

## IMMEDIATE EFFECTIVENESS OF RELAXATION IN MANAGEMENT OF CHRONIC LOW BACK PAIN

### EFICIENȚA IMEDIATĂ A UNUI PROGRAM DE RELAXARE ÎN MANAGEMENTUL DURERII LOMBARE CRONICE

*Nishat Khan<sup>1</sup>, Khatri SM<sup>2</sup>*

**Key words:** non-specific chronic low back pain, relaxation, guided imagery, mindfulness of breathing

**Cuvinte cheie:** durere lombară nespecifică, relaxare, imaginație ghidată, conștientizarea respirației

#### Abstract

**Introduction.** One in three people suffer from chronic low back pain frequently associated with quality of life and high levels of psychological risks. Psychosocial factors appear to play a larger prognostic role than physical factors in low back pain. Relaxation has found to be effective in reducing symptoms in a variety of population including anxiety, cancer, Alzheimer's. However very few studies have been done to find out the effect of relaxation on chronic pain, hence this study aims to find the immediate effectiveness of relaxation in management of chronic low back pain.

**Method.** 72 Participants with Non-specific Chronic Low Back Pain meeting the inclusion and exclusion criteria were given two sessions of relaxation. Pre and post intervention scores were measured on first and second day. First day, any one of the relaxation technique was administered to the patient and then post intervention scores were noted. The second relaxation technique was given to the patient and post scores were noted.

**Results.** Pre intervention the mean baseline scores of Guided Imagery and Mindfulness of Breathing in terms of PPT, VAS, Systolic Blood Pressure, and Diastolic Blood Pressure showed extremely significant improvement ( $p < 0.0001$ ). Participants after receiving Guided Imagery showed no significant difference in Pulse Rate ( $p = 0.06$ ) while participants after receiving Mindfulness of Breathing showed significant difference in terms of Pulse Rate ( $p = 0.021$ ).

**Conclusion:** Guided Imagery and Mindfulness of Breathing are effective and can be utilized as an adjunct in the treatment of Non-Specific Chronic Low Back Pain.

#### Rezumat

**Introducere.** Unul din trei oameni suferă de durere lombară cronică, frecvent asociată cu reducerea calității vieții și riscuri psihologice. În durerea lombară, factorii psihologici par să aibă un rol prognostic mai mare decât factorii fizici. S-a demonstrat că relaxarea este eficientă în reducerea simptomelor la o mare varietate de persoane, incluzând anxietate, cancer, Alzheimer. Cu toate acestea, doar câteva studii au ca scop demonstrarea efectului relaxării în durerea lombară cronică. Prin urmare, acest studiu dorește să scoată în evidență efectul imediat al relaxării în managementul durerii lombare cronice.

**Metode.** 72 de subiecți cu durere lombară nespecifică au întrunit criteriile de includere sau de excludere. Ei au participat la 2 ședințe de relaxare. Scorurile pre și postintervenție s-au măsurat în prima și a doua zi. În prima zi s-a aplicat tehnica de relaxare și s-au notat scorurile postintervenție. A doua tehnică de relaxare s-a aplicat a doua zi, după care s-au notat scorurile la evaluarea finală.

**Rezultate.** Valorile medii preintervenție pentru imaginația ghidată și conștientizarea respirației, în termeni de PPT, VAS, tensiune arterială sistolică și diastolică au arătat o îmbunătățire semnificativă ( $p < 0.0001$ ). După aplicarea imaginației ghidate, nu au prezentat o diferență semnificativă a pulsului ( $p = 0.06$ ), în timp ce participanții care au urmat metoda conștientizării respirației au demonstrat diferențe semnificative a ratei pulsului ( $p = 0.021$ ).

**Concluzie:** Imaginația ghidată și conștientizarea respirației sunt eficiente și pot fi folosite ca metodă adjuvantă în tratamentul durerii lombare nespecifice.

<sup>1</sup> postgraduate student, B.P.T, M.P.T(Ortho), Dr. A. P. J. Abdul Kalam College of Physiotherapy, Pravara institute of Medical Sciences, Loni, Tal: Rahata, Dist: Ahmednagar, Maharashtra State, India 413 736

**Corresponding Author:** Nishat H Khan; e-mail: [khannishat036@gmail.com](mailto:khannishat036@gmail.com), contact number: 07066899264.

<sup>2</sup> B.Ph T, M.P.T(Ortho), Ph.D, Dr. A. P. J. Abdul Kalam College of Physiotherapy, Pravara institute of Medical Sciences, Loni, Tal: Rahata, Dist: Ahmednagar, Maharashtra State, India 413 736

## Introduction

For literally hundreds of years, the back has been a symbol of strength and a focus of stress.[1] Pain or discomfort can happen anywhere in the back, the most common area affected is lower back, and this is because the lower back supports most of the body's weight. Low back pain represents cause of one of the most common medical problems and a major cause of disability. Researchers suggest a 50% to 70% chance of any one adult suffering from low back pain during their lifetime with a prevalence of about 18% - 20%. [2] In USA, Back pain is the most common cause of activity limitation in people younger than 45 years of age, second most frequent reason for visits to physicians, the fifth ranking cause of admission to hospital and third major cause of surgical procedure.[3]

The International Association for the Study of Pain (IASP) defines lumbar spinal pain as “pain perceived as arising from anywhere within a region bounded superiorly by an imaginary transverse line through the tip of the last thoracic spinous process, inferiorly by an imaginary transverse line through the tip of the first sacral spinous process, and laterally by vertical lines tangential to the lateral borders of the lumbar erectors spinae.” Sacral spinal pain is defined as “pain perceived as arising from anywhere within a region bounded superiorly by an imaginary transverse line through the tip of the first sacral spinous process, inferiorly by an imaginary transverse line through the sacrococcygeal joints, and laterally by imaginary lines passing through the posterior superior and posterior inferior iliac spines.” Low back pain is considered to arise from both the lumbar and sacral locations.[4]

The low back pain can be categorized according to the “diagnostic triage” into three divisions as Specific spinal pathology, Nerve root pain/radicular pain, Non-specific low back pain.[5] On basis of duration, low back pain can be classified as acute, sub-acute and chronic. In acute low back pain, the duration of pain is in between 0 and 6 weeks, in sub-acute the duration of low back ache is 6 and 12 weeks and in chronic the duration is more than 12 weeks. Chronic low back pain can further be classified as early phase, intermediate and late phase. [6]

Nonspecific low back pain is the most common type of back pain. About 19 in 20 cases of sudden-onset low back pain are classed as nonspecific. It is called nonspecific because there is no specific problem or disease that can be identified as the cause of the pain. In some cases the cause may be a sprain of a ligament or muscle, minor problem with a disc, or a minor problem with a small facet joint between two vertebrae. It may develop immediately after lifting something heavy, or after an awkward twisting movement. The severity of the pain can range from mild to severe. The pain is usually eased by lying down flat. It is often made worse if you move your back, cough, or sneeze. So, nonspecific low back pain is mechanical in the sense that it varies with posture or activity. [7]

There has been growing recognition that pain is a complex perceptual experience influenced by a wide range of psychosocial factors, including emotions, social and environmental context, social-cultural background, the beliefs, attitude and the biological factors.[8] The pharmacological treatment for low back pain begins with maximum recommended doses of Non inflammatory anti-steroidal drugs and acetaminophen followed by other adjunctive medications. Physical therapy includes patient's education about the condition and a combination of stretching, strengthening exercises, manual therapy and modalities like ice, heat, TENS, ultrasound to treat pain. Coping skills are extremely important in management of chronic low back pain. Chronic pain affects all areas of life. Pain affects mood and mood affects the individual's ability to cope up. [9]

In 1995, Ryman defined relaxation as ‘a state of consciousness and release from tension, anxiety and fear’.[10] Relaxation strategies have been used for centuries as integral components of major philosophical, theological and therapeutic traditions. The relaxation response is defined as the response that is the opposite of the “fight-or-flight” or stress response. It is characterized by the following: decreased metabolism, heart rate, blood pressure, and rate of breathing; a decrease or “calming” in brain activity; an increase in attention and decision-making functions of the brain; and changes in gene activity that are the opposite of those associated with stress. [11]

The Imagery technique has been used for a century-but research about the efficacy of the technique did not surface until the 70's from the medical profession. Guided Imagery also defined as a "range of techniques, from simple visualization and direct imagery-based suggestion through metaphor and storytelling". [12]

In 1990 Guy Claxton defined Mindfulness as "Mindfulness is simply the knack of noticing without comment whatever is happening in your present experience".[13] In most cases chronic low back pain is a psychosomatic condition in which a real physical problem exists but psychological factors play important role in determining the experience of problem. Relaxation has found to be effective in reducing symptoms in a variety of population including anxiety, phobias, headaches, substance abuse, hypertension, fibromyalgia, asthma, cancer, Alzheimer's. [14]

However very few studies have been done to find out the effect of relaxation on chronic pain, hence this study aims to find the immediate effectiveness of relaxation in management of chronic low back pain.

### **Material and method**

The study design used was experimental study. The study included participants who fulfilled the inclusion and exclusion criteria in the study. Non Probability type of convenient sampling was done in this study. No efforts were made regarding blinding of therapist or patient. 91 male and female participants within 30-60 years of age were referred to Orthopaedic Physiotherapy Department, Pravara Rural Hospital, Loni, Taluka – Rahata, District-Ahmednagar, Maharashtra state, India-413 736 from February 2015 – December 2015 with a clinical diagnosis of Non Specific Chronic Low Back Pain(> 12 weeks) and who were willing to participate in the study were included in the study. Participants were excluded if they had recent trauma/ recent surgeries, acute low back pain, gastrointestinal disorders, cardiac conditions, psychotic symptoms, involved in other psychological or pharmacological intervention, epilepsy, vertigo and those with full stomach. [15][16]

#### *Intervention*

The intervention was performed for 2 days. Participants received a one day session of first relaxation technique for 10 minutes and one session of second technique on the next day for 10 minutes. All the participants were in a single group. Pre and post intervention scores were measured on day one and day two. On day one Pressure pain threshold, Visual analogue scale, Blood pressure and pulse rate was measured before the intervention.

The Pressure Pain Threshold (PPT) was assessed with pressure algometer. Blood pressure and pulse rate was assessed with the help of Digital blood pressure monitor. The study included two types of relaxation techniques, on the first day any one of the relaxation technique was administered to the participants and then post intervention scores were noted. On day two pre- intervention scores were assessed. The second relaxation technique was given to the participant and post scores were noted. Participants were then guided to take conventional physiotherapy once the intervention was over.

**Procedure for Guided Imagery:** To begin with the technique, participants were told to be in comfortable position. Once the body is completely relaxed, allow visualization relaxation to begin. Participants were told to imagine that they were walking towards the shore, walking through a beautiful path, instructed to hear the waves and try to smell the beach, feel the cool breeze blowing through the trees. Participants were made to imagine that they are walking towards the water and were made to feel the water touching their toes, see the waves approaching them. Then instructions were given to open their eyes, stretch their muscles, become alert and refreshed, and filled with energy. [17]

**Procedure for Mindfulness of Breathing:** Participants were in meditation posture with the back erect. Patients were instructed to be in comfortable position in chair, allowing hands to rest comfortably, loosen any tight clothing that restricts stomach. Gently close your eyes. Instructions were given to take two or three deeper breaths from your diaphragm, letting the air flow all the

way into stomach, without any push or strain, and then flow gently back out again. Let breathing find its own natural, comfortable rhythm and depth. Focus attention on the feeling of your breath as it comes in at the tip of nose, moving through the back of throat, into lower diaphragm, and back out again, letting stomach rise and fall naturally with each breath. Participants were guided to stay focused on their breath and away from the noise, the thoughts, the feelings, the concerns that may usually fill their mind. Observe the process of the mind. Gently return attention to the breath if mind becomes caught in thoughts. Instructions were given to silently in their mind, count “one” on inhalation and “one” on exhalation. Do it up to ten for 10 minutes.[18]

#### Outcomes

The following were the outcome measures used in this study: PPT (Pressure Pain Threshold), VAS (Visual Analogue Scale), Blood Pressure and Pulse Rate.

#### Data analysis

Analysis was done on the basis of data obtained pre and post intervention using PPT, VAS, Blood pressure and Pulse Rate. Data was analyzed using Graph Pad InStat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as t test. The confidence interval was set as at 95% and data was considered statistically significant with  $p < 0.05$  and highly significant with  $p < 0.01$

### Results

A total of ninety-one participants were screened, of which eighty three participants met the inclusion criteria. Out of these, seventy four participants agreed to participate in the study. However, two participants dropped out during the intervention, as they stayed away from hospital and found it difficult to travel. Thus there were 72 participants in total who received two sessions of relaxation. The mean age of participants was  $44.97 \pm 9.00$  years. The average age of females was  $44.98 \pm 9.00$  years and for males was  $44.96 \pm 9.20$  years. The gender ratio was 49:23 (49 females and 23 males). The mean BMI of participants was  $24.75 \pm 1.99 \text{ kg/m}^2$ .

In participants with Guided Imagery, comparing the pre and post values for PPT, VAS, Systolic BP, Diastolic BP it was observed that the mean difference was extremely significant ( $p < 0.0001$ ). Pre and post values for pulse rate it was observed that this mean difference was not significant ( $p = 0.06$ ).

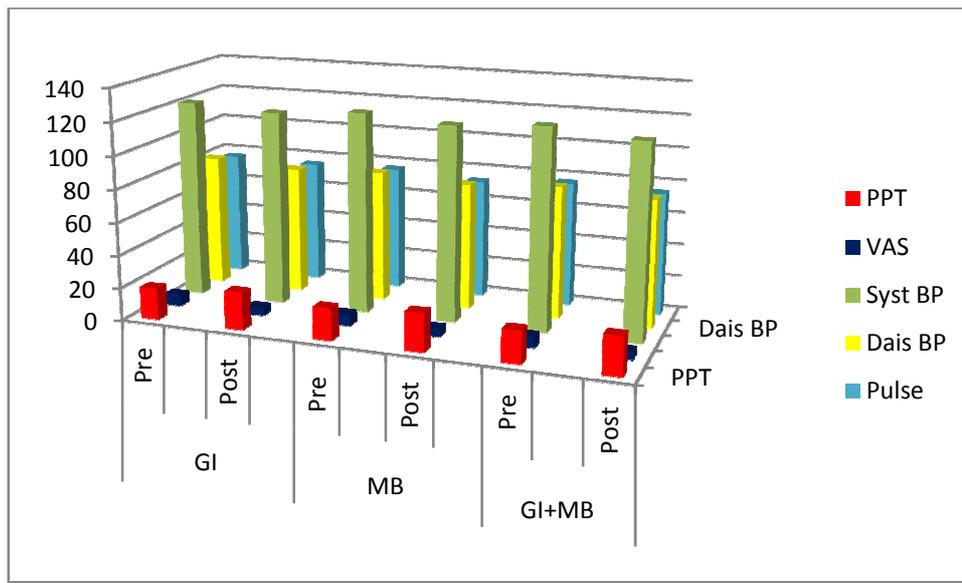
In participants with Mindfulness of Breathing, comparing the pre and post values for PPT, VAS, Systolic BP, Diastolic BP it was observed that the mean difference was extremely significant ( $p < 0.0001$ ). Pre and post values for pulse rate it was observed that this mean difference was significant ( $p = 0.0213$ )

On comparing pre and post values for PPT, VAS and Diastolic Blood Pressure in participants with Guided Imagery and Mindfulness of Breathing, it was observed that this difference was extremely significant ( $p < 0.0001$ ). The pre and post mean difference for systolic and diastolic Blood Pressure was very significant ( $p = 0.041$ ) while pulse rate was observed to be non-significant ( $p = 0.052$ ) (**Table 1**) (**Graph 1**)

**Table 1: Values for Mean, Standard Deviation, t & p value.**

|             |      | GI          |       |          | MB          |       |          | GI + MB     |       |          |
|-------------|------|-------------|-------|----------|-------------|-------|----------|-------------|-------|----------|
|             |      | Mean± SD    | T     | p value  | Mean ± SD   | t     | p value  | Mean±SD     | t     | p value  |
| PPT         | Pre  | 19.20±4.49  | 11.85 | p<0.0001 | 19.43±4.81  | 12.87 | p<0.0001 | 19.60±4.57  | 14.74 | p<0.0001 |
|             | Post | 22.07±4.7   |       |          | 23.21±4.55  |       |          | 23.17±4.39  |       |          |
| VAS         | Pre  | 6.69±1.251  | 19.43 | p<0.0001 | 6.85±1.436  | 16.21 | p<0.001  | 6.806±1.10  | 22.93 | p<0.0001 |
|             | Post | 4.786±1.10  |       |          | 4.79±1.326  |       |          | 4.786±1.04  |       |          |
| Systolic BP | Pre  | 121.29±6.91 | 3.61  | p=0.02   | 122.29±7.12 | 4.96  | p<0.0001 | 121.89±6.04 | 2.96  | p=0.004  |

|              |      |             |      |         |             |      |          |             |       |         |
|--------------|------|-------------|------|---------|-------------|------|----------|-------------|-------|---------|
|              | Post | 118.71±6.91 |      | 006     | 118.56±8.29 |      | 1        | 117.40±13.5 |       | 1       |
| Diastolic BP | Pre  | 80.68±6.8   | 4.58 | p<0.001 | 80.19±5.69  | 5.76 | p<0.001  | 80.53±6.27  | 5.576 | p<0.001 |
|              | Post | 78±7.04     |      |         | 77.32±5.72  |      |          | 77.89±5.89  |       |         |
| Pulse Rate   | Pre  | 76.31±8.36  | 1.85 | p=0.067 | 76.43±8.02  | 2.35 | p=0.0213 | 76.44±7.63  | 1.97  | p=0.052 |
|              | Post | 75.29±7.48  |      |         | 75.04±7.9   |      |          | 74.76±10.88 |       |         |



Graph 1: PPT, VAS, BP, Pulse Rate in GI, MB, GI+MB

**Discussion**

Chronic pain is both physically and psychologically noticeable. Pain is often associated with stress, depression, anxiety. Stress lowers the pain tolerance and hence techniques such as relaxation help the mind and body to relax so that it can alleviate stress, thus helping the chronic pain to feel better.[19]Kingston J et al., investigated the effect of mind on pain tolerance, psychological well-being and physiological activity stated that pain tolerance significantly increased in the mindfulness condition only. There was a strong trend indicating that mindfulness skills increased in the mindfulness condition, but this was not related to improved pain tolerance. Interestingly, there is some evidence suggesting that higher levels of mindfulness could be linked to decreased pain perception and to an overall better functioning. [20]

Intensity of pain perceived by participants was measured by Visual Analogue Scale. When your body remains in a stress state for long time, emotional or physical damage may occur. The over riding tenet in all theories regarding low back pain is that psychological and emotional factors cause some type of physical change resulting in back pain. Pain is regulated by nervous system. The brain inhibits the pain signal but if the body is under constant stress, the brain’s ability to filter pain is affected adversely and this contributes to increase in pain. Relaxation relieves pain or keeps it from getting worse by reducing tension in the muscles. Relaxation techniques are used in order to divert the attention away from pain. A study evaluated the effects of guided imagery on pain, function, and self-efficacy in 48 people with fibromyalgia.

Functional status and self-efficacy for managing pain were significantly improved in the guided-imagery group, compared with the usual-care group. There were, however, no significant improvements or differences in pain between the two groups on pain scores.

When a situation is perceived as challenging, the brain immediately responds via the spinal ganglia, by stimulating the adrenal medulla to release catecholamines such as adrenaline and noradrenaline into the bloodstream. The function of these neurotransmitters is to prepare the organs for action in a manner which has been known as the 'fright/flight/fight' response. It is characterized by increase in heart rate and redistribution of blood from the viscera to the voluntary muscles. Blood pressure and respiratory rate are also increased, alertness and sensory awareness are heightened and muscle tension is raised. Relaxation aims to counteract the effects of sympathetic activity by promoting the action of parasympathetic nature of two parts of the autonomic nervous system. It causes reductions in heart rate, breathing rate, oxygen consumption, blood pressure and blood lactate.

The last thirty years of mind body cardiac research shows that Guided Imagery for heart health to improve heart rate, blood pressure, heart rate variability associated in reducing arterial plaque. [21] Prof Hughes in a study found that patients with Mindfulness group gave lower readings for both systolic and diastolic blood pressure. The systolic blood pressure decreased by almost 5 mmHg and diastolic reading decreased by 2 mmHg. Researches from Ohio claim that Mindfulness training can lower blood pressure to such an extent that it could prevent or delay the need for drug intervention. [22]

National Center for Complementary and Alternative Medicine states the goal of techniques such breathing relaxation is to decrease your heart rate and stress levels by stabilizing CO<sub>2</sub> levels in your blood, maximizing oxygen levels in your blood, increasing oxygen saturation in cells, and lowering your blood pressure and pulse rate all of which will lower the concentration of stress hormones in your body and activate the PSNS. [23]

## Conclusion

Guided Imagery and Mindfulness of Breathing are effective and can be utilized as an adjunct in the treatment of Non-Specific Chronic Low Back Pain. Limitations of the study were that it included more number of female participants and there was no follow up done for long duration.

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## Limitations

Limitations of the study were that it included more number of female participants and there was no follow up done for long duration. One of the major limitation in the study was some of the participants might have forced their mind to do the imagery.

## Future Research

Future study could be conducted with a long term follow up in larger sample size consisting of equal number of males and female participants. Also, study should be aimed at finding out the effectiveness of relaxation techniques given in groups to participants with Nonspecific Low Back Pain.

## References

- [01] Derebery VJ, Tullis W. (1986) Low back pain exacerbated by psychosocial factors. *West J Med.*:5:144:574-579.
- [02] Donatelli Robert, Wooden Micheal. (2010) *Orthopaedic Physical Therapy*. Philadelphia: Fourth edition. Churchill Livingstone
- [03] Andersson BJ Gunnar. (1999) *Epidemiological features of chronic low back pain*. *Lancet.*: 354:581-585.

- [04] \*\*\* (2012) *Back and Neck pain*. Feb. Available at:  
<https://medtextfree.wordpress.com/2012/02/09/27-back-and-neck-pain/> accessed on 2/10/2015.
- [05] Aoraksinen O et al. (2004) *European guidelines for management of chronic non-specific low back pain* [Internet]. Nov. Available at:  
[www.backpaineurope.org/web/files/WG2\\_Guidelines.pdf](http://www.backpaineurope.org/web/files/WG2_Guidelines.pdf) accessed on 4/5/2015.
- [06] Khatri S. (2013) *Basics Of Orthopedic Physiotherapy*. New Delhi: Jaypee Brothers Medical Publishers Ltd
- [07] Non-specific Lower Back Pain in Adults. (2015) Available on:  
<http://patient.info/health/nonspecific-lower-back-pain-in-adults> accessed on 10/9.
- [08] Turk Dennis, Okifuji Akiko. (2002) Psychological factors in chronic pain. *Journal of Consulting and Clinical Psychology*.: 70(3): 678–690.
- [09] \*\*\* (2015) *Chronic Low Back Pain*. North American Spine Society Public Education Series. Available at:  
[http://www.knowyourback.org/Documents/chronic\\_lbp.pdf](http://www.knowyourback.org/Documents/chronic_lbp.pdf) accessed on 3/01/2015.
- [10] Payne A. Rosemary. (2003) *A Practical Handbook for the Health Care Professional: Relaxation Techniques*. Philadelphia: Second Edition. Elsevier Science limited;.
- [11] Benson H. (2011) *The Relaxation Revolution*. Available at: <https://experiencelife.com/wp-content/uploads/11/The-Relaxation-Revolution.pdf> accessed on 6/6/2015.
- [12] Perez A. *The use of Progressive relaxation and Guided Imagery Techniques with Forgiveness in treating trauma related sexual abuse*. Available at:  
<http://www.esextherapy.com/dissertations/Alicia%20Perez%20The%20Use%20of%20Progressive%20Relaxation%20and%20Guided%20Imagery%20Techniques%20with%20Forgiveness%20in%20Treating%20Trauma%20Related%20Sexual%20Abuse.pdf>
- [13] Harris R. (2007) *Acceptance and commitment therapy (ACT).Introductory workshop Handout 2007*. Available at:  
<http://www.thehappinesstrap.com/upimages/2007%20Introductory%20ACT%20Workshop%20Handout%20-%20%20Russ%20Harris.pdf> accessed 8/5/2015.
- [14] Gavian Margaret. (2014) *The effects of Relaxation and Gratitude intervention on stress outcomes*. 2011 September. Available at: [www.conservancy.umn.edu](http://www.conservancy.umn.edu) accessed on 04/12/
- [15] Elton D, Burrows G, Stanley G. Relaxation (1978) *The Physiotherapist and the Psychiatric Patient. The Australian Journal of Physiotherapy*. Decemeber; 4 : 183-186.
- [16] \*\*\* (2015) *Cautions/ Contraindications – Relaxation. Stress Management for Health Course*. Available at: <http://stresscourse.tripod.com/id41.html> accessed on 28/4
- [17] \*\*\* (2015) Candi Raudebaugh. Inner Health Studio. Coping skills and Relaxation Resources. Accessed at: <http://www.innerhealthstudio.com/guided-imagery-scripts.html> accessed on 4/5
- [18] Kristelar. L. Jean, In Lehrer P. , Woolfolk R.L, Sime W.E. (2007) *Principles and Practice of Stress Management : Mindfulness Meditation*. 3rd Edition. New York: Guilford Press ;.
- [19] Bressert S. (2008) *Can Relaxation technique help chronic Pain?* [Internet] [Jan 2007] [updated jan 2013]. Available at: <http://psychcentral.com/blog/archives/> accessed on 30/10/2015.
- [20] Kingston J ,Chadwick P, Meron D, Skinner TC (2007). A pilot randomized control trial investigating the effect of mindfulness practice on pain tolerance, psychological well-being, and physiological activity. *J Psychosom Res. March*; 62(3) : 297-300.
- [21] \*\*\* (2015) *Meditation for Hearth Health & Cardiac Fitness* [Internet]. Available at:  
<http://www.healthjourneys.com/Main/Home/Heart-Health/> accessed on 15/10/2015.
- [22] \*\*\* (2013) *Mindfulness training helps lower blood pressure* [Internet]. October. Available at:  
<http://www.medicalnewstoday.com/articles/267528.php> accessed on 16/10/2015.
- [23] \*\*\* (2013) *The Science of Stress Heart Rate and Breathing*. Oct. Available at:  
<http://www.mybasis.com/blog/2013/10/the-science-of-stress-heart-rate-and-breathing/> accessed on 18/10/2015.