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EFFICACY OF CONTROLLED DIAPHRAGMATIC BREATHING EXERCISE ON MENTAL HEALTH OF FAMILY CAREGIVERS OF POST STROKE PATIENTS

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ABSTRACT

Background:

Families are often the primary source of home care and support. It is therefore essential to ensure that they are in best of their health while carrying out their responsibilities. Clinical observation and early empirical research showed that assuming a caregiving role are stressful and burdensome. Mental health issues such as depression, anxiety, lack of sleep is highly likely to be expected in them.

Stroke is a very common cause of adult disability often leaving stroke survivors dependent on others. Much of this support comes from informal carers.

Among stroke caregivers, mental health and social functioning have repeatedly been found to be the most severely compromised health-related quality of life domains.

Past researches indicates that caring for a stroke survivors, especially the ones with disabling condition, places an undue strain on caregivers.

Studies have found earlier that exercise has both physical and psychological effects. However, the heterogeneous nature of the exercise intervention trials makes determining the appropriate program variables (frequency, intensity, duration and type of exercise) difficult. Most studies explored the benefit of aerobic exercise in depression and anxiety and included running, brisk walking, treadmill or stationary bicycle. Also most of these aerobic activities might not be possible to be carried out in home by all and difficult to be supervised.

Diaphragmatic breathing have been shown to have a relaxing and stabilizing effect on the autonomic nervous system. So, its role in mental health as a physical therapy intervention is an area that needs to be further explored. Several studies indicate that breath controls used in various combinations could have beneficial effects on mental health and well-being of an individual. Whether they really play a significant positive role in regulating mental health or are more placebo in nature is something that needs to be seen.

The Objective of the study was to find out the efficacy of controlled diaphragmatic breathing exercise as a simple and easy to practice mean in addressing the mental health issues of family caregivers of post stroke patients who probably suffers from and are susceptible to develop more advance mental health complications.

Methods:

A total of 200 subjects were recruited based on inclusion and exclusion criteria from family members serving as caregivers to post stroke patients residing in Kolkata and undergoing rehabilitation upon due recommendations. They were allotted in two groups (100 each) alternately. The intervention group underwent a supervised controlled diaphragmatic breathing exercise program at thrice a week for eight weeks. The control group has undergone baseline measurements and were allowed to carry on their normal life without any recommendations. At the end of 8 weeks outcome measures were further evaluated for every subject and analyzed statistically.

Outcome measures included Karolinska Sleepiness Scale for sleep, Beck Depression inventory for depression, Beck Anxiety inventory for anxiety, Positive and negative affect schedule (PANAS) to measure both positive and negative affect. Abbreviated Profile of mood state (POMS) to assess the mood.

Results:

The intervention group showed significant difference ($p<0.01$) in the outcome measures in comparison to their baseline values whereas there were no significant differences in the outcome measures of control group in comparison to baseline.

Conclusion:

This study shows that controlled diaphragmatic breathing has significant positive and beneficial effects on the mental health of family caregivers of post stroke patients.

Key words:

Family Caregiver, Mental health, Breathing exercise

Background:

Families often are a primary source of home care and support. The associations between physical and psychological health and being an informal caregiver are well established [1,2]. *Caregiving or Caregiver* here denotes care that is provided by a family member or friend rather than by a professional who is reimbursed for services. Clinical observation and early empirical research showed that assuming a caregiving role can be stressful and burdensome [3,4]. Mental health issues such as depression, anxiety, lack of sleep is highly likely to be expected in them [5].

There is growing interest in the use of exercise in the treatment of depression.

A number of randomized controlled trials (RCTs) have demonstrated a reduction in depressive symptoms with both aerobic and non-aerobic exercise interventions. This has been supported in a number of systematic reviews and meta-analyses [6]. However, the heterogeneous nature of the exercise intervention trials makes determining the appropriate program variables (frequency, intensity, duration and type of exercise) difficult. Most studies explored the benefit of aerobic exercise in depression and anxiety and included running, brisk walking, treadmill or stationary bicycle. These activities might not be possible to be carried out in home by all.

Diaphragmatic breathing have been shown to raise the vital capacity in patients with asthma, functional status with heart failure, and in those with chronic obstructive pulmonary disease (Cahalin, Braga,Matsuo, & Hernandez, 2002) [7]. Further, this exercise has also been shown to reduce the levels of pain associated with migraines and with recovery from surgery (de Jong & Gamel, 2006; Kaushik, kaushik, Mahajan, &Rajesh, 2005) [8,9].

Diaphragmatic Breathing has been shown to have a relaxing and stabilizing effect on the autonomic nervous system (Kim et al., 2015; Subbalakshmi, Adhikari, & Shanmugavel Jeganathan, 2014) [10, 11]. However, its role in mental health as a physical therapy intervention is an area that needs to be further explored. The advantages of breathing exercise are that it is a non-pharmacological approach and can be administered safely, space requirements are minimal, easy to learn, and easy to practice (Kim, Roth, & Wollburg, 2015) [10].

Several studies on yoga and its beneficial effects on depression, anxiety, mood etc. have been noted [12]. These studies included various yogic breathing techniques and pranayamas along with other means.

Hence, it indicates that breath controls used in various combinations could have beneficial effects on mental health and well-being of an individual. Whether they really play a significant positive role in regulating mental health or are more placebo in nature is something that needs to be seen.

Limited number of Studies have explored the use of breathing exercise on mental health parameters. Some used supervision and monitoring with instruments and other means that might not be feasible or available for use during self-practice [13].

This study was therefore aimed at studying the efficacy of breathing exercise as a very simple and easy mean on mental health targeting the family caregivers who are probably suffering from or are susceptible to develop more serious mental disorders.

A study by vilano et al [14] combined the results of 23 studies to compare the physical health of caregivers with demographically similar noncaregivers. When examined across 11 health categories, caregivers exhibited a slightly greater risk for health problems than did noncaregivers. Schulz et al [15] concluded that Psychological health appears to be the aspect of the family caregiver's life that is most affected by providing care. A Study by Cohen et al [16] reported higher levels of depressive symptoms and mental health problems among caregivers than among their noncaregiving peers. Depression appears to be the most common psychological disorder, with 20% to 50% of caregivers reporting depressive disorders or symptoms.

Weihua et al (2015) [17] found that more the severe pathogenic condition of the patient, the heavier the psychological pressure is on their family member caregivers and cocluded that medical staff should therefore pay close attention to the psychological health of family caregivers of TBI

patients, especially family caregivers of critical cases. Interventions should be accordingly designed and conducted to meet the needs of family caregivers.

A systematic review on exercise for depression by mead et al (2008) [6], revealed that there were positive effects of exercise to reduce depression. Most of the studies involved use of aerobic exercises. Although there is dearth of studies exploring the isolated efficacy of controlled Diaphragmatic Breathing on mental health there are reasons why it should have a role to play because studies have documented and claimed its effects on heart rate variability, skin conductance parasympathetic dominance etc. Evaristo et al. (2014) [18] are still analyzing data on a comparative study benefits of aerobic and breathing exercise. Results and conclusion of this study could explain why breathing exercise can have similar effects as aerobic exercise.

Marie et al (2014) [19] concluded that controlled breathing exercises improve anxiety and depression in patients hospitalized for COPD exacerbation. They conducted a randomized clinical study with 46 male subjects, 67–86 years old, hospitalized with acute COPD exacerbation. Subjects were randomly and equally divided into a control group and a controlled breathing intervention group. They measured baseline and post-intervention dyspnea, anxiety and depression, quality of life with the St George's Respiratory Questionnaire and the European Quality of Life questionnaire, maximum inspiratory and expiratory pressure, hand-grip strength, and sleep quality. The cohort had high dyspnea and low overall quality of life. Controlled breathing techniques significantly improved dyspnea, anxiety, and mobility. All the measured variables improved in the intervention group. The control group had poorer values in all the variables after the hospitalization period.

Ma et al (2017) [13] aimed to investigate the effect of diaphragmatic breathing on cognition, affect, and cortisol responses to stress. Forty participants were randomly assigned to either a breathing intervention group (BIG) or a control group (CG). The BIG received intensive training for 20 sessions, implemented over 8 weeks, employing a real time feedback device, and an average respiratory rate of 4 breaths/min, while the CG did not receive this treatment. Results show that diaphragmatic breathing could improve sustained attention, affect, and cortisol levels.

Methods:

Design:

A total of 200 subjects were recruited from family members serving as caregivers to post stroke patients residing in Kolkata and undergoing rehabilitation upon due recommendations. The following are the details of method used in the study.

The study was approved by institutional ethics committee. Subjects have given their consent and their confidentiality were maintained.

Sample Size:

200 participants were selected based on inclusion and exclusion criteria. from the caregivers of post stroke patients in Kolkata.

Sample design

Participants were selected by convenient sampling.

Inclusion criteria

Subjects were chosen if they are above 18years of age, is not taking any psychotropic medication and were able to read and understand simple English.

They were the caregivers of stroke patients having a score of 14 or below in Barthel index.

Exclusion Criteria

Subjects pre-diagnosed with psychiatric, neurological or cardio respiratory ailments that may interfere with the study would be excluded. Subjects facing any triggering events would also be excluded from the study.

Withdrawal Criteria

Participants were withdrawn from the study if they were unwilling to continue with or without any reason

Outcome measures

Outcome measures includes Karolinska Sleepiness Scale (KSS) for sleep, Beck Depression inventory (BDI) for depression, Beck Anxiety inventory (BAI) for anxiety, Positive and negative affect schedule (PANAS) to measure both positive and negative affect. Profile of mood state –Modified (POMS) to assess the mood.

Testing procedure

Caregivers of stroke patients with a score of 14 or below in Barthel index (0-20) were taken as cut off to indicate their level of dependency. Patients had the ability to speak (speech unaffected) and underwent rehabilitation from same therapist during the study period. Subjects were allotted in two groups (100 each) alternately.

The intervention group underwent a supervised controlled diaphragmatic breathing exercise program at thrice a week for eight weeks. Each session would be clock guided and last for 15 minutes. They were required to breathe in for 5 seconds and breathe out for 10 seconds thereby having a respiratory rate of 4 per minute. A break of 90 seconds after every 4 minutes were allowed. There was a preceding training period of 4 weeks at thrice per week. The control group would only undergo baseline measurements and were allowed to carry on their normal life without any recommendations. At the end of 8 weeks outcome measures were further evaluated for every subject and analyzed statistically.

Results

The data collected were based on the outcome measures were analyzed statistically using SPSS. Paired t test was conducted and significance were determined at $p < 0.01$. Mean age of the subjects in intervention group was 51.36 with SD 6.23 and in control group was 51.35 with SD 5.35. There were 48 males and 52 females in the intervention group. Control group had 46 males and 54 females.

Statistical Analysis

The intervention group showed significant lower scores in KSS, BDI,

BAI, PANAS-N, and Total Mood disturbance (TMD) score in modified POMS when compared with baseline measures. The scores in PANAS-P was significantly higher for this group.

The control group showed no significant difference in their outcome

Measures when compared with the baseline.

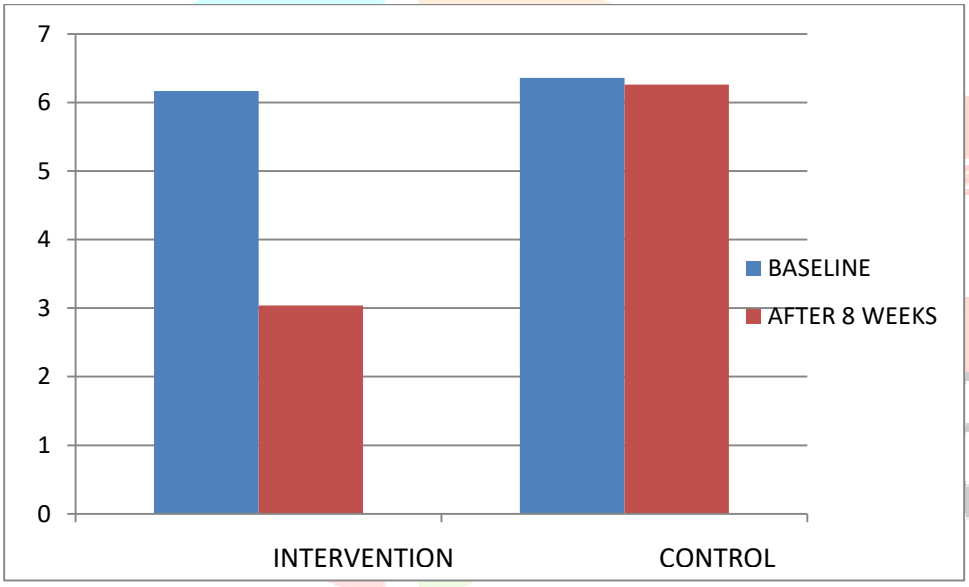

Figure 1 : Comparison between intervention group and control group by baseline and after 8 weeks value of KSS

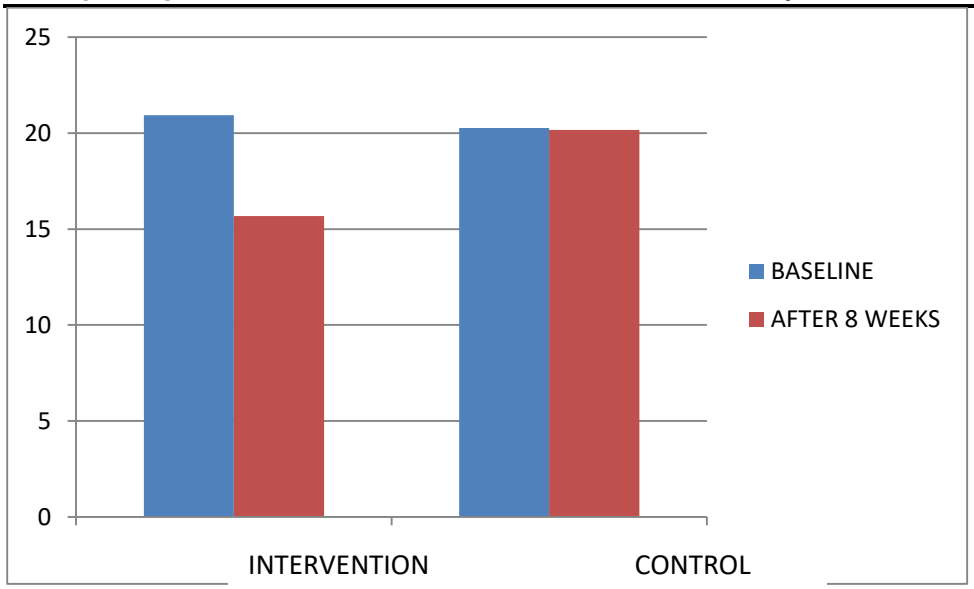

Figure 2 : Comparison between intervention group and control group by baseline and after 8 weeks value of BDI

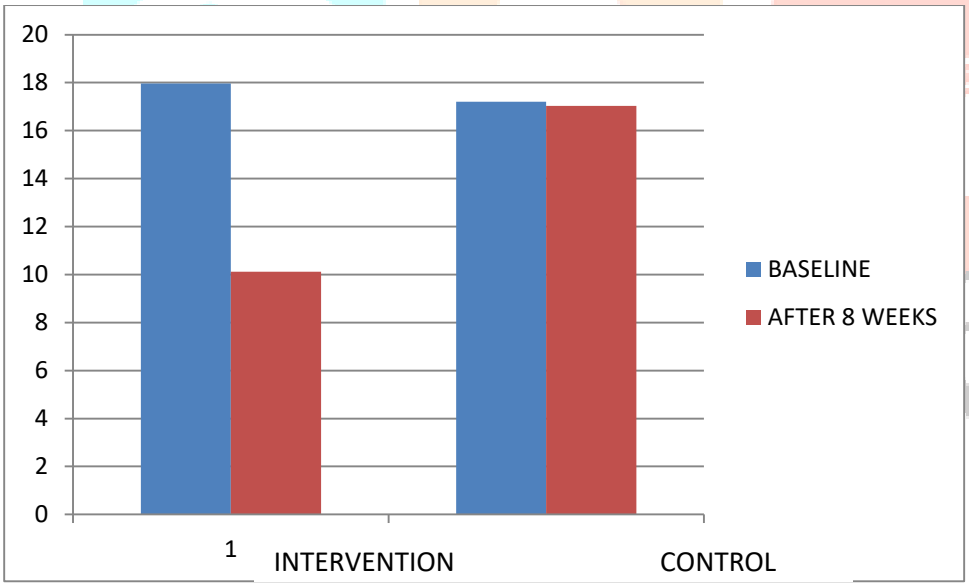

Figure 3 : Comparison between intervention group and control group by baseline and after 8 weeks value of BAI

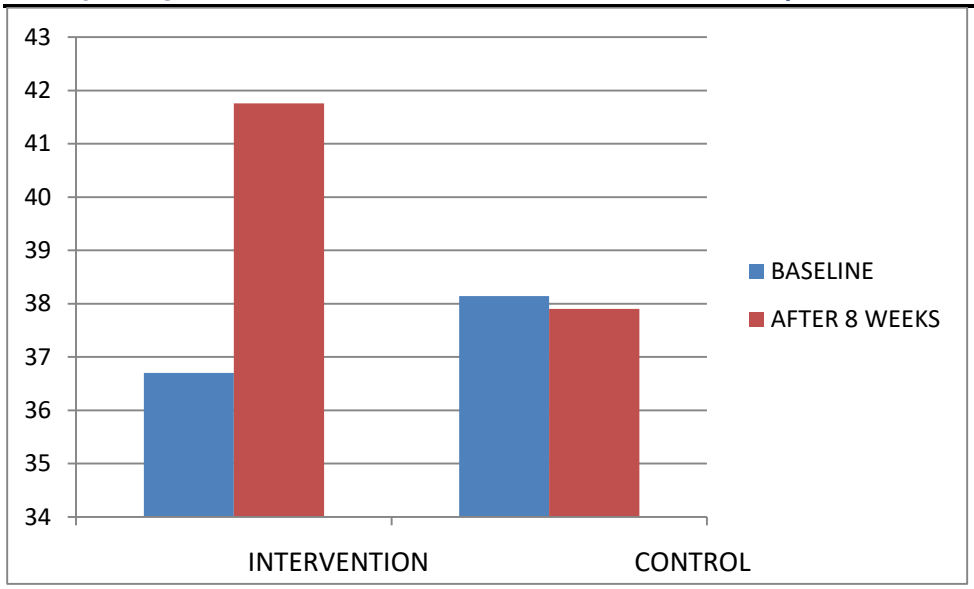

Figure 4 : Comparison between intervention group and control group by baseline and after 8 weeks value of PANAS-P

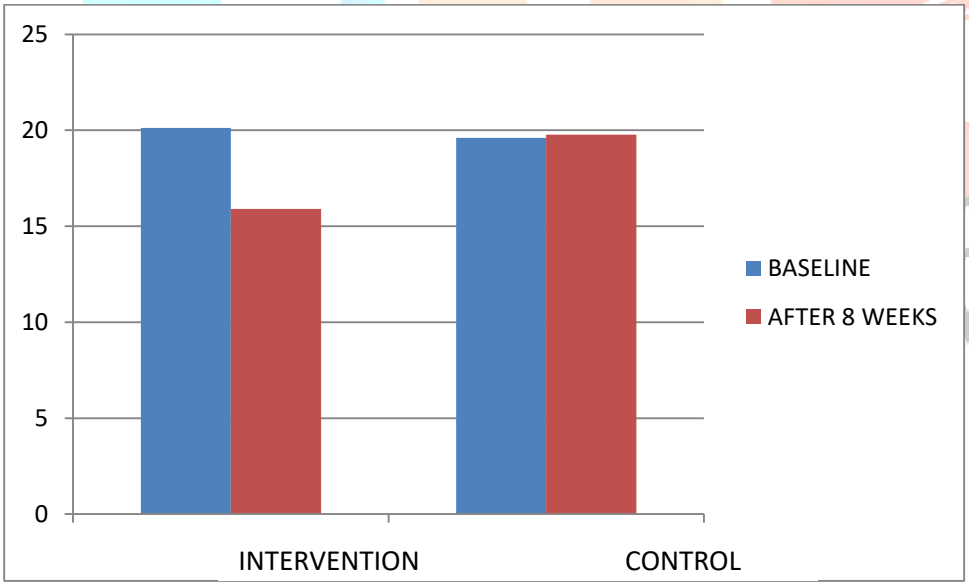

Figure 5 : Comparison between intervention group and control group by baseline and after 8 weeks value of PANAS-N

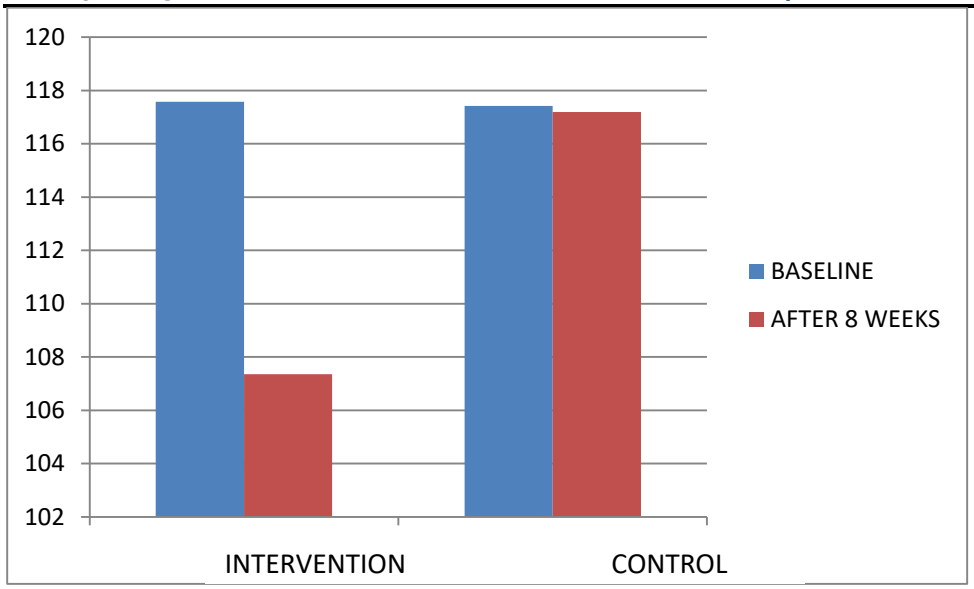

Figure 6 : Comparison between intervention group and control group by baseline and after 8 weeks value of abbreviated POMS

		Mean	N	Std. Deviation	Std. Error Mean
Baseline	KSS-IG	6.1700	100	1.29533	.12953
	KSS-CG	3.0400	100	.92025	.09203
Baseline	BDI-IG	6.3600	100	1.18509	.11851
	BDI-CG	6.2600	100	.83630	.08363
Baseline	BAI-IG	20.9300	100	3.84354	.38435
	BAI-CG	15.6800	100	2.92975	.29297
Baseline	PANAS-P(IG)	20.2600	100	3.80754	.38075
	PANAS-P(CG)	20.1600	100	3.62015	.36201
Baseline	PANAS-N(IG)	17.9600	100	3.85578	.38558
	PANAS-N(CG)	10.1200	100	3.28535	.32854
Baseline	POMS-IG	17.2000	100	3.90027	.39003
	POMS-CG	17.0300	100	3.81241	.38124
After 8 weeks	KSS-IG	36.7000	100	3.80988	.38099
	KSS-CG	41.7600	100	2.51107	.25111
After 8 weeks	BDI-IG	38.1400	100	2.99501	.29950
	BDI-CG	37.9000	100	2.75424	.27542
After 8 weeks	BAI-IG	20.1300	100	4.38467	.43847
	BAI-CG	15.9100	100	2.81445	.28144
After 8 weeks	PANAS-P(IG)	19.6000	100	3.91578	.39158
	PANAS-P(CG)	19.7700	100	3.62052	.36205
After 8 weeks	PANAS-N(IG)	117.5800	100	5.89501	.58950
	PANAS-N(CG)	107.3600	100	6.88802	.68880
After 8 weeks	POMS-IG	117.4200	100	5.36577	.53658
	POMS-CG	117.1900	100	5.17901	.51790

Table 1: Descriptive Statistics

Paired Samples Test

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Baseline	KSS CG - KSS IG	3.13000	1.04112	.10411	2.92342	3.33658	30.064	99	<.001	<.001
After 8 weeks	KSS CG - KSS IG	.10000	.93744	.09374	-.08601	.28601	1.067	99	.144	.289
Baseline	BDI IG - BDI CG	5.25000	1.65983	.16598	4.92065	5.57935	31.630	99	<.001	<.001
After 8 weeks	BDI IG - BDI CG	.10000	.90453	.09045	-.07948	.27948	1.106	99	.136	.272
Baseline	BAI IG - BAI CG	7.84000	1.75073	.17507	7.49262	8.18738	44.781	99	<.001	<.001
After 8 weeks	BAI IG - BAI CG	.17000	2.25655	.22566	-.27775	.61775	.753	99	.227	.453
Baseline	PANASP IG - PANASPC G	5.06000	2.52990	.25299	-5.56199	-4.55801	-20.001	99	<.001	<.001
After 8 weeks	PANASP IG - PANASPC G	.24000	1.56425	.15642	-.07038	.55038	1.534	99	.064	.128
Baseline	PANASN IG - PANASNC G	4.22000	2.11096	.21110	3.80114	4.63886	19.991	99	<.001	<.001
After 8 weeks	PANASN IG - PANASNC G	-.17000	1.08297	.10830	-.38489	.04489	-1.570	99	.060	.120
Baseline	POMS IG - POMS CG	10.22000	3.23360	.32336	9.57838	10.86162	31.606	99	<.001	<.001

After 8 weeks	POMS IG - POMS CG	.23000	1.93247	.19325	-.15344	.61344	1.190	99	.118	.237

Table 2 : Statistical analysis using t-test

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardizer[a]	Point Estimate	Lower	Upper
Baseline	KSS IG - KSS CG	Cohen's d	1.12355	2.786	2.350	3.218
		Hedges' correction	1.13216	2.765	2.332	3.194
After 8 weeks	KSS IG - KSS CG	Cohen's d	1.02563	.098	-.099	.294
		Hedges' correction	1.03348	.097	-.098	.291
Baseline	BDI IG - BDI CG	Cohen's d	3.41733	1.536	1.244	1.824
		Hedges' correction	3.44349	1.525	1.235	1.811
After 8 weeks	BDI IG - BDI CG	Cohen's d	3.71503	.027	-.169	.223
		Hedges' correction	3.74347	.027	-.168	.221
Baseline	BAI IG - BAI CG	Cohen's d	3.58194	2.189	1.825	2.549
		Hedges' correction	3.60937	2.172	1.811	2.530
After 8 weeks	BAI IG - BAI CG	Cohen's d	3.85659	.044	-.152	.240
		Hedges' correction	3.88612	.044	-.151	.238
Baseline	PANASPIG - PANAS CG	Cohen's d	3.22650	-1.568	-1.860	-1.273
		Hedges' correction	3.25120	-1.556	-1.846	-1.263
After 8 weeks	PANASPIG - PANAS CG	Cohen's d	2.87715	.083	-.113	.280
		Hedges' correction	2.89918	.083	-.112	.277
Baseline	PANASNIG - PANASNCG	Cohen's d	3.68419	1.145	.891	1.396
		Hedges' correction	3.71239	1.137	.884	1.386
After 8 weeks	PANASNIG - PANASNCG	Cohen's d	3.77104	-.045	-.241	.151
		Hedges' correction	3.79991	-.045	-.239	.150
Baseline	POMS IG - POMS CG	Cohen's d	6.41077	1.594	1.296	1.888
		Hedges' correction	6.45985	1.582	1.287	1.874
After 8 weeks	POMS IG - POMS CG	Cohen's d	5.27322	.044	-.153	.240
		Hedges' correction	5.31359	.043	-.151	.238

a. The denominator used in estimating the effect sizes.

Cohen's d uses the square root of the average variance of measures.

Hedges' correction uses the square root of the average variance of measures, plus a correction factor.

Table 3: Effect size of the paired samples

Discussion:

The results of this study shows that controlled diaphragmatic breathing exercise has a positive effect on the mental health of family caregivers of post stroke patients. It has shown to significantly reduce the scores in KSS, BDI, BAI, PANAS-N, and TMD in modified POMS which means it has helped to improve the quality of sleep, reduce depression and anxiety, lower the negative affect raise the positive affect and minimize the mental disturbances in the subjects.

Since the control group didn't show any significant differences between their baseline measures and that of after 8 weeks, it can be attributed to the practise of controlled diaphragmatic breathing exercise which may have had a role to play in the significant difference of the intervention group .

Role of controlled diaphragmatic breathing

How controlled diaphragmatic breathing (DB) may have such positive impact remains a source of scientific study. One theory is that controlled diaphragmatic breathing can change the response of the body's autonomic nervous system, which controls unconscious processes such as heart rate and digestion as well as the body's stress response.

Consciously changing the way one breathe appears to send a signal to the brain to adjust the parasympathetic branch of the nervous system, which can slow heart rate and digestion and promote feelings of calm as well as the sympathetic system, which controls the release of stress hormones like cortisol. Many maladies, such as anxiety and depression, are aggravated or triggered by stress.

With slow, steady breaths, brain activates the parasympathetic response. With shallow rapid breaths or breath holds, the sympathetic response is activated. Changing the rate and pattern of breathing affects the way the autonomic nervous system (ANS) functions. Certain types of rapid breathing can help activate the

sympathetic system. Other slow breath practices can help bring this excitation back down to baseline and reduce the amount of adrenaline coursing through the body.

Slow breath techniques activate the counter-balancing parasympathetic nervous system, which acts to slow the heart rate, restore energy reserves, reduce inflammation, and send messages to the brain that it can now relax and start to release beneficial hormones.

DB reduces the oxidative stress induced by exhaustive exercise or physical activity. It is known that cortisol inhibits enzymes responsible for the antioxidant activity of cells and that melatonin is a strong antioxidant. Cortisol and melatonin levels could affect the modulation of antioxidant defenses and are relevant in determining the final level of oxidative stress.

A number of studies support the fact that meditation, through the modulation of the neuroendocrine response, combats stress and its related diseases. In fact, beyond its psychological and social effects, clinical studies have documented that meditation improves the immune system and decreases cardiovascular risk factors such as hyperlipidemia, hypertension and atherosclerosis. A reduction in both glucocorticoids and oxidative stress has been documented in people who practice meditation regularly. Hormonal reactions to stressors, in particular plasma cortisol levels, are lower in people who meditate than in people who do not, suggesting that it is possible to modulate the neuroendocrine system through neurological pathways. Analysis of oxidative stress levels in people who meditate indicated that transcendental meditation, Zen meditation and Yoga correlate with lower oxidative stress levels. Most, if not all, meditation procedures involve diaphragmatic breathing (DB), which is the act of breathing deep.

A number of studies [20] support the fact that meditation, through the modulation of the neuroendocrine response, combats stress and its related diseases. A reduction in both glucocorticoids and oxidative stress has been documented in people who practice meditation regularly. Hormonal reactions to stressors, in particular plasma cortisol levels, are lower in people who meditate than in people who do not suggesting

that it is possible to modulate the neuroendocrine system through neurological pathways. Analysis of oxidative stress levels in people who meditate indicated that transcendental meditation, Zen meditation and Yoga correlate with lower oxidative stress levels.

DB has various physiological effects in humans. The diaphragm is the major respiratory muscle. As the movement of the diaphragm has a positive correlation with the lung volume, using the diaphragm consciously during respiration increases the lung capacity. DB facilitates slow respiration, but if RR decreases, hypercapnia and the activation of chemoreceptors would be induced to increase RR to maintain the respiratory homeostasis. [21]. DB that controlled RR at six breaths/min reduces the chemoreflex response to hypoxia and hypercapnia compared with normal breathing

Decreased RR increases the VT, which improves the efficiency of ventilation for oxygen through alveolar recruitment and distention, improving the alveolar ventilation due to reduced alveolar dead space and increasing the arterial oxygen saturation. [21]. Therefore, DB has a potential to improve the blood oxygen levels. RR also affects the heart rate, systemic blood pressure, and circulating blood volume.

Generally, inspiration decreases the intra thoracic pressure and increases the pressure gap between the right heart and the systemic circulation, which increases the venous return to the right heart. On the other hand, the pulmonary venous return decreases and the blood volume in the left heart is reduced. As a result, the cardiac output increases due to the increase of blood volume in the right heart. This physiological action is reversed in expiration. Heart rate increases during inspiration and decreases during expiration while arterial blood pressure is lowered. DB enhances the fluctuations in blood pressure and heart rate via slow breathing and diaphragm excursions, therefore improving the baroreflex sensitivity, heart rate variability, and blood pressure oscillations [21].

Breathing has a close relationship with autonomic nervous system function.

The phrenic nerve that controls the movement of the diaphragm is connected to the vagus (parasympathetic) nerve. Decreasing the RR by DB activates the parasympathetic nervous activity while suppressing the sympathetic nervous activity.

Chang et al. [22] reported that slow breathing with eight breaths/min makes the balance of the parasympathetic nervous activity dominant. Autonomic dysfunction, for example, a reduction in heart rate variability, is associated with an increased risk of cardiovascular mortality and morbidity. Hyperactive sympathetic nervous activity and hypoactive parasympathetic nervous activity can be regulated by DB, which will improve the cardiovascular health.

Jerath et al. [23] indicated that breathing stimulated the vagal activation of gamma-aminobutyric acid pathways in the brain, and reduced stress and anxiety. Furthermore, DB appears to have a favourable effect on the cardiovascular system and brain through the improvement of the autonomic balance.

Thus we can say that Diaphragmatic breathing can be a widely utilized intervention for physiological and psychological stress reduction. Diaphragmatic breathing may decrease physiological stress as measured by blood pressure, respiration and cortisol levels, and psychological stress.

Impact on stroke caregivers

Stroke survivors have varying degrees of dysfunction, which leads to their self-care deficiencies. Thus, they need long-term care by the caregivers, and this will disrupt the normal life and work of the caregivers to a certain extent. At the same time, long-term use of drugs, economic pressures of rehabilitation and concerns about the health status of patients also have a huge impact on the physiology, psychology and quality of life of the caregivers. A large number of studies[24] have found that the incidence of mental illness of the main caregivers of stroke patients is equal to

or greater than that of the stroke patients themselves. The main caregivers are in a status of high burden, anxiety and depression, leading to decreased quality of life.

Carol et al [25] showed that the length of care time was an important factor influencing the mental state of caregivers. It was reported that negative emotions like anxiety and depression were more likely to appear with prolonged care time. This may be because the long care time per day occupies too much private time of the caregivers, and thus reduces their work, social and entertainment time.

Stroke events in itself are a great source of stress for both stroke survivors and family caregivers, especially for the long-term family caregivers, who are subjected to physiological, psychological, and economic pressures, as well as family and social responsibilities. Thus, they are prone to bear care burden.

The correlation analysis of the study by hu et al [26] showed that the burden of caregivers was positively correlated with the level of anxiety and depression, which is in accordance with the results of previous studies. Further analysis found that personal burden had more correlation to anxiety and depression relative to the responsibility burden. This may probably be because that most caregivers are not professionals and lack of knowledge of the disease. Therefore, they spend more time and energy in the care process and have a self-restricted life and work, but with little support. So the long-term care experience will lead to disorders in their physical and mental health, family and social role, and their personal burdens dramatically increase.

Heavy burden not only leads to caregiver emotional problems but also reduces the enthusiasm of caregivers and affects the treatment and rehabilitation of patients. This suggests that clinicians should strengthen the assessment of care burdens for the caregivers of stroke patients and identify the carvigers with low-level social supports in the early stage to provide early assistance. In addition, a management team including the nursing staff, and the specialist, physician, counsellor and other members of

the family, should be of a great help to provide individualized home care instruction and counselling for caregivers.

Furthermore, social or financial support can assist in reducing caregiver burden among the caregivers of post-stroke patients or a comprehensive caregiver support programme should be developed as the guide for caregivers.[27] This may fundamentally reduce the burden of stroke patients caregivers, relieve their emotional disorders, strengthen the family function of the patients to ensure their improvement of physical and mental health, and provide good conditions for their disease management. In addition, the severity of the patient's condition may have an impact on the mental condition and care burden of caregivers.

Therefore we find, stroke caregivers have anxiety and varying degrees of depressive symptoms. Majority of the caregivers bear moderate and severe care burden, indicating the emotion and burden of stroke caregivers are not optimistic. Care time per day, medical payment method, and education levels of caregivers are major influencing factors of caregivers' emotion. The personal and responsibility burden of caregivers are positively correlated with anxiety and depression.

The study by Berg et al [28] is one of the few follow-up investigations available on depression of stroke caregivers. They examined the dynamic changes occurring in caregiver depression and its associated factors.

In their study, the percentages of depressive caregivers are of average level compared with the rates observed in previous studies. The rates of depression remained similar throughout the 18-month follow-up.

Interestingly, the association between stroke severity and depression is seen earlier among caregivers than among patients themselves. It was found [28] previously that the association between stroke severity and patient depression first became significant at 2 months. They suggest that caregivers can recognize the problems earlier than patients who may be unaware of their impairments at the acute stage.

The correlation between ages of the patients and spouses' depression became stronger throughout the follow-up. The patient and his or her spouse are older. It is unknown whether patient age or caregiver age

is more important, and it cannot be commented on age association at more advance ages. The correlation between patient depression and caregiver depression at 18 months suggests a possibility of some interaction between these variables in longer follow-up.

In later follow-up, caregiver depression was best predicted by caregiver's acute-phase depression. We tend to focus on patient- and stroke-related factors, but the importance of caregiver-related factors cannot be ignored.

The factors associated with exhaustion were not identical to those of depression . When age was significantly associated with spouse depression, the female sex of the caregiver was an important factor in exhaustion. Stroke severity and/or dependency were associated with caregiver depression and exhaustion during the first 6 months, which is in line with Bugge et al [29] but thereafter other factors became more important. When Bugge et al [29] found that caregiver stress appeared to increase in the early post stroke period, study by Berg et al [28] showed a slightly descending rate of exhaustion from 6 to 18 months. Exhaustion and depression were associated with each other 18 months after stroke. It is possible that exhaustion is one cause of depression.

The depressive symptoms of caregivers are frequent. If the financial burden and future responsibility for organizing health care shift more to community care, these questions may become even more important. Stroke severity is an important determinant of caregiver depression, and spouses of older patients are at risk of developing depressive symptoms not only at the acute stage but also during long follow-ups. The best predictor of caregiver depression at later stages is caregiver depression at the acute stage. This suggests that assessment of caregivers' medical, social, and emotional needs should be included as part of the general rehabilitationplan of the stroke patient.

So by use of simple cost effective non pharmacological methods like controlled diaphragmatic breathing, these issues of caregiver can be addressed to an extent and it would improve their health, help them to cope up with the care giving stress and burden as well as a improve the quality of care. Physiotherapists are the ones who are in regular direct contact with the stroke patient, so it is much easier for them to educate,

counsel, guide, motivate the caregivers and conduct regular therapy sessions consisting of controlled diaphragmatic breathing with them.

Limitations and recommendations

The outcome measures in this study were questionnaires and scales. It would have been better to use more parameters like B.P, H.R, cortisol levels etc.

Secondly, immediate, short term and long term effect along with the subject's compliance was not evaluated. Further studies addressing these shortcomings are needed.

Now it would be interesting to see the comparative and combined effects of

such controlled diaphragmatic breathing with other stress management means like Progressive muscle relaxation, bio feedback, guided imagery etc. in a wider population group.

It also needs to be seen whether spending a small part of the therapy session upon the family caregivers helps to fasten up the post stroke recovery.

Given the potential benefits of diaphragmatic breathing for physiological and psychological stress reduction, research is required to continue to establish the evidence base for this self-administered, low-cost and non-pharmacologic intervention.

Overall, there are limited studies on diaphragmatic breathing as an independent intervention to reduce physiological and psychological stress. Further research is needed to continue to develop the evidence base on the effectiveness of diaphragmatic breathing on physiological and psychological stress.

Well-designed studies such as randomized control trials with appropriate sample size and methodology are recommended. Study designs should include data that reflect effects over time of the positive impact of diaphragmatic breathing on stress reduction.

Although all researchers were able to establish the importance of diaphragmatic breathing on reducing stress, it will be necessary for future studies to precisely describe the intervention of interest. The future researches should aim to define guidelines and develop measurement tools that more clearly identify how to assess the effectiveness of diaphragmatic breathing on stress. It will also be essential to consider additional reliable, valid and more quantifiable outcome measure, to assess the effects of diaphragmatic breathing on psychological stress and physiological stress. Further testing with these tools will be needed to continue to demonstrate the efficacy of diaphragmatic breathing for stress reduction, anxiety, depression, mood, affect and sleepiness. Finally, additional research will help to develop cost savings related to diaphragmatic breathing in the reduction of stress.

Conclusion:

This study shows that controlled diaphragmatic breathing has significant positive and beneficial effects on the mental health of family caregivers of post stroke patients. It shows that controlled Diaphragmatic breathing could improve the sleep quality. Depressive and anxiety symptoms which are among the major mental health issue of stroke caregivers have also shown to improve. In addition to this it has positively impacted the mood and affect of the stroke caregivers

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