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Original Research Article

Evaluation of lung function among the Indian elite female weightlifters

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ABSTRACT

Background: Spirometry is an essential tool to evaluate lung function of health and disease. Adaptability of lung and chest among athletes can be assessed by lung function test (LFT). The quest of our study was to evaluate the lung function (LF) of highly trained Indian female weighting athletes, and intended to appraise the adaptation of LF among trained elite athletes.
Methods: Top ranked Indian female professional weightlifters (study group, n=6) were recruited for this study. Three out of the six weightlifters were from top ten world ranking of 6th, 7th and 9th. Age matched controls (control group, n=6) were selected for this study. Maximum voluntary ventilation (MVV), vital capacity (VC), forced vital capacity (FVC), percentage of forced expiratory volume in first second (FEV1%) and ratio of forced expiratory volume in first second and forced vital capacity (FEV1/FVC%) have been evaluated as per the ATS/ERS guidelines.
Results: Statistically higher significant values of VC and FVC were noted in study group, where as other values (MVV, FEV1% and FEV1/FVC%) found no significant difference between two groups.
Conclusions: Power, strength and explosiveness of the skeletal muscles are vital domains in weightlifting sport. Weightlifting is such a sport doesn't require much ventilatory efforts during training as well as competition. This study clueing that physiological adaptation/ improvement of the pulmonary function (PF) depends on the type of the sport being engaged by the athletes.

Keywords: Elite athletes, Female weightlifters, Lung function, Physiological adaptation

INTRODUCTION

Health and disease of the lung is assessed by Spirometry.[1] Spirometry is an essential gold standard tool to evaluate the adaptation of the lung and chest through the lung function test (LFT).[2]

Lung function (LF) of the healthy and patients can be improved through the regular physical activity.[3] Other parameters like age, smoking, certain specific occupations declines the LF.[4,5]

LFT has become widely been used instrumental component of scientific assessment in talent identification and selection at gross root level, training and improvement of the sports or athletes.[6] Research evidence is categorically demonstrated that values of LFT among the elite athletes have superior than non-athletes.[7]

Whether the routine weightlifting training essentially improves the LF of weightlifters is the quest of our approach.

METHODS

Study was initiated followed by approval the institutional ethical committee. Top ranked Indian professional weighting females (study group, n=6) were selected to achieve the answer of our research question. Written consents were acquired and complete test protocols were demonstrated to all the participants.

All players had more than three years of high intensity training of weightlifting at Netaji Subhas National Institute of Sports (NSNIS), Patiala, Punjab, India campus. All players had an exposure to international level of competition at least once in their tenure at NSNIS, Patiala. Subsequently, age matched controls (control group, n=6) were selected randomly for the study. After collecting the written consent, LFT maneuvers were thoroughly explained.

Height and weight of the volunteers were taken as per the standard anthropometric procedure. Non-smokers and no history of any kind of significant cardiopulmonary illness in their lifetime were only included in this study. Maximum voluntary ventilation (MVV), vital capacity (VC), forced vital capacity (FVC), percentage of forced expiratory volume in first second (FEV1%) and ratio of forced expiratory volume in first second and forced vital capacity (FEV1/FVC%) have been evaluated. LFT conducted during the mid-day session, using Quark Cardio Pulmonary Exercise Testing (CPET) System (Cosmed Srl, Italy). ATS and ERS guidelines have been followed while evaluating the LFT.8 While performing the spirometry, ambient temperature and relative humidity were noted 29°C and 65% respectively. Lung volumes/capacities were expressed in BTPS.2 LFT's were carried out at the department of Exercise Physiology Laboratory, NSNIS, Patiala. All the values were expressed as mean ± standard deviations. Student's-t test have been performed to find out the significant difference between study and control groups, using SPSS version 20 (SPSS Inc., USA), where p value less than 0.05 ($p<0.05$) was statistically significant.

RESULTS

Results of the current study clearly indicate that VC and FVC were found statistical significant different between the two groups. The current study was not able to find out significant difference in MVV, FEV1% and FEV1/FVC% in these two groups.

Table 1: Spirometry values between athlete and control groups.

Parameter	Study group (n=6)		Control group (n=6)		p value
	Mean	SD	Mean	SD	
MVV (Liters/Min)	82	27.97856	71.1667	21.32995	0.468
VC (Liters)	2.9783	0.42358	2.2533	0.36828	0.01*
FVC (Liters)	3.1583	0.40157	2.4633	0.30474	0.007*
FEV1%	86.5	15.489	91.17	9.517	0.544
FEV1/FVC%	81.3667	11.52747	87.2167	7.21787	0.317

*p value was significantly different between study and control groups.

DISCUSSION

Weightlifting is an athletic discipline which involves regular high intensity training. Explosive strength (of the muscles), reflexes, power and other psycho-physiological parameters are essential for better performance. Weightlifting maneuvers (snatch and clean & jerk) have mostly been performed by upper extremities, pectoral girdle and then weight concentrates on central axis of the vertebral column.[9] Our preliminary study was mainly carried out to instigate the LF of the elite Indian female weightlifting athletes and also to find out the differences when compared to age matched controls. It was a cross sectional observatory study. Master elite athletes were selected for this study to evaluate the LF. Athletes being engaged with high intensity weightlifting training of minimum 3 hours per day for 5 days in a week. Three out of six athletes were from the top ten world ranker's category; 6th, 7th and 9th rank holders. Athlete ranked after 7th has also participated in the last Olympics held in Rio-2016, Brazil.[10] MVV reflects the compliance of the thoracic cage, strength of respiratory muscles and airway resistance.10 Ventilatory limitation/reserve is classically evaluated with MVV.[11] Improvement in trans-diaphragmatic pressure has been observed in weightlifting trainees (3-4day/week of the training) as reported earlier by Al-Bilbeisi and McCool, 2002.[12] Present study demonstrated no change in MVV among elite weighting players versus normal control female. This may not be compulsory domain of the performance as the weightlifting maneuvers have not required intense ventilatory efforts. Moreover, studies required to establish the role of trans-diaphragmatic pressure in strengthening the respiratory muscles and then role of

respiratory muscles in performance. VC and FVC reflect the degree of starch-ability of the lung and chest. VC and FVC were found significantly high among the athletes compared to age matched control group where p=0.01 and p=0.007 respectively. Present results clearly depicted that there is positive reinforcement of weightlifting training on VC and FVC which might have been achieved by the higher strength of respiratory muscles compared to the normal control population. There are similar findings of present results reported in earlier studies viz. Adegoke OA et al, and Guenette JA et al.[13,14] In addition, decline of FVC followed by regular physical exercise have also been reported by a study, Fatima SS et al.[15] Nevertheless, reflection of these variables attributes that VC and FVC in the study group might have been enhanced with vigorous weightlifting training.[16] FEV 1.0 and FEV1/FVC ratio implies the degree of airflow limitations to lung.[8] In Present study there is no statistically significant difference of these parameters between the two groups. Higher values of FEV 1.0 may not be essential since training of weightlifters do not require strong ventilatory efforts during the maneuvers. A study to detect pulmonary function on various Indian sports men held in 1985, concluded that hockey and swimmers had higher PF than others (including weightlifters). It is therefore, signifying that physiological adaptation of respiratory system is purely depends on type of physical activity that the athlete being engaged.[2]

CONCLUSION

In conclusion, high level and world ranked weightlifters have been picked up to observe LF as a cross sectional study. Result of the study group showing not much encouragement when compared with sedentary group. Power, strength and explosiveness of the skeletal muscles are vitals domains in weightlifting sport. Weightlifting is such a sport doesn't require much ventilatory efforts during training as well as competition. This study clueing that physiological adaptation/ improvement of the PF depends on the type of the sport being engaged by the athletes.

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