

A COMPARATIVE STUDY OF PEFR AND MVV BETWEEN INDIAN BORN TIBETAN YOUTHS AND INDIAN YOUTHS

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ABSTRACT: BACKGROUND AND OBJECTIVE: Tibetans are the oldest population living permanently at high altitude (4000m). This ethnic group along with Sherpas may have been living at high altitude for longer than any other population. Previous research has shown Tibetans living at high altitude to have superior pulmonary functions. The size of the lungs relative to the size of the person varies depending on ethnic group and a host of environmental factors. Peak expiratory flow rate (PEFR) measurement is the easiest and cheapest method to evaluate respiratory functions. MVV tests the overall functioning of the respiratory system, the respiratory muscles, airway resistance and compliance of lungs and chest wall. So, the study was carried out to evaluate PEFR and MVV of healthy Tibetans youths born and brought up in India and compare their values with healthy Indian youths, to know whether Tibetans born and brought up in India (sea level) retain better respiratory parameters as their ancestors (born at high altitude). **MATERIALS AND METHOD:** A comparative study was conducted in which the PEFR and MVV of 50 Tibetan male youths born and brought up in Mundgod, North Karnataka district, Hubli, in the age group of 20-30yrs were compared with 50 Indian male youths matched for age and sex as controls. The PEFR and MVV were measured with spiroanalyser SPL-95. The obtained data was analysed using unpaired student's 't' test. **RESULTS:** The Indian born Tibetan male youths had a PEFR (L/sec) of value 8.18 ± 2.47 where as the corresponding value for Indian male youths was 4.86 ± 1.89 . The PEFR was higher in Indian born Tibetan male youths than Indian male youths. This was statistically highly significant at ($P < 0.001$). The Tibetan youths had a MVV (L/min) of value 116.16 ± 25.78 whereas the corresponding value for Indian youths was 101.49 ± 19.21 . The MVV was less in Indian youths than Tibetan youths. This was statistically significant at $p < 0.01$. **CONCLUSION:** Though both Indian born Tibetan male youths and Indian male youths share similar environmental challenges, this difference in PEFR and MVV has shown that Indian born Tibetan male youths have retained better respiratory parameters as their ancestors.

KEYWORDS: PEFR, MVV, Spiroanalyser-95, Tibetan youths, Indian youths.

INTRODUCTION: Functioning of the lung is assessed by lung function tests that are carried out routinely in clinical practice.¹ Peak expiratory flow rate (PEFR) is a measure of ventilatory capacity of the lungs and is regarded as a basic physiological parameter for the diagnosis, follow up and treatment of patients. Maximum breathing capacity (MBC) is the maximal volume of air that a subject can breathe per minute (the circumstances should be defined). When the manoeuvre is performed by voluntary effort, the index is called Maximal Voluntary Ventilation, it is usually measured over 15secs.² MVV tests the overall functioning of the respiratory system, the strength of respiratory muscles, airway resistance, compliance of lungs and chest wall. The value is decreased with moderately severe airways obstruction. As the manoeuvre for measuring MVV is largely effort

ORIGINAL ARTICLE

dependant and normal values very much, only a large reduction in MVV is clinically significant.³ The Tibetan highlands are one of the most extreme environments inhabited by humans. Many present-day Tibetan populations are thought to be descendants of people who have occupied the Tibetan Plateau since the mid-Holocene, between 7000 and 5000 years ago and possibly since the late Pleistocene, ~21,000 years ago. Tibetans exhibit a distinct suite of physiologic traits: decreased arterial oxygen content, increased resting ventilation, lack of hypoxic pulmonary vasoconstriction, lower incidence of reduced birth weight, and reduced hemoglobin (Hb) concentration (On average, 3.6 g/dl less for both males and females). Collectively, these traits strongly suggest that Tibetans have adapted uniquely to extreme high-altitude conditions. The genetic basis of this adaptation, however, remains unknown.² Tibetans have greater hypoxic and hypercapnic ventilatory responses, larger lungs, better lung functions and greater lung diffusing capacities than lowlanders. Tibetans are indeed better adapted for life and work at high altitude as compared to other populations and this adaptation might be inborn. It has been hypothesized for possible evolutionary genetic adaptation to high altitude among Tibetans.⁴ Therefore our hypothesis is that whether Indian born Tibetan youths whose ancestors had resided at high altitude for longer duration, are better able to perform pulmonary function tests as compared to Indians. These factors have made us to study respiratory parameters in these Indian born Tibetan youths just to know whether genes of Indian born young Tibetans still regulate better respiratory parameters as their ancestors or because of environmental factors, the effects have been waned over time.

MATERIALS AND METHODS: SOURCE OF DATA-This study was conducted on 50 healthy Tibetan male youths residing in Mundgod, North Kannada District, Karnataka and 50 Indian male youths, (students of KIMS College, Hubli) as controls in the age group of 20-30 years. **STUDY PERIOD-** This study was carried out during June 2011 to May 2012.

STUDY DESIGN: Comparative study.

Visits were made to Tibetan camp in Mundgod to sensitize Tibetan youths regarding objectives of the present study. This study was carried out at DTR (Doeguling Tibetan Resettlement) hospital, Mundgod, with permission from the hospital administrative officer. Assistance of local doctors and technician was obtained to inform the details of the tests to Tibetan youths in their own language. Tibetan youths in the age group of 20-30 years were invited to take part in this study. Random selection of subjects was carried out on the basis of following inclusion and exclusion criteria.

INCLUSION CRITERIA:

- Healthy young Tibetan males born and residing in India and never migrated to Tibet or to any other high altitude regions.

EXCLUSION CRITERIA:

- Youth born in India but travelled to Tibet or to any other high altitude regions.
- History of smoking.
- History of occupational hazards/ exposure to dust (particulate matter).

ORIGINAL ARTICLE

- History of COPD and obstructive sleep apnoea syndrome.
- History of congenital cardiopulmonary diseases.
- History of Diabetes Mellitus, Hypertension.
- History of medications like antihypertensive, anti-tubercular drugs.
- History of addiction to narcotics like opium, cannabis, poppy straw, cocoa leaf.
- Age less than 20yrs and more than 30yrs.
- History of allergy and any bone deformity of chest and spine.

About 75 youths had come forward and 25 were excluded who could not fulfill the inclusion criteria. In our study only 50 Tibetan male youths exactly fulfilled the inclusion criteria and hence were involved in the study. Similarly height and age matched 50 Indian male youths, (students of medical college KIMS, Hubli), were involved as controls in the present study.

ETHICAL CLEARANCE: Prior permission from subjects and controls were taken and an informed written consent from the youths of both the groups involved in the study was obtained. The study and its conduct was given ethical clearance from “institutional research and ethical committee” of Karnataka Institute of Medical sciences, Hubli.

All the mothers of these Tibetan subjects resided in Tibetan camp Mundgod throughout their pregnancies. No mother reported the use of medications or smoking during their pregnancies. The birth certificates of the Tibetan subjects were verified to ensure that they were born in India only. The purpose and objective of the study was explained to Tibetan and Indian youths. A detailed proforma was filled up for both subjects and controls and a thorough clinical examination of each subject was done to rule out any significant findings coming under the exclusion criteria. The subjects were made familiar with the test procedure and techniques with prior demonstration and practice until full familiarity was achieved.

Height and weight of each subject was recorded. Body surface area (BSA) was calculated using Dubois nomogram. Body mass index (BMI) was calculated using the formula.

$BMI = \text{Weight in kilogram} / \text{Height in square metres (m}^2\text{)}$. Vital parameters like pulse rate, blood pressure and respiratory rates were recorded. A detailed clinical examination of respiratory, cardiovascular and central nervous system was done. Evaluation of respiratory parameters such as PEFr and MVV were carried out on both the groups by using Spiroanalyser SPL-95. “95”- it is the model name of spiroanalyser of FIM company.

The instrument was calibrated daily using calibration syringe of 2 litres.

PROTOCOL OF TEST – PEFr: The sensor is kept on the stand and the FVC key is pressed. Now the subject is asked to keep the mouthpiece in mouth taking care to avoid obstruction by tongue. The start button is pressed and subject is asked to take a maximum inspiration followed by forceful expiration and then followed by maximum inspiration after which the stop button is pressed. The screen displays PEFr values along with graphical interpretation. Likewise another test can be repeated as the test has 3 memories. The best of 3 results can be selected for printing.

MAXIMAL VOLUNTARY VENTILATION (MVV): The MVV key is pressed while the sensor is in the stand. The mouth piece is given to the subject and asked to keep it as instructed. The start button is

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pressed. The subject is asked to breathe deeply and quickly for 12 seconds after which the test will automatically stop on its own. The screen displays the values of MVV along with the graph. This test has no memories.

The print key is pressed to obtain a full printout containing ID of subject and respiratory parameters along with graphical representation.

The obtained data was tabulated, analyzed and expressed as Mean \pm Standard Deviation (Mean \pm SD) to assess anthropometric, vital and various Pulmonary Function Test parameters of the 2 groups. In order to compare the level of PFT parameters between the two groups, the unpaired student's 't' test was applied by using SPSS version 16 and statistical significance was indicated by 'P' value less than 0.05 ($P < 0.05$).

RESULTS: The anthropometric data shows that the mean \pm SD of age in years, height in cms, weight in kgs, BMI in kg/m^2 and BSA in sq.m among Indian born Tibetan youths were 25.58 ± 4.12 , 169.70 ± 6.68 , 66.30 ± 11.58 , 23 ± 3.66 and 1.72 ± 0.16 respectively and of Indian youths were 24.40 ± 3.16 , 169.02 ± 6.14 , 65.02 ± 9.06 , 22.69 ± 2.38 and 1.76 ± 0.18 respectively. These values were not statistically significant.

The vital parameters show that the mean \pm SD of respiratory rate (breaths/min), pulse rate (beats/min), systolic blood pressure (mmHg) and diastolic blood pressure (mmHg) in Indian born Tibetan youths were 16.64 ± 2.85 , 78.34 ± 4.78 , 122.60 ± 5.33 and 77.48 ± 4.57 respectively and in Indian youths were 15.18 ± 2.37 , 75.20 ± 3.98 , 120.72 ± 6.09 and 79.76 ± 5.54 respectively. These values show statistically significant difference between the two groups.

Peak Expiratory Flow Rate (PEFR): The Indian born Tibetan youths had a PEFR (L/sec) of value 8.18 ± 2.47 whereas the corresponding value for Indian youths was 4.86 ± 1.89 . The PEFR was less in Indian youths than Tibetan youths. This was statistically highly significant $P < 0.001$.

MAXIMAL VOLUNTARY VENTILATION (MVV): The Indian born Tibetan youths had a MVV (L/min) of value 116.16 ± 25.78 whereas the corresponding value for Indian youths was 101.49 ± 19.21 . The MVV was less in Indian youths than Tibetan youths. This was statistically significant at $p < 0.01$.

DISCUSSION AND CONCLUSION: Although our subjects in the present study were well matched for age, body built, sex and nutritional condition, we observed that the values of PEFR and MVV in Indian born Tibetan youths were significantly higher than those in the Indian youths. Significant increase in PEFR in Tibetan youths could be due to larger force of contraction of main expiratory muscles like anterior abdominal wall muscles, internal inter costals muscles and decreased airway resistance. PEFR is more sensitive to muscular effort in respiration. Similar observations were made by other authors.⁵ The calibre of the airways increases with the increasing lung volumes. As a result the airflow resistance decreases with the increasing lung volumes. In high lung volumes there is more elastic recoiling of lungs. Therefore more negativity is in the pleural cavity. This increases the transpulmonary pressure and exerts a radial traction over the bronchi which are then dilated leading to decreased airway resistance.⁶

In our study we found that the value of Maximum Voluntary Ventilation was higher in Tibetan male youths who were born and brought up in India than those of Indian youths and this difference was statistically significant. A study observed that at rest Tibetan adolescents had significantly

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greater maximal voluntary ventilation than the Han adolescents at altitudes of 3417 and 4300m.⁷ MVV depends on the patency of airways, strength of respiratory musculature.⁸

One of the study that compared resting ventilation and hypoxic ventilatory responses of 320 Tibetans 9-82 yrs of age and 542 Bolivian Aymara 13-94yrs of age, native residents at 3,800 - 4,065m found that Tibetan resting ventilation was roughly 1.5times higher and Tibetan HVR (Hypoxic Ventilatory Response) was roughly double that of Aymara population. 35% of Tibetans, but none of the Aymara, resting ventilation variance was due to genetic differences among individuals. Thus there is greater potential for evolutionary change in these traits in the Tibetans.⁹

Another study concluded that Tibetans born at low altitude do not seem to differ from lowlanders with regard to their metabolic response whereas their ventilatory response to exercise is greater.¹⁰

Hence we conclude in our study that, though both Indian born Tibetan male youths and Indian male youths share similar environmental challenges, this difference in PEFr and MVV has shown that Indian born Tibetan male youths have retained better respiratory parameters as their ancestors which could be due to their inheritance of genetic factors which favour the Tibetans to survive at high altitude.

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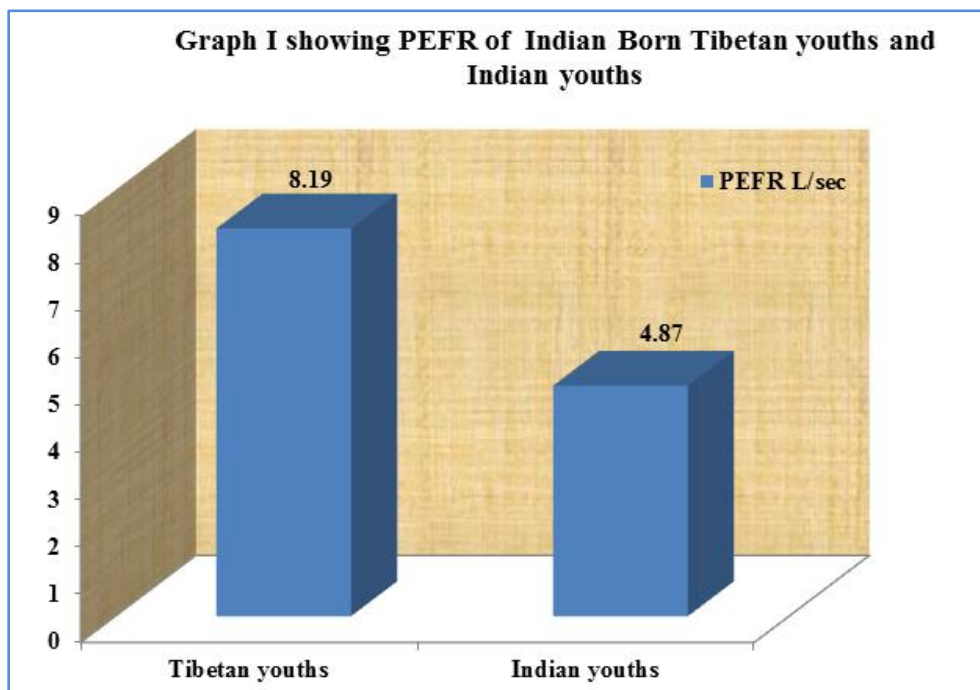
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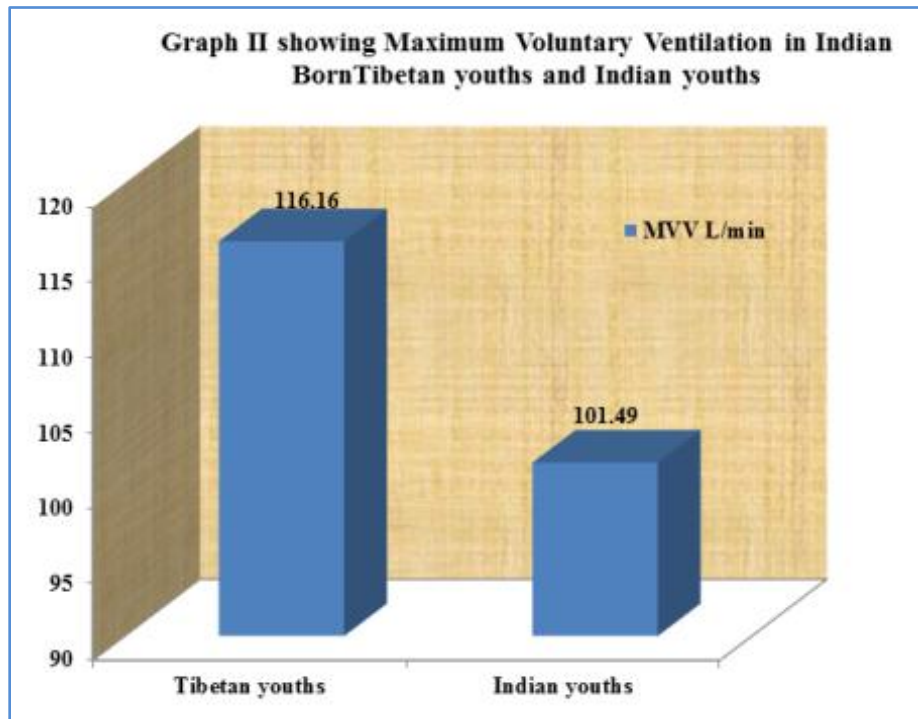
	No. of subjects	PEFR L/sec
Tibetan youths	50	8.19 ± 2.47
Indian youths	50	4.87 ± 1.89
'P' value		<0.001

Table 1: PEFR OF INDIAN BORN TIBETAN YOUTHS AND INDIAN YOUTHS Mean with SD

	No. of subjects	MVV L/min
Tibetan youths	50	116.16 ± 25.78
Indian youths	50	101.49 ± 19.21
'P' value		<0.01

Table 2: MAXIMUM VOLUNTARY VENTILATION IN INDIAN BORN TIBETAN YOUTHS AND INDIAN YOUTHS Mean with SD



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