JMSCR Vol||07||Issue||12||Page 767-773||December 2019

http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v7i12.136

IGM Publication Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Research Paper

Effect of Pranayama in Pulmonary Functions using Spirometry in Offspring of Type II Diabetes Mellitus

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Abstract

Background: *Offspring of Diabetes Mellitus (DM) parents perceive hereditary risk as much higher than lifestyle-related risk. They showed higher proportion of variables related to metabolic syndrome compared with those offspring of healthy parents, and this proportion increased in case of DM parents plus metabolic syndrome. It was also evident that the pulmonary functions of obese offspring of DM parents was affected and more prone for restrictive lung disease. This study was framed to screen the offspring of DM for pulmonary function, evaluate the effect of Pranayama in pulmonary functions of offspring of DM and compare the influence of Pranayama in pulmonary functions of normal BMI offspring, overweight and obese offspring of DM parents.*

Method: *Cross sectional study was performed with 30 individuals for each group after satisfying the inclusion and exclusion criteria and the study group consists of Group I: Control group - Normal BMI healthy individuals aged between 18- 25 years offspring of Non-diabetic healthy parents. Group II: Normal BMI healthy individuals aged between 18- 25 years offspring of DM. Group III: Overweight and obese individuals (BMI ≥ 25) aged between 18- 25 years offspring of DM. Pulmonary function Test was performed using EASY ON PC COMPUTERISED SPIROMETER*

Results: *FEV1, FVC, FEV1/FVC ratio, FEF (25% - 75%) and PEFR did not show any significant increase or decrease when compared between the three groups before pranayama training. But, FEV1, FVC, FEF (25% - 75%) and PEFR showed a marked significant increase in the Group II and Group III after 6 weeks training of pranayama.*

Conclusion: *This study concludes that offspring of diabetic parents with normal BMI and those who are obese showed significant improvement in pulmonary functions by performing short term pranayama techniques for six weeks but there is no confirmed possibility that they would be prone to type II diabetes in near future.*

Keywords: *DM: Type II diabetes mellitus, BMI: Body mass index.*

Introduction

Type II Diabetes mellitus (DM) refers to a group of common metabolic disorders characterized by hyperglycemia. DM is characterized by impaired pancreatic β-cell function and insulin action. The disease is thought to be caused by environmental and inherited factors in about equal proportions.

Many environmental risks factors are known, and they include obesity, sedentary lifestyle, small or large birth weight, stress, nutritional factors and toxins.

Apart from cardiovascular, neurological and other complications, DM being a systemic disease, also affects lungs causing restrictive type of ventilatory changes probably because of glycosylation of connective tissues, reduced pulmonary elastic recoil, and inflammatory changes in lungs, which results in reduced pulmonary functions[1]. Deterioration of the pulmonary function is proportional to the degree of hyperglycemia[2].

Offspring of DM perceive hereditary risk as much higher than lifestyle-related risk[3]. The offspring of parents with diabetes showed higher proportion of variables related to metabolic syndrome compared with those offspring of healthy parents, and this proportion increased in case of diabetic parents plus metabolic syndrome[4]. Pettitt et al., 1987[5] indicates that excessive obesity may still develop in the offspring of diabetic women despite normal birth weight. The obese individuals demonstrated, reduced lung volumes and capacities when compared to normal-weight individuals. Reduction in total lung capacity and forced vital capacity, accompanied by reduced forced expiratory volume after one second were the most representative findings among the samples, both suggesting the presence of a restrictive respiratory pattern associated with obesity[6]. So, the obese offspring of diabetic parents will be more prone for restrictive lung disease. Studies of obese individuals not diagnosed with other diseases have suggested that pulmonary and chest wall compliance was reduced due to fat deposition in the chest and the abdomen thereby causing decreased elasticity and reduced dispensability of extra pulmonary structures[7].

With increased awareness and interest in health and natural remedies, yogic techniques including pranayama are gaining importance and becoming increasingly acceptable to the scientific society. Pranayama is a method of yogic type of breathing and chest expansion exercise, has been reported to improve respiratory function in healthy individuals as well as in respiratory diseases. Pranayama, the fourth step of ash tang yoga is an important component of yoga training. "Prana" the vital life force that acts as a catalyst in all our activities and "Ayama" is the expansion of Pranayama can be defined as the science of controlled, conscious expansion of Prana in our energy body sheath. As a deep breathing technique, Pranayama reduces ventilation and decreases work of breathing. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs[8]. Joshi et al., 1992[9] have also demonstrated that 6 weeks of pranayama breathing course resulted in improved ventilatory functions in the form of lowered respiratory rate, and increases in the forced vital capacity, forced expiratory volume at the end of first second, maximum voluntary ventilation, peak expiratory flow rate, and prolongation of breath holding time.

The American Diabetes Association (ADA) recommends that screening of high-risk individuals should be considered at a younger age or be carried out more frequently. As per ADA, screening the offspring of DM for pulmonary function using spirometry will be helpful for their livelihood. According to the phrase "Prevention is better than cure" hypothesis of the present study is that practising pranayama by the high risk groups like offspring of DM may delay or postpone the respiratory complications.

Objectives

1) To screen the offspring of DM for pulmonary function using spirometry.
2) To evaluate the effect of Pranayama in pulmonary functions of offspring of DM.
3) To compare the influence of Pranayama in pulmonary functions of normal body mass index offspring, overweight and obese offspring of DM.

Implications

1) Study was framed as such to screen the high risk groups like offspring of DM for pulmonary functions.

2) If the high risk groups like offspring of DM practices pranayama may prevent or postpone the respiratory complications.
3) Also, the offspring with increased BMI can reduce their BMI, improve their pulmonary function and reduce the risk of Type II Diabetes Mellitus in near future.

Materials and Methods

Study Design

Exclusion Criteria

1. Patients having complaints of cough, sputum, or dyspnoea.
2. Smokers and patients with any cardio-respiratory illnesses or major diseases.
3. Those with cardio-respiratory, musculoskeletal, or endocrine diseases
4. Previous experience of yoga training,
5. History of major surgery in the recent past.

Inclusion Criteria

1. Normal BMI healthy individuals aged between 18- 25 years offspring of Non-diabetic healthy parents.
2. Normal BMI healthy individuals aged between 18- 25 years offspring of DM.
3. Overweight and obese individuals (BMI ≥ 25) aged between 18- 25 years offspring of DM.

Study Groups

Group I: Control group - Normal BMI healthy individuals aged between 18- 25 years offspring of Non-diabetic healthy parents.

Group II: Normal BMI healthy individuals aged between 18- 25 years offspring of DM.

Group III: Overweight and obese individuals (BMI ≥ 25) aged between 18- 25 years offspring of DM.

Procedure

After obtaining institutional ethical committee approval, a questionnaire was given among the students and 30 individuals for each group with above said criteria were chosen.

1) Subjects were motivated and recruited for the study. They were given prior information about the techniques to be performed.
2) The pulmonary function tests was measured by asking the subjects to blow up in the Easy on PC Spirometer.
3) Six weeks of Naadi shuddhi pranayama sessions will be conducted and monitored from Monday to Saturday and on rest day subject were motivated to practice at their home.
4) Anuloma-viloma, a simple type of Naadi shuddhi pranayama occurs in two stages, first by asking the subjects to close their left nostril and deep inhale followed by relaxed exhale for five times.
5) Then the subjects were asked to perform the same by closing the right nostril. This procedure was followed for six weeks.
6) Training was given by Yoga experts from Yoga Centre, Chengalpattu Medical College and Hospital.

Study Instrument

EASY ON PC COMPUTERISED SPIROMETER

All the tests were conducted according to American Thoracic Society/European Respiratory Society (ATS/ERS guidelines) in a quiet room in sitting position by the trained personnel.

Parameters Studied

1. Pulmonary Function Tests parameters: The controls and offspring of DM were performed spirometry three times at the interval of 15 minutes and the best of the three was taken into account.
   A) Forced Vital Capacity (FVC),
   B) Forced Expiratory Volume in first second (FEV1),
   C) Ratio between FEV1 and FVC (FEV1/ FVC),
   D) Peak Expiratory Flow Rate (PEFR),
   E) Forced Expiratory Flow at 25% -75% (FEF25% - 75%)

2 Anthropometric measurements:
   A) Height (Ht)
   B) Weight (Wt)
   C) Body mass index (BMI)

Statistical Analysis

In all the groups, the above mentioned parameters were measured at the beginning and again at the end of the 6 weeks study period. The data were analyzed using Student's paired't' test to compare the pre and post training values. Comparisons between groups was made by one-way analysis of variance followed by Tukey's test using SPSS software version 20.

Results

The mean age and BMI of the Group I was 18.06±0.8 years and 21.73±1.8kg/m2 respectively, Group II was 17.87±0.7 years and 21.31 ±2 kg/m2 respectively and Group III was 17.9±0.47 years and 27.01±1.88kg/m2 respectively.

Pulmonary function parameters data from various groups are shown in Table1. When compared between the three groups, there was no significant variation observed. FEV1, FVC, FEV1/FVC ratio, FEF (25% - 75%) and PEFR did not show any significant increase or decrease when compared between the groups. These parameters were recorded at the beginning of the experiment to analyse whether there was any significance noted when compared between the three groups.

In Table 2, Pulmonary function parameters data of Group II recorded before and after training period was given. Except FEV1/FVC ratio, all the parameters - FEV1, FVC, FEF (25% - 75%) and PEFR showed a marked significant increase in the Group II after 6 weeks training of pranayama.

In Table 3, Pulmonary function parameters data of Group III recorded before and after training period was given. All the parameters- FEV1, FVC, FEV1/FVC, FEF (25% - 75%) and PEFR showed a marked significant increase in the Group III after 6 weeks training of pranayama.

Table 1: Pulmonary function parameters in Group I, II and III recorded before Pranayama training analyzed with one way ANOVA, p<0.05.

S.No	Parameters	Group I	Group II	Group III	df	F	SIG
		Mean ± SD	Mean± SD	Mean ± SD			P<0.05
1	FEV1(L)	2.94± 0.71	3.02± 0.79	2.76±0.66	2	1.022	0.364
2	FVC(L)	3.30± 0.78	3.27± 0.87	3.23±0.76	2	0.059	0.943
3	FEV1/FVC	0.87±0.16	0.92±0.05	0.86±0.07	2	2.678	0.074
4	FEF (25%-75%) (L/s)	3.59±0.94	3.98±1.29	3.60±1.49	2	0.933	0.397
5	PEFR(L/s)	6.19±1.90	6.48±1.49	5.93±1.41	2	0.851	0.430

Table 2: Pulmonary function parameters in Group II recorded before and after the training period of 6 weeks

S.No	Parameters	Before Pranayama	After Pranayama	t value	df	Significance P<0.05
		Mean ± SD	Mean ± SD			
1	FEV1(L)	3.01±0.79	3.25±0.79	-5.313	29	0.000
2	FVC(L)	3.27±0.86	3.55±0.84	-5.235	29	0.000
3	FEV1/FVC	0.92±0.04	0.91±0.06	0.972	29	0.339
4	FEF (25%-75%) (L/s)	3.97±1.28	4.66±1.68	-4.711	29	0.000
5	PEFR(L/s)	6.47±1.48	7.01±1.32	-4.373	29	0.000

Table 3: Pulmonary function parameters in Group III recorded before and after the training period of 6 weeks

S.No	Paramaeters	Before Pranayama Mean ± SD	After Pranayama Mean ± SD	t value	df	Significance P<0.05
1	FEV1(L)	2.75±0.66	3.13±0.61	-6.300	29	0.000
2	FVC(L)	3.22±0.76	3.53±0.66	-4.877	29	0.000
3	FEV1/FVC	0.85± 0.06	0.89±0.09	-2.504	29	0.018
4	FEF (25%-75%)(L/s)	3.77 ±1.29	4.52± 1.11	-4.622	29	0.000
5	PEFR(L/s)	5.93± 1.41	6.88± 0.70	-4.043	29	0.000

Discussion

The rapidly growing worldwide epidemic of type II diabetes has been explained by obesity and the sedentary lifestyle of humans in modernity. Although such environmental factors are undoubtedly important, familial factors also seem to play a major role in the pathogenesis of type II diabetes. Consequently, offspring of a parent with diabetes have a lifetime risk of type II diabetes of 40%, and when both parents have type II diabetes, the risk is even higher[10]. Many studies have also reported that a marked decrease in the lung functions in diabetes patients. In the present study, Pulmonary functions was analyzed as a screening procedure in offspring of DM parents but the results observed did not show any significant variation when compared with the control group, hence to screen the high risk groups like offspring of DM for pulmonary functions was rejected statistically.

Breathing is the only autonomic function that can be consciously controlled and it is the key in bringing the sympathetic and the parasympathetic nervous system into harmony[11]. Pranayama may allow broncho-dilatation by correcting abnormal breathing patterns & reducing muscle tone of respiratory muscles[12]. Most studies agree that, by increasing intrathoracic and intraabdominal negative pressure due to a greater diaphragmatic excursion[13], yoga practice —especially pranayama— leads to higher FVC, FEV1 and FEV1/FVC ratio[14]. During pranayama training, regular inspiration and expiration for prolonged period leads the lungs to inflate and deflate maximally and that it causes strengthening and increased endurance of the respiratory muscles[15]. This maximum inflation and deflation is an important physiological stimulus for the release of surfactant and prostaglandins into the alveolar spaces, which thereby increase the lung compliance[16]. The stretch receptors reflexly decrease the tracheobronchial smooth muscle tone activity, which leads to decreased air flow resistance and increased airway caliber, which causes the dynamic parameters of the lung function test to improve. In this present study, Group II and Group III subjects showed a marked increase in FVC, FEV1, FEF (25 – 75%) and PEFR at the end of six weeks training of pranayama. In well agreement with our study, Shankarappa et al., 2012[17] also states that the pulmonary function parameters FVC, FEV1, PEFR, FEF25-75% and Breath holding time (BHT) were found to be significantly increased after six weeks of pranayama. The improvement in PFT parameters is correlated with overall improvement in all aspects of pulmonary functions due to increasing efficiency of respiratory muscles, balanced activity of opposing muscles, increase in alveolar ventilation, decreased resistance of both large and small airways also decreases anatomical as well as physiological dead space[18].

Conclusion

DM being a systemic disease, also affects lungs causing restrictive type of ventilatory changes probably because of glycosylation of connective tissues, reduced pulmonary elastic recoil, and inflammatory changes in lungs.

Even though screening the high risk groups like offspring of DM for pulmonary functions was rejected statistically, this study concludes that offspring of diabetic parents with normal BMI and those who are obese showed significant improvement in pulmonary function test by performing short term pranayama techniques for six weeks but there is no confirmed possibility that they would be prone to type II diabetes in near future.

Limitations

It seems to be necessary to repeat PFTs and to assess the changes of pulmonary functions among the same subjects. Over a long observation course, the relationship between the plasma glucose concentration and the PFTs can be elucidated.

Acknowledgement

The research was supported by ICMR for Short term studentship during the study period.

Conflicts of Interest

The authors declare that they have no conflict of interest concerning this research article.

References

1. Swati H. Shah, Pranali Sonawane, Pradeep Nahar, Savita Vaidya, and SundeepSalvi· Pulmonary function tests in type 2 diabetes mellitus and their association with glycemic control and duration of the disease. Lung India. 2013, 30(2), 108–112.
2. Ramiru Le, Nogare DA. Hsia C, Araur C, Butt I. Strowig MS, Breen SL. Relationship between dlabetes control and pulmonary function in lnsulin dependent diabetes mellitus. Am J Med 1991, 91, 371.
3. Chapple A, May C, Campion P: Parental guilt: the part played by the clinical geneticist. J Genet Couns. 1995, 4, 179–191.
4. Linares Segovia, Maximiliano Gutierrez Tinoco, Angeles IzquierdoArrizon,Juan Manuel Guızar Mendoza, and Norma Amador Licona. Long-Term Consequences for Offspring of Paternal Diabetes and Metabolic Syndrome. Experimental Diabetes Research. 2012, 1 – 6.
5. David J. Pettitt, MD, William C. Knowler, MD, Peter H. Bennett, MB, Kirk A. Aleck, MD, and Robert Baird, M. obesity in Offspring of Diabetic Pima Indian Women Despite Normal Birth Weight. Diabetes Care. 1987, 10, 76- 80.
6. Luciana, Maria AlaydeMendonça da Silva and Ana Carolina do Nascimento Calles. Obesity and lung function: a systematic review. Einstein (Sao Paulo). 2014, 12(1), 120–125.
7. DeLorenzo LJ, Aronow WS. Impact of Morbid Obesity on Pulmonary Function. Chest, 2007, 132, 4.
8. Bijilani RL. The Yogic Practices: Asanas, Pranayamas and Kriyas. Bijilani RL, editor, Understanding medical physiology, Third edition. New Delhi, India: Jaypee Brothers Medical Publishers. 2004, 883-889.
9. Joshi LN, Joshi VD, Gokhale LV. Effect of short term 'Pranayam' practice on breathing rate and ventilator functions of lung. Indian J PhysiolPharmacol. 1992, 36, 105–8.
10. Köbberling J, Tillil H: Empirical risk figures for first degree relatives of non-insulin dependent diabetics. In Serono Symposium No. 47. The Genetics of Diabetes Mellitus. Köbberling J, Tattersall R, Eds. London, Academic Press, 1982, 201–209.
11. 11. Grover P, Varma VD, Pershad D, Verma SK. Role of yoga in the treatment of psychoneuron's bull. PGI. 1998, 22(2), 68-76.
12. Chanavirut R, Khaidjapho K, Jaree P, Pongnaratorn P. Yoga exercise increases chest wall expansion and lung volumes. Thai Journal of Physiological Sciences. 2006, 19(1), 1–7.
13. Prakash S, Meshram S, Ramtekkar U. Athletes, yogis and individuals with sedentary lifestyle; do their lung functions differ? Indian J PhysiolPharmacol. 2007, 51(1), 76-80.
14. Manaspure S, Fadia A, Gowda D. Effect of specific pranayama techniques on ventilator

functions of lung. Res J Pharm Bio Cheml Sci. 2011, 2(4), 351-7.

15. Madanmohan, Lakshmi J, Udupa K, Bhavanani AB. Effect of yoga training on handgrip, respiratory pressures and pulmonary function. Indian J PhysiolPharmacol 2003, 47(4), 387-92.
16. Hilderbran JN, Georke J, Clements JA. Surfactant release exercised rat lung which is stimulated by air inflation. J Applied physiol. 1981, 51, 905-10.
17. Shankarappa V., Prashanth P., NachalAnnamalai and Varunmalhotra, The Short Term Effect of Pranayama on the Lung Parameters. Journal of Clinical and Diagnostic Research. 2012, 6(1), 27-30.
18. Suman R, et al. The effect of pranayama on pulmonary function test. Indian Medical Gazette 2011, 1, 314-318.