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ORIGINAL ARTICLE

Outcome of Breathing Exercise (Pranayam) on Spirometric Parameters in Type 2 Diabetic Individuals: a Clinical Study

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Pranayama aims by carrying the involuntary functions of the respiratory mechanism within human control. The term pranayama has comprised by two words: Prana + Ayama. Prana is the vital force and energy which permeates the whole universe. Prana is novel subtle than air and can be defined as the energy essence that is within everything in the universe. In present time emphasis is on the beneficial effects of Pranayam in various diseases i.e. diabetes mellitus, hypertension, obesity and depression by application of specific exercise like walking in a planned way. This was also explained and proved by American college of sport medicine. In Ayurveda various breathing exercise and yogic practices have been mentioned. The respiratory System, central nervous system and cardiovascular system are the important systems which are mostly affected by Pranayam and other physical activities. Breathing exercise is highly effective in endorsement of respiratory system and management of diseases related to respiratory system.

Key words: Breathing exercise, Diabetes Mellitus, Pranayama.

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Prana is the principle of development and sustenance both of the nervous and cellular tissues of the body and the mind. In the process of breathing when the Prana air is inhaled, definite action takes place. One is related to the intake of oxygen into the alveoli and the other to the ingestion of the nervous energy into the brain system. Vyayama means to control or to give a rhythm or a definite flow. In this sense Pranayama may be defined as a process and procedure through which vital energy has stimulated and increased: and this brings about just right control over the flow of Prana within the body. Pranayama is an accurate science. Regulation of breathing, as a matter of information is natural. It hardly offers any scope of artificiality. The breath enters through the nose and depending on ones general health and strength of the lungs; it is retained inside and then is exhaled. This natural condition of intake and outflow of the breath goes on continuously and it is on this process that human life depends. The difference between this natural process and the

'Pranayama' is that in the former the inhalation and exhalation is not necessarily connected with the mind; that process continues owing to the natural functioning of the heart and lungs. The inhalation and the exhalation are, hence, not of any set period. In some person the inhalation may take a longer time than the exhalation and in some others the opposite may occur. In Pranayama, however, there is a systematic regulation of both the inhalation and exhalation. This is for the basis that the mind is tied to the action of inhalation and exhalation known as Puraka and Rechaka correspondingly in practicing the Pranayama. Hence their longer and shorter duration within a specified time has to be controlled. The result of this controlled inhalation and exhalation, both in respect of speed and time has a mere beneficial effect on the mind and the body than that of the natural process. Most of the people largely depend on the natural process will derive immense benefit on falling ill by controlled inhalation and exhalation. Such person should inhale slowly and exhale equally slowly in the beginning for 5 to 10 times depending on their strength and continue doing this morning and evening for 25 to 30 day. The natural inhalation is therefore called "SWASHANA" or breathing and that inhalation and exhalation which is done extending time limit by applying the power of mind is called Pranayama. Individuals can take in a certain amount of energy or Prana from the atmospheric air along with each breath. Vital capacity is the capacity shown by the largest quantity of air a man can inhale after the deepest possible exhalation. A man takes fifteen breaths in a minute. The total number of breaths comes to 21,600 times per day. (http://www.healthnwealth.in/pranayama.html cited 2012)

Effect of breathing exercise on Respiratory system:

Oxygen consumption and pulmonary ventilation in exercise

Normal O_2 consumption at rest is 250ml/min and under maximal conditions can be increased to the following average levels. (Guyton and Hall 2006)

- Untrained average 3600 ml/min
- Athletically trained average male 4000 ml/min
- Male marathon runner 5100 ml/min

Limits of pulmonary ventilation:

Respiratory rate and force of respiration increases about 20 fold between the resting state and maximal intensity of exercise in the well trained Athlete. Pulmonary ventilation at maximal exercise 100-110 L/min and Maximal breathing capacity 150-170 L/min, which is about 50% greater than the actual pulmonary ventilation during maximal exercise, provides safety for athletes giving them extra ventilation in such conditions as

1. Exercise at high altitudes and under very hot conditions

2. Abnormalities in the respiratory system

Effect of exercise on nervous system

Intense increase in metabolism in active skeletal muscles acts directly on the muscle arterioles to relax them and to allow adequate O_2 and other nutrients needed to sustain the peripheral resistance. Brain sends motor signals to the muscles, sends simultaneous signals in to the autonomic nervous centers of the brain to excite circulatory activity causing large vein constriction increased heart rate contractility of heart increased arterial pressure, Cardiac output (30-100%).Physical activity could play an important role in influencing cognitive brain functions including learning and memory. Epidemiological studies support a positive

relationship between cognition and physical activities.

Diabetes Mellitus

Diabetes mellitus is one of the common metabolic syndromes and considered as one of the major threat to the human health in the 21st century by the world health organization (WHO). It is one of the oldest diseases known to mankind. First clearly recognizable description of diabetes was given by Arataeus of Cappadocia in the 2nd century A.D. Charak (2nd B.C.) and Sushruta (2nd A.D.) were the first Indian physicians to recognize the sweetness of diabetic urine.

Breathing Exercise and Diabetes Mellitus

Type 2 Diabetes mellitus (DM 2) is a foremost reason of death and disability in the United States (US) and other industrialized nations (Innes, Vincent**,** 2007; Rizvi, 2004) and it is most common disease of mankind which can be improved by exercise. It has also been emphasized long back that excess intake of Kaphaja aahara along with lack of exercise, enjoying the pleasure of sedentary habits , sleep, intake of curd, soups of meat of domesticated and aquatic animals and animals inhabitating marshy lands, milky preparations, freshly prepared alcoholic drinks, preparations of jaggery and all the kapha aggravating factors are the causes of prameha, So it shows that the importance of exercise (Vyayama) was described by our Acharyas in reference to healthy individuals and diseases like prameha (Madhumeha) etc. (Sharma, 2001). It must also be recognized that the benefit of exercise in improving the metabolic abnormalities of type 2 diabetes is probably greatest when it is used early in its progression from insulin resistance to impaired glucose tolerance to overt hyperglycemia requiring treatment with oral glucose-lowering agents and finally to insulin. Emergent number of studies suggest that yoga may improve indices of risk in adults with type 2 diabetes, including glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics and blood pressure. Some data also designate that yoga may reduce oxidative damage, improve pulmonary function, and decrease sympathetic activation in adults with diabetes and related chronic disorders. Yoga may also be useful in reducing medication requirements in patients with diabetes and could help prevent and manage cardiovascular complications in this population. (Innes, Vincent, 2007)

Methodology:

In the present work effect of breathing exercise has been observed among diabetic individuals through the spirometric parameters and respiratory rate. Breathing exercise was prescribed for Diabetic patients for 3 months (two follow up) under the proper guidance. Breathing exercise like kapal bhati, anuloma- viloma and deep breathing both inspiration and expiration has been advised for 15 minutes.

Our study divided into two groups

1. Diabetic control (DMC)
2. Diabetic exercise (DME)

INCLUSION CRITERIA:

In all the groups subjects aged from 35 years to 65 years were included

Diabetic Control group:

(i) Diabetic patients who did not perform breathing exercise

(ii) Patients suffering from diabetes Mellitus on the basis of ADA classification of blood sugar level.

(iii) Blood sugar level (F) above 110 and PP 140 mg/dl.

Diabetic exercise group:

(i) Diabetic Patients who performed breathing exercise.

(ii) Patients suffering from diabetes Mellitus on the basis of ADA classification of blood sugar level.

EXCLUSION CRITERIA:

In all the groups individuals aged below 35 years and above 65 years were excluded.

Diabetic Control group:

(i) Patients suffering from any secondary diseases.

(ii) Diabetes mellitus with complication like diabetic nephropathy, Retinopathy, neuropathy etc.

Diabetic exercise group:

(i) Patients suffering from any secondary diseases and unable to perform exercise.

SELECTION OF CASES:

All these cases of Diabetes mellitus individuals were enrolled from Kayachikitsa O.P.D., IMS, BHU, for the duration of Jan 2009 to Jan 2011. The selection was random irrespective of sex, occupation and socioeconomic deliberation. One follow ups have been assessed during the research work i.e. initially after three months for all the sprirometric parametetrs except respiratory rate. (initially after one month and finally after 3months).

CLINICAL CRITERIA FOR DIABETES (ADA 2000)

Fasting plasma glucose	Normal glucose tolerance	Impaired Glucose tolerance	D.M.
Fasting	<110	110-125	≥126
PP	<140	140-199	≥200

Parameters

1. Clinical parameter: Respiratory Rate

2. Electrophysiological: Spirometry was carried out by the departmental computerized spirometery spiroexcel Medicaid made.

Statistical analysis:

The data of 83 patients were collected, coded and fed into the computer. Analysis was done by using Statistical Package for Social Sciences (SPSS) Software Version17.0. Data tabulated and appropriate statistical test viz .cross tabulation, frequency, descriptive mean, paired sample t test and unpaired t-test were applied in order to draw meaningful inferences. The statistical methods were adopted to evaluate the significance of changes after the treatment and also in different comparative groups in clinical observation.

Observations:

In the present study attempt has been made to recognize consequences of breathing exercise on various spirometric variants in of Diabetes Mellitus.

The present work comprised a study of 83 diabetic cases (44 male, 39 female). (This distribution can be seen from **table no. 1**)

Intergroup group comparison depicted statistically highly significant ($p< 0.001$) change in respiratory rate between I&IIgroup after initial and all follow up **(Details can be visualized from Table No.2)**

At the time of analysis of FVC table **no.3** showed statistically highly significant ($p< 0.001$) change in DMC, DME breathing exercise. Intergroup comparison was statistically insignificant overall.

As per table **no. 4** a statistically highly significant ($p< 0.001$) decrease in SVC was observed in DME and DMC group after breathing exercise. Intergroup

comparison illustrated statistically highly significant (p< 0.001) change in SVC interval between I&II group during initial and first follow-up. As per table **no. 4** a statistically highly significant (p< 0.001) decrease in SVC was observed in DME and increase DMC group after breathing exercise.

Table 1: Incidence of Gender as per group

SEX	Group			
	DMC	DME	Total	%
Male	16	28	44	53.01
Female	16	23	39	46.99
Total	32	51	83	100

Table 2: Effect of exercise on Respiratory Rate in different groups

Group	Respiratory Rate (per minute) (Mean ± S.D)			Intra group comparison Paired t- Test	
	Initial	F 1	F2	Initial vs F1	F1 vs F2
DMC	19.47 ±3.66	19.81±2.51	19.97±2.76	t= 0.853 p>0.05 (NS)	t=0. 359 p>0.05 (NS)
DME	24.84± 8.59	22.74± 2.96	22.38± 2.80	t= 1.980 p>0.05 (NS)	t=0 .692 p>0.05 (NS)
Unpaired t – test	I vs II t= 3.348 p<0.001 **(HS)**	I vs II t= 4.646 p<0.001 **(HS)**	I vs II t= 3.697 p<0.001 **(HS)**		

Table 3: Effect of exercise on Forceful Vital Capacity in different groups

Group	FVC(L) (Mean ± S.D)		Intra group comparison Paired t- Test
	Initial	F 1	Initial vs F1
DMC	4.14± 0.8900	2.59± 1.11	t=6.267 p<0. 01 **(HS)**
DME	4.196± 0.713	2.4014± 1.12	t=16.14 p<0.001 **(HS)**
Unpaired t – test	I vs II t=0.318 p>0.05**(NS)**	I vs II t=0.755 p>0.05 **(NS)**	

Table 4: Effect of exercise on Slow Vital Capacity in different groups

Group	SVC(L) (Mean ± S.D)		Intra group comparison Paired t- Test
	Initial	**F 1**	**Initial vs F1**
DMC	1.38±0 .298	2.35±0 .93	t=12.14 p<0.001 **(HS)**
DME	3.81± 1.20	2.22± 0.8052	t=10.84 p<0.001 **(HS)**
Unpaired t – test	I vs II t=11.22 p<0.001 **(HS)**	I vs II t=6.53 p<.001 **(HS)**	

DISCUSSION

Present study comprised of 83 individuals belonging to the age group of 35 – 65 years with the aim to find out any correlations that may exist between these breathing exercise and spirometric parameters .In this study diabetes mellitus is the psychosomatic disorder. In present time due to stress, sedentary life style psychosomatic diseases are very common which affect mind follows the body. There is strong connection between mind and body means upset stomach or bad headache when an important obligation is due, one probably find out that there is a connection between what is experiencing in emotions and what is happening in body (Halgin, Whitbourne, 2000, Tiwari *et al.,* 2012). Maximum number of patients belonged to male in diabetic group. This study was not consistent with other because the maximum numbers of studies have shown high prevalence of female diabetic worldwide. (Javid *et al.*, 2011) **(Table no. 1).** In this study respiratory rate has been decreased after 3 months of breathing exercise because breathing exercise is possible cause in the reduction of respiratory rate. (Jain, 2009). Some previous studies have suggested that yoga-derived breathing training reduced their spontaneous breathing rate (Bernardi *et al.*, 1998; Huang, Osness, 2005, Tiwari *et al.,* 2012).At the time of analysis of FVC, **table no. 3** showed that, a statistically highly significant (p< 0.001) decrease in FVC was observed in DMC, DME group after walking (Isotonic exercise). Intergroup comparison was statistically insignificant overall. Some previous studies reported the consistent effect. Statistically highly significant (p< 0.001) decrease in SVC was observed in DME and DMC group after walking (Isotonic exercise). Intergroup comparison illustrated statistically highly significant (p< 0.001) change in SVC interval between I&II group during initial and first follow-up. As per table **no. 4** a statistically highly significant (p< 0.001) decrease in SVC was observed in DME and increase DMC group after breathing exercise.

Intergroup comparison illustrated statistically highly significant (p< 0.001) change in SVC interval between I&II group during initial and first follow-up.

CONCLUSION

The present work comprised a study of 83 diabetic cases (44 males, 39 females). Respiratory rate, FVC and SVC all these clinical parameters were significantly decreased after 3 months of breathing

exercise in this study but these changes were within normal limits.

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