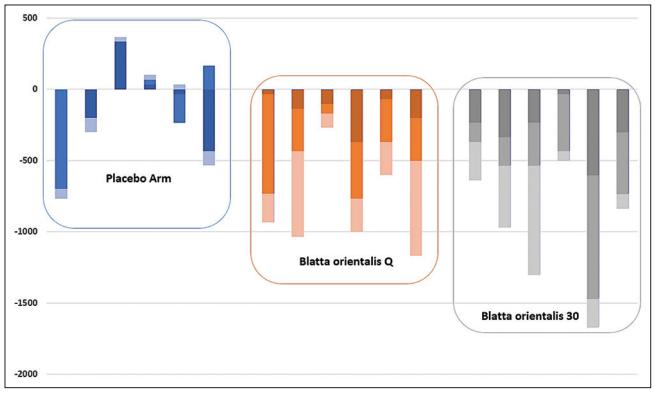

Figure 1: Daily cumulative variations of vital capacities (in cm^3) for participants in each arm after administration of assigned medicine. Initial days are indicated with a darker shade

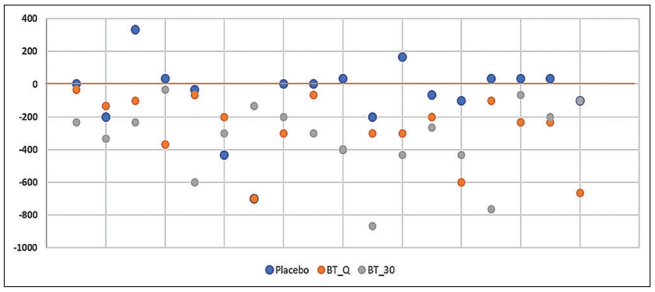

Figure 2: Scatter plot for the variations in vital capacities (in cm^3) after administering investigational medicines for all 3 days put together

to the one used by the above brand to maintain dosage uniformity. Both investigational medicines and placebo will be referred to as "investigational medicines" in the following content.

Nonmedicated plain globules of no. 30 size prepared from pharmaceutical-grade cane sugar conforming to the pharmacopeia standards and quality control measures were used as a vehicle for preparing administrative doses that absorb alcohol uniformly. Three airtight vials of 1-dram size were used for the preparation and administration of doses. These vials were made up of 100% pharma grade, nonreactive, virgin plastic. The vials were labeled and color coded based on the medicine arms and kept separated.

Investigational arms

Three-medicine arms were constituted as follows to administer the abovementioned two homeopathic medicines and one placebo – Arm 1 – *B. orientalis* Q, Arm 2 – *B. orientalis* 30C, and Arm 3 – placebo following random allocation of six participants into each medicine arm.

Three 1-dram vials were freshly prepared for each investigational arm following Hahnemann's method of medication[19] using no. 30 globules. Around eight drops of the three investigational medicines were poured carefully into their respective vials using that moistened every globule in the space of 1 min at the Physiology Laboratory of Homoeopathic Medical College and Hospital, keeping necessary precautions in mind. Each investigational medicine was handled at different times and by different team members. They were fastened with differently colored caps, labeled, respectively, using a black sharpie, and kept separated for administration. From each investigational medicine, six globules were considered one standard dose.

The prepared 1-dram vials were labeled as below:

a. *Q* representing bottle containing *B. orientalis* Q
b. *30C* representing bottle containing *B. orientalis* 30C
c. *S* representing bottle containing placebo.

As discussed above, 18 participants who fulfilled the inclusion criteria gave voluntary consent to participate in this study. The research team measured the Tmax (mean compressing force of muscles) and the vital lung capacity of these participants at the baseline. Arm circumference and height of all participants were also measured to standardize the Tmax and vital lung capacities. The participants were then placed into three arms to administer medicines: Arm 1 – *B. orientalis Q*, Arm 2 – *B. orientalis 30C*, and Arm 3 – placebo, following random allocation of six participants into each medicine arm. The research team blindfolded the participants with a cloth bandage (*dupatta*) before categorizing them into different medicine arms. One dose of the assigned medicine was administered to each participant. Table 1 shows the baseline data for the participants and the arms they were allocated to.

Measuring Tmax and vital capacity of lungs

The following process was used to measure the Tmax of each participant. A handgrip dynamometer for measuring Tmax was developed due to isometric contraction exercise. This device consists of two hollow metal tubes connected through a flexible metal strip. A graduated pressure scale between the two handles is used for directly recording the compressing force.[20] The participants were requested to stand with arms at the sides with elbows slightly bent and hold a handgrip dynamometer in their dominant hand for a full grip. They were requested to squeeze the device once only. The research team recorded the compressing force or tension indicated on the device. This process was repeated after 1-min pause to exclude any fatigue in muscles. A mean of the two readings was considered their Tmax.

For measuring the vital lung capacity of participants, a vitalograph was used. This device is used in hospitals and sports medicine for measuring lung volume against time. It consists of a cylindrical chamber, having an outer container filled with water of 6-l capacity (corresponding to average lung capacity) in which a light metal gas bell floats. The bell is attached to a chain with a graduated pulley and a spring-mounted indicator needle. The movement of pulley indicates the volume of air presents in the bell.[19] The participants were requested to sit comfortably, facing the vitalograph, and breath normally (quietly) for a minute. This process was followed by requesting them to inspire as deeply and as fully as possible, followed by expelling out all the air with maximum effort into the vitalograph through a mouthpiece. As the bell moved up, the pointer on the pulley indicated the volume of expired air. The participants were advised to make the forced expiration deep and quick but without haste. The research team took three readings at an interval of 5 min, and the mean of these measurements was considered the vital capacity of the lungs of each participant.

The research team measured the Tmax and vital lung capacity of the participants from 10 min of administering the investigational medicine [Table 2]. Each participant was blindfolded for 20 min at each step that required blinding for a total of 2 h approximately. The cloth bandages were removed only after the complete procedure for that day was over, and the investigational medicines were stored securely. The measurements of one participant were taken at one time,

and the uniformity of the dose measurement time gap was ensured. The measurements were not shared with the participants, and they were advised to feel normal during the procedure. The idea was to avoid any kind of bias or intention to overdo or underdo during the measurement procedures. As the same devices were used for each participant, the devices were checked for recalibration requirements to the standard and recalibrated if needed to ensure an accurate reading. The process was repeated after 24 h for 3 consecutive days.

Participant safety

This research involved a vitalograph in taking respiratory measurements, and among its components, mouthpieces have a significant risk of contamination. Hence, hygiene, disinfection, and infection control were of utmost importance for this study. The research team cleaned the mouthpiece and wiped other exposed parts of the device with alcohol after every use. The handgrip dynamometer was also wiped with alcohol after each participant's measurements.

Ethical clearance

The study followed the conditions laid down in the Declaration of Helsinki. Participation was voluntary, and informed consent was obtained from participants prior to the commencement of the study. The study followed the Guidelines for Good Clinical Practice, which are described in the documents by the International Conference on Harmonization and the European Central Council of Homeopaths (Guidelines for Homeopathic Provings).[21] The hospital's Ethics Committee approved the study protocol, the approval number of which has been included.

Data analysis

A paired *t*-test was used to analyze the measurements of respiratory function parameters, before and after administering medicines for each investigational medicine arm. Analysis was done while keeping a 95% confidence interval (CI). For such samples, a 95% CI is effective when measuring the significance of differences between matched pairs of pre- and posttest readings for normal distributions using a paired *t*-test.

Results

As discussed in the methods section, 18 participants were randomly grouped into three medicine arms. Most participants were females (n = 15). The mean age was 21.7 years (range: 18–25, standard deviation: 2.04), and the median age was 22.5 years. The average height was 161.4 cm (males: 176 cm, females: 159 cm, overall range: 156–180, standard deviation: 6.6 cm), and the median height was 159 cm. The mean mid-arm circumference was 29.4 cm (males: 32.6, females: 28.8, overall range: 21–38, standard deviation: 3.8 cm), and the median circumference was 29 cm. The degree of skewness was higher for height measurements as the males were significantly taller than females. However, a normal distribution was observed for overall measurements of mid-arm circumferences. However, keeping the gender variations in mind, these readings depicted that the participants had minimum outliers during height measurements and met the inclusion criteria for a mid-arm circumference measurement of 23.5 cm to 31 cm – an average mid-arm circumference for this age group. Both arms had the same ratio of male and female gender which was 5:1.

The vital capacity and Tmax measurements were significantly lowered after administration of investigational medicines for both Arm 1 with *B. orientalis* Q and Arm 2 with *B. orientalis* 30C, whereas the participants in the placebo arm (Arm 3) did not show significant changes in their vital capacities or Tmax. The variations in vital capacity before and after oral administration of assigned medicine for each arm for successive 3 days are compared in Figure 1. The figure clearly indicates that the participants who were administered *B. orientalis* showed a significant decrease in their vital capacities.

Another surprising finding was that most of the figures remained below zero in terms of variation of vital capacity after administration of investigational medicines, while not much difference was seen in the placebo arm. The scatter diagram shown in Figure 2 indicates the difference in vital capacity after administering *B. orientalis*. The values that are less than zero indicate a significant reduction in vital capacities in participants in the investigation medicine arms. These values are indicated in Table 2, which also details the randomization of participants and their respective readings of Tmax and vital capacities. Similar findings were observed with Tmax measurements, where the readings were highly significant in Arm 1 and 2 while least significant in the placebo arm. From these findings, it can be interpreted with ease that the medicine has reduced the vital capacity of lungs of the participants in *B. orientalis* arms.

As stated earlier, for all statistical tests, the degree of freedom was 5, with a CI of 95%. *Post hoc* tests showed [Table 3] that a decrease in vital capacity with ongoing isometric contraction was significantly higher after administration of *B. orientalis* Q and 30C both in all 3 days. The test revealed no significant difference in the placebo arm. Comparing Q and 30C potencies of *B. orientalis*, an overall higher significance was seen for the effects for 30C potency (P = 0.0003 Day 1, 0.0005 Day 2, and 0.003 Day 3) while *B. orientalis* Q also showed

a significant effect on all 3 days (P = 0.0077 Day 1, 0.0001 Day 2, and 0.0008 Day 3)

Discussion

The team carried out this research to investigate the prediction of changes in the vital capacity of lungs during acute bouts of isometric contraction after administration of *B. orientalis* Q, 30C and placebo (non-medicated cane sugar globules) in healthy young adults. This study showed that oral administration of *B. orientalis* in Q and 30C potency decreases Tmax and vital capacity of lungs in subsequent 3 days. No such increase or decrease relationship was found in Tmax and vital capacity of lungs on oral administration of placebo. The evaluation of vital capacity of lungs suggested that *B. orientalis* 30C had a significantly higher mean lung capacity than *B. orientalis* Q. Therefore, vital capacity with ongoing isometric contraction parameters assessed was significantly reduced with oral administration of *B. orientalis* Q and 30C.

The statistical dissimilarities could be attributed to factors such as smaller sample size, increased age, and high sedentary state of participants. The shorter age range (18–25 years) of the participants may have limited the generalizability of our findings. The participants selected for this study were well-informed individuals who may be aware of keywords used in the study. However, blinding was used to avoid bias from the participants while no prompts or names of the medicine were mentioned or shared with the participants. Furthermore, factors such as physical activity and ethnicity that influence lung function were not evaluated in this study. The research team strongly believes that the practical implications and benefits of this study are more valuable than these limitations as it provides the groundwork indication that *B. orientalis* would increase the vital capacity of patients with respiratory illnesses.

Table 1: Baseline figures for the participants in various arms

P.No.	Age (Yrs.)	Gender (Binary)	Weight (Kg.)	Mid-arm circumference (cm.)	Arms
1	23	Female	55	23	S
2	24	Female	53	25	S
3	18	Female	43	23	S
4	23	Female	57	26	S
5	19	Female	60	27	S
6	21	Male	68	30	S
7	24	Female	70	29	Q
8	22	Female	68	31	Q
9	20	Female	50	23	Q
10	19	Female	40	25.5	Q
11	19	Female	48	26	Q
12	23	Male	70	31	Q
13	25	Female	65	28	30C
14	23	Female	62	26.5	30C
15	23	Female	50	23	30C
16	22	Female	75	30	30C
17	21	Female	53	24	30C
18	23	Male	80	32	30C

Table 2: Changes in Tmax (x%v) and vital capacities (cm3) for all 3 days before and after administration of medicine and categorized into three medicine arms

Ppt.	DAY 1				DAY 2				DAY 3			
	Before		After		Before		After		Before		After	
	Tmax	VC	Tmax	VC	Tmax	VC	Tmax	VC	Tmax	VC	Tmax	Vc
Placebo												
1	10	2833	12	2833	11.5	2167	6.5	1467	9.5	2200	9.5	2133
2	10	2300	8	2100	10	2000	10	2000	11	2033	10	1933
3	17	1233	11.5	1567	9	1600	9.5	1600	6.5	1567	8	1600
4	23.5	1866	9.5	1900	19.5	1900	17	1933	17	1800	15.5	1833
5	12.5	1933	5	1900	10	1900	9	1700	6.5	1367	5	1400
6	22.5	3500	35	3067	25.5	2967	32	3133	34.5	3200	36	3100
ARM 1												
7	11.5	2366	11	2333	21	2233	16	1533	21	2167	12	1967
8	25	2266	22	2166	21.5	2300	20	2000	25.5	2100	15.5	1500
9	6	2367	5	2267	7	2167	4	2100	4	2000	3	1900
10	32	3067	31.5	2700	33.5	2933	31.5	2533	31.5	2633	29.5	2400
11	9.5	2300	8.5	2233	8.5	1933	6.5	1633	8	2300	7	2067
12	30	1933	23	1733	16.5	2033	14.5	1733	19.5	1733	19	1067
ARM 2												
13	48.5	3100	44	2867	50	2733	44	2600	44.5	2767	42.5	2500
14	18.5	1900	15	1567	20	1633	12.5	1433	19.5	1500	14.5	1067
15	11.5	2500	5.5	2267	8.5	2433	3.5	2133	4.5	2133	3.5	1367
16	2.5	1333	6	1300	9.5	1166	3	767	4.5	733	4	667
17	25	2267	18	1667	20.5	1900	19.5	1033	23	1500	17	1300
18	19	2067	17	1767	13	2133	9	1700	15	1633	7	1533

Table 3: *Post hoc* tests indicating a higher significance in Arms 1 and 2 compared to placebo

Arms Scores	Day 1			Day 2			Day 3		
	Placebo arm	Arm 1 (BO-Q)	Arm 2 (BO-30)	Placebo arm	Arm 1 (BO-Q)	Arm 2 (BO-30)	Placebo arm	Arm 1 (BO-Q)	Arm 2 (BO-30)
T- score	1.2086	2.8903	3.8281	0.9268	4.0942	3.6525	1.0101	3.5439	3.179
SED – std. error of diff.	123.8399	49.9452	75.4067	126.0615	84.1442	106.4107	27.72	95.5621	101.2894
P	0.4537	0.0077	0.0003	0.7081	0.0001	0.0005	0.62	0.0008	0.003
Mean Difference	149.6667	144.5	288.6677	116.8333	344.5	388.6667	28	338.6667	332

Homeopaths have been using potentized *B. orientalis* to treat cases of bronchial asthma characterized by suffocation with marked accumulation of mucus. This was proved accidentally in 1890 by a patient who happened to drink tea in which beetle had been infused.[22] Bronchial asthma is a chronic inflammatory disorder of the airway under the classification of obstructive respiratory diseases. The vital capacity may be standard or decreased in obstructive lung diseases, whereas vital capacity is decreased in restrictive lung diseases. The respiratory performances result from coordinated modulation of the autonomic nervous system by inputs from exercising muscles, joints, respiratory centers, and cardiovascular centers. The stimulation of sympathetic fibers results in activation of dilator fibers in bronchial muscles with constriction of pulmonary blood vessels.[19] This results in the dilation of the bronchus, hence allowing more expansion of lungs during breathing.

In addition, isometric contraction activates the sympathetic nervous system, which results in the dilation of the bronchial tree, hence increasing vital capacity. The knowledge that *B. orientalis* improves vital capacity expands the scope of research to expand its usability and potential in treating restrictive lung diseases where vital capacity is significantly decreased. In obstructive lung diseases, vital capacity of lungs remains same or slightly reduced, whereas in restrictive lung diseases, it is significantly decreased. It goes back to what has been mentioned in the aphorism 47 of the organon of medicine that "medicinal agents have an absolute unconditional power" to derange a person's health and thus the physician must judiciously choose the artificial morbific agent (medicine) that conformably does this process as it takes place in nature.[23] Therefore, the current study helps the prescribing parameters of *B. orientalis* as a treatment for restrictive lung diseases. Such a physiological effect can help to correlate the role of *B. orientalis* to enhance the sympathetic nervous system resulting in vital capacity; however, its further exploration warrants more research in this area.

Conclusion

This randomized, single-blinded, placebo-controlled dose–response study has elucidated the effect of ongoing isometric contraction of muscles on the vital capacity of lungs on administering *B. orientalis* Q and 30C while also comparing them with each other. This study helps to expand the knowledge of the usability of *B. orientalis* as a homeopathic medicine. The findings imply that *B. orientalis* Q and 30C decrease Tmax and vital capacity of lungs in normal healthy participants. Further studies with a bigger sample size are recommended to validate the outcome and usability in interstitial lung diseases.

Acknowledgments

The authors acknowledge Dr. SPS Bakshi, CMD, Dr. C. P. Sharma, Principal, all the supporting staff, and the student participants of Bakson Homoeopathic Medical College and Hospital, Greater Noida, Uttar Pradesh.

Financial support and sponsorship

This study was financially supported by the Bakson Homoeopathic Medical College and Hospital, Greater Noida, Uttar Pradesh, India.

Conflicts of interest

There are no conflicts of interest.

References

1. Chandrakant Nimgulkar C, Dattatray Patil S, Dinesh Kumar B. Anti-asthmatic and anti-anaphylactic activities of *Blatta orientalis* mother tincture. Homeopathy 2011;100:138-43.
2. Nimgulkar CC, Patil SD, Chauk DS. Evaluation of *Blatta orientalis* (Q) nasal gel formulation in milk aspiration induced eosinophilia. Pharm Dev Technol 2009;14:435-41.
3. Balasubramanian S, Priya K, Revathi I, Revathi A, Venkatesh P, Gunasekaran G, *et al*. Screening of antibacterial activity and biochemical assay from the haemolymph of cockroach *Blatta orientalis* (Linnaeus, 1758). J Entomol Zool Stud 2017;5:753-8.
4. Moore VC. Spirometry: Step by step. Breathe 2012;8:232-40.
5. John NA. CC Chatterjee's Human Physiology. Vol. 1. India: CBS Publishers and Distributors Private Limited India; 2019.
6. Hazari MA, Arifuddin MS, Junaid MA, Ali MA. Effect of ongoing isometric handgrip exercise on the inspiratory and expiratory reserve volumes. Natl J Physiol Pharm Pharmacol 2016;6:329-32.
7. Imms FJ, Mehta D. Respiratory responses to sustained isometric muscle contractions in man: The effect of muscle mass. J Physiol 1989;419:1-14.
8. David S, Sharma S. Vital Capacity. In: StatPearls. Treasure Island: StatPearls Publishing; 2022.
9. Luzak A, Karrasch S, Thorand B, Nowak D, Holle R, Peters A, *et al*. Association of physical activity with lung function in lung-healthy

German adults: Results from the KORA FF4 study. BMC Pulm Med 2017;17:215.
10. Berntsen S, Wisløff T, Nafstad P, Nystad W. Lung function increases with increasing level of physical activity in school children. Pediatr Exerc Sci 2008;20:402-10.
11. Nystad W, Samuelsen SO, Nafstad P, Langhammer A. Association between level of physical activity and lung function among Norwegian men and women: The HUNT study. Int J Tuberc Lung Dis 2006;10:1399-405.
12. Smith MP, Standl M, Berdel D, von Berg A, Bauer CP, Schikowski T, *et al*. Handgrip strength is associated with improved spirometry in adolescents. PLoS One 2018;13:e0194560.
13. Koley S, Kumaar S. Correlations of handgrip strength with selected hand-anthropometric variables in university softball players. Biomed Hum Kinet 2011;3:91.
14. Ortega FB, Silventoinen K, Tynelius P, Rasmussen F. Muscular strength in male adolescents and premature death: Cohort study of one million participants. BMJ 2012;345:e7279.
15. Mgbemena NC, Aweto HA, Tella BA, Emeto TI, Malau-Aduli BS. Prediction of lung function using handgrip strength in healthy young adults. Physiol Rep 2019;7:e13960.
16. Latorre-Román PÁ, Navarro-Martínez AV, Mañas-Bastidas A, García-Pinillos F. Handgrip strength test as a complementary tool in monitoring asthma in daily clinical practice in children. Iran J Allergy Asthma Immunol 2014;13:396-403.
17. Ram H, Choudhary P, Dewan D, Kumar A. Effects of *Blatta orientalis* on treatment of bronchial asthma: A prospective, non-randomised, open-label, observational study. Homoeopath Links 2021;34:182-90.
18. Kalhan R, Dransfield MT, Colangelo LA, Cuttica MJ, Jacobs DR Jr., Thyagarajan B, *et al*. Respiratory symptoms in young adults and future lung disease. The CARDIA Lung Study. Am J Respir Crit Care Med 2018;197:1616-24.
19. Ghai CL. Spirometry (Determination of vital capacity, Peak expiratory flow rate and lung volumes and capacities). A Textbook of Practical Physiology. Vol. 13. New Delhi: Jaypee Brothers Medical Publisher (P) Ltd.; 2013. p. 147-52.
20. Jain AK. Manual of practical physiology. New Delhi: Arya publications; 2003.
21. European Committee for Homeopathy. Homeopathic Drug Proving Guidelines. Bruxelles, Brussels: European Committee for Homeopathy; 2004.
22. Clarke JH. Dictionary of Practical Homeopathic Materia Medica, Blatta orientalis, Indian Cockroach. Noida: B. Jain Publishers; 1920.
23. Hahnemann S. Organon of Medicine. Noida: B. Jain Publishers; 2002.