## Role of Mindfulness and Meditation in the Medicine

### Cancer:

The pathophysiology of cancer is complex in nature and diverse in terms of the affected tissue and organs. However, among myriads of etiologies, it is believed that an aberrant mental process may be involved, at least in part, in the initiation, progression, and exacerbation of cancer. In this context, several studies have revealed the utility of mindfulness-based intervention in preventing or alleviating cancer and its associated pain.

- A book authored by **Ian Gawler named "You can conquer cancer"** created a huge debate in the scientific community where the author described the **healing of his own cancer by practicing mindfulness-based activity** such as meditation.
    - The book described the along with the conventional treatment, lifestyle modification, and diet, a practice that **inculcates positive approach towards life** can contribute towards the prevention of progression of cancer.
    - However, scientific evidence is still lacking for this approach and the idea is mostly defended by the notion that **it has at least no harmful effect** in practicing meditation (Gawler, 2012; Lowenthal, 1989).
- The prevalence of breast cancer has alarmingly increased in the past few decades and accounts for an incidence of 1.7 million annually worldwide. The health-related quality of life (physiological. psychological and social quality) in patients with breast cancer significantly deteriorates due to cancer and its treatment-related fatigue, stress, psychological disturbances, etc which indirectly contributes towards the increased mortality.
    - A study has shown that complementary therapies based on mindfulness have significantly improved the quality of life with patients suffering from breast cancer.
    - A systematic review analyzed the effect of mindfulness-based stress reduction (MBSR) therapies along with orthodox adjuvant therapies revealed that there is a very short term improvement (for 6 months) in secondary outcomes such as quality **of life such as HQoL, sleep, fatigue, anxiety, stress, and depression**

which on average failed to reach minimal clinically important differences (MCIDs).
    - In the next 6 months, a statistically significant effect was found only on **anxiety** (Haller et al., 2017)
- While most of the studies showed the improvement on the psychological parameters, a study with 10 patients of prostate cancer looked at the **Prostate specific Antigen (PSA)** level after subjecting the patients to Mindfulness-Based Stress Reduction (MBSR) therapy in parallel with a plant-based, low saturated fat, high-fiber diet.
    - The result showed a **decrease in the rate of increase of PSA** in 8 men.
    - Moreover, three patients showed an absolute decline in PSA value.
    - This observation warrants further studies with a larger sample size that can establish the benefits of MBSR in improving physiological factors in cancer patients (Saxe et al., 2001).
- An MBSR based eight-week program enrolled Forty-nine and ten patients with breast cancer and prostate cancer respectively.
    - The result showed remarkable positive changes not only in psychological parameters like **stress and mood**, but it also exhibited marked improvement in **endocrine, immune and autonomic parameters** of health.
    - The stress score decreased during the intervention period and remained low for 6-months and 12-months follow-up period. However, no significant change was observed in mood disturbance score which can be attributed to initial low mood disturbance in patients.
    - On the other hand, among health parameters morning, afternoon, evening and mean **cortisol level** significantly decreased over the post-intervention period.
    - In this study, the most remarkable changes were observed in terms of production of pro-inflammatory cytokines such as **IFN-γ, TNF, IL-4. IL-10** etc. The decrease in these cytokines is consequences of improvement of both inflammatory and stress-related conditions.
    - In normotensive individual, **systolic blood pressure (SBP) decreased** significantly in this study and a **reduction in Hear rate** also indicates towards stress reduction (Carlson, Speca, Faris, & Patel, 2007)

- A non-randomized study on the effect MBSR program was conducted to observe the effect of on the immune function, quality of life (QOL), and psychosocial coping abilities of women with early stages of breast cancer.
    - The study showed a significant **increase in peripheral blood mononuclear cell (PBMC) NK cell activity (NKCA) and an increase in other PBMC** subset cells.
    - Over time, the production of **IFN-γ** also increased. The production of other pro-inflammatory cytokines such as **IL-4, IL-6, and IL-10** was also elevated in women practicing MBSR.
    - In addition, plasma **cortisol levels** were high in women who are not enrolled in the MBSR program.
    - The quality of life (QOL) was measured in terms of **Jalowiec Coping Scale** ( the scale eight coping styles namely evasive confrontive, fatalistic, optimistic, emotive, palliative, supportant, and self-reliant). The optimistic **and supportant coping styles were found to be significantly high** in MBSR patient group than who are not practicing MBSR (Witek-Janusek et al., 2008).

**Asthma:**

Asthma affects approximately 339 million people worldwide and kills 1000 people every day making it a serious health burden across the globe. Asthma can be triggered by both environmental and psychological factors. Apart from physical ailments associated with asthma, people suffering from asthma present with associated psychological issues such as anxiety, stress, mood disorder, depression, etc. Therefore, therapies based on mindfulness along with standard treatment regimen (eg. inhaled corticosteroids) show a significant effect on such patients.

- A study with three participants suffering from asthma showed marked improvement in their pulmonary functions in terms of **$FEV_1$ and $FEF_{25-75}$**. All physical symptoms of asthma such as shortness of **breath, chest tightening, wheezing improved in all patients**. Dry cough was reduced in the other two participants except participants 3.
    - Especially, participant 3 showed a significant improvement in the physical parameter as participant three presented with high initial anxiety.

- The **state of anxiety as measured by the STAI (State-Trait Anxiety Inventory) was improved** in all participants. The quality of life and emotional functions were also found to be improved post-mindfulness based therapy in all three subjects (M et al., 2017).

- One study conducted among 1516 college student in China, showed a strong connection between mindfulness and asthma.
  - The study measured mindfulness among students by the **Mindful Attention Awareness Scale (MAAS)** calculated from a questionnaire containing 15 questions. The result showed that one unit increase in MAAS is negatively associated with the diagnosis of asthma (self-reported).
  - The increase in mindfulness also found to be **negatively correlated with dry cough and wheezing** in students who do not have asthma.
  - The study conducted in a large non-clinical sample concluded that higher mindfulness is negatively correlated with the **diagnosis of asthma and its associated symptoms** (Shi et al., 2017).
- A randomized controlled clinical trial assessed pulmonary function and quality of life after compared an 8-week long MBSR group-based intervention in 42 subjects.
  - After 12 months of follow-up patients, clinically significant improvements were observed in the quality of life as assessed by the **Asthma Quality of Life Questionnaire (AQLQ)** score. However, no improvement in lung function in terms of **peak expiratory flow (PEF) forced expiratory volume in 1 s (FEV1)** was observed.
  - In this study when the statistical adjustment was made for prednisone use before 30 days of baseline assessment, patients in MBSR group exhibited a significant **decrease in the use of rescue medication** compared to non-MBSR group (Pbert et al., 2012).
- A meta-analysis study involving 4 Randomized Control Trials investigated the effect of mindfulness-based training on the quality of life and pulmonary functions of 201 asthma patients.
  - Different trials used different mindfulness-based interventions such as Sahaja Yoga Meditation, transcendental meditation, Mindfulness-Based Stress Reduction (MBSR) program, etc.

- The trials assessed the disease-related quality of life by two different questionnaires based investigation namely the **Juniper Asthma-Specific Quality of Life Questionnaire (AQLQ-J) comprising 32 items and the Sydney Asthma-Specific Quality of Life Questionnaire (AQLQ-S) comprising 20 items**. The meta-analysis clearly shows improved quality of life in patients subjected to mindfulness-based intervention.

- However, the effect of mindfulness therapy on $FEV_1$ and PEF was uncertain as the difference failed to achieve a statistical significance (Paudyal, Jones, Grindey, Dawood, & Smith, 2017).

- Association of panic psychopathology and asthma attack is clinically well documented. A study aimed at finding the effect of mindfulness on panic attacks and consequently on asthma-related symptoms.
  - The result indicated that a higher level of mindfulness **decreased anxiety sensitivity and panic symptoms.**
  - The study suggested that engaging in activities with awareness than acting unconsciously **help to fight with anxiety and panic provoking physical symptoms** (Kraemer, McLeish, & Johnson, 2014)

**Anxiety**

Persistent and excessive anxiety is a debilitating psychological issue that affects the life of individuals. The clinical term for this condition is generalized or acute anxiety disorder. Several studies analyzed the effect of mindfulness-based therapy for relief from this clinical condition.

- A study evaluated the effect of MBSR /attention control class on the specific biomarkers of anxiety disorder. The subject underwent **Trier Social Stress Test (TSST) pre-and post-intervention and the area under the curve (AUC)** was calculated for the level of **adrenocorticotropic hormone (ACTH)** and **pro-inflammatory cytokines** in the subjects.

- The study revealed that the patients with Generalized Anxiety Disorder who practiced MBSR had a significant reduction in stress-related ACTH hormone as calculated from AUC.
- Patients in the MBSR group showed a marked reduction in pro-inflammatory cytokines (**IL-6 and TNF-alpha**) when performing stress task (Hoge et al., 2018).
- The results clearly indicated that such a mindfulness-based program induced a **better coping mechanism** in patients during stress task.

- Professional stress and burnout is a major concern in graduate healthcare students. A quasi-experimental trial aimed at evaluating the effect of MBSR program (self-regulatory skills for stress reduction and management of emotion) on the graduate healthcare students from five different disciplines.
  - The study measured anxiety score using **Burns Anxiety Inventory** and it was found that at 8 and 11 weeks post-MBSR program the **anxiety in students decreased significantly.**
  - On the other hand, at 8th week the **empathy** was elevated in students as observed using the **Jefferson Scale of Physician Empathy scale**.
  - There was no statistically significant difference in burnout between students in the intervention and control group at both 8 and 11 weeks (Barbosa et al., 2013).
- Most of the studies measured parameters of anxiety in the psychiatric approach by evaluating scores based on a formulated questionnaire. However, some studies also look at the neural changes during and post-meditation program.
  - The study utilized **fMRI based evaluation** of neural mechanism on the improvement of **generalized anxiety disorder (GAD)** symptoms post-MBSR intervention.
  - In general, GAD patients exhibit a higher activation of amygdala than healthy subjects (Amygdala is a term for a small nucleus that is situated inside the anterio-inferior region of the medial temporal lobe) to neutral faces. Interestingly, **amygdala activation significantly decreased** after the patients were subjected to stress reduction interventions.
  - Moreover, **ventrolateral prefrontal regions (VLPFC) activation in GAD subjects during affect labeling was elevated** post MBSR program.

    - The study pointed out an increase in functional connectivity between **Amygdala and PFC** following mindfulness intervention.
    - These neural changes are strongly correlated with the improvement of GAD symptoms (Hölzel et al., 2013).
- A study evaluated both behavioral and neural effect of MBSR on patients with a **social anxiety disorder (SAD).**
    - The completion of the MBSR program increased self-esteem and decreased anxiety in SAD patients
    - The study revealed decreased social depression, anxiety, rumination, and state anxiety and an increased self-esteem measured in terms of **Beck Depression Inventory-II (BDI-II), Liebowitz Social Anxiety Inventory (LSAI), Rumination Style Questionnaire (RSQ), Spielberg State Trait Anxiety Inventory (STAI), Rosenberg Self-Esteem Scale (RSES).**
    - **Blood oxygenation level-dependent (BOLD) contrast imaging** by fMRI revealed improved activity in the brain network relevant for specific attention function and regulation. Neuroimaging showed **decreased BOLD responses** in areas of the brain such as left inferior frontal gyrus and dorsomedial and medial PFC that controls language processing and self-processing respectively. An **increased BOLD response was observed in left inferior parietal lobule and medial precuneus** that regulates visual attention
    - The study concludes with clinical, behavioral and neural evidence that MBSR program is able to modulate self-referential processing (SRP) and attention regulation in SAD patients (Goldin, Ramel, & Gross, 2009).

**Chronic Pain:**

Chronic pain can arise from different etiologies and can also be presented as a comorbidity to other severe diseases like cancer, AIDS, etc. MBSR based practices have shown excellent outcome in patients with severe to moderate chronic pain.

- A study evaluated the effect of MBSR on chronic pain from different etiologies such as arthritis, migraine, fibromyalgia, etc.

- The study showed induction to MBSR **can reduce the intensity of pain and alleviate functional limitations arose due to pain**.
- The participant with arthritis showed the highest level of improvement in terms of **health-related quality of life (HRQoL) and psychological issues such as anxiety, stress**, etc.
- Patients with **migraine and headaches** from other etiologies showed the least effect on pain reduction and HRQoL.
- The **psychological distress** was least reduced in fibromyalgia patients.
- Patients who did not enroll for the MBSR program in the healthcare center but practiced home-based meditation did not experience improvement in pain relief and HRQoL. However, other psychological outcomes such as **psychological distress, somatoform symptoms, and self-rated health conditions improved** in their case (Rosenzweig et al., 2010).

- A systematic review and meta-analysis study assessed 38 RCTs for the effectiveness of MBSR program on chronic pain from varied etiology such as osteoarthritis, fibromyalgia, cancer, musculoskeletal pain, migraine, gulf war symptom, IBS, rheumatoid arthritis, etc.
  - The meta-analysis revealed MBSR can impart a small decrease in pain (evidence quality: low). Further, well-designed larger RCTs may unearth the benefits of MBSR, if any, in alleviating chronic pain.
  - However, statistically significant strong evidence was obtained showing the **positive effect of MBSR program in depression and improving quality of life** (Hilton et al., 2016).
- A study investigated the role of MBSR and cognitive behavioral therapy (CBT) in patients experiencing chronic pain.
  - The study found a marked **improvement in physical functioning, reduction in pain intensity and controlling depression** in the patients undergoing MBSR and CBT with respect to their control group.
  - However, no significant difference was found in terms of these parameters between MBSR and CBT group (Khoo et al., 2019).
- A study evaluated the role of meditation in female patients with **Nonspecific Chronic Low Back Pain (NSCLBP).**

- The study showed that the severity of **pain was significantly reduced** in patients who underwent an MBSR program than in patients who were subjected to only medical care. The pain assessment was done by **McGill Pain questionnaire**.
- The physical and mental quality of life (assessed by the validated **SF-12 Health Survey**) also improved in patients practicing MBSR (Ardebil & Banth, 2015).

- Mindfulness-based intervention in chronic pain patients not only showed an influence on psychological parameters, but it showed significant alterations in immune-inflammatory pathways related to pain.
  - A study on **Fibromyalgia** patients, who show a range of cognitive and affective symptoms while suffering from chronic debilitating musculoskeletal pain, aimed at finding the role of MBSR on immune biomarkers relevant for pain (eg. **IL-6, CXCL8, IL-10, and hs-CRP**, etc) and clinical symptoms.
  - The result of the study showed that MBSR effectively reduces the pain severity in fibromyalgia patients.
  - Patients undergoing the MBSR program are able to maintain an effective level of **IL-10**, an anti-inflammatory cytokine whereas patients receiving conventional therapy showed a decline in IL-10.
  - In addition, levels and ratios of biomarkers were proven to be useful for predicting the efficacy of MBSR program. For instance, a high initial CXCL8 level was found to be a barrier to the efficacy of MBSR on clinical pain symptoms.
  - Furthermore, **ratios of IL-6 to IL-10 and CXCL8 to IL-10** can be a good predictor for the outcome of the MBSR program. A higher baseline value of these two ratios predicts a poorer outcome of MBSR on modulating psychological inflexibility in fibromyalgia patients (Andrés-Rodríguez et al., 2019).

**Insomnia:**

Insomnia is a condition where an individual has difficulty to fall or remain asleep. The etiology can vary or may remain unspecified. Mindfulness-based training and meditation have a significant role to play in alleviating this condition.

- A study evaluated 6 randomized controlled trials with 330 participants for the effectiveness of mindfulness meditation as a treatment for insomnia supplementary to medical care.
    - The mindfulness meditation practice improved **sleep quality and reduced total wake time.**
    - Further subgroup analysis did not show any significant effect of total sleep time but showed statistically significant improvement in sleep parameters such as **sleep onset latency, total wake time, quality of sleep, sleep efficiency, and Pittsburgh Sleep Quality Index (PSQI) global score** (Gong et al., 2016).
- A study showed how mindfulness meditation can augment cognitive behavioral therapy in treating insomnia.
    - After adding mindfulness meditation to cognitive behavioral therapy (CBT) significant changes in sleep variables were observed in people who completed the training.
    - The improvement was found in **sleep variables from the diary, PSQI, Insomnia Severity Index (ISI), anxiety, Dysfunctional Beliefs, and Attitudes about Sleep (DBAS) 16 score.**
    - The use **of the sleeping pill considerably decreased** in the mindfulness group.
    - The vitality measured by the **SF36 health survey** was found to be markedly improved in mindfulness trained group.
    - The **Wake after Sleep Onset (WASO)** parameter was significantly reduced in groups who practiced meditation along with CBT than in only CBT group.
    - the meditation associated with CBT-I shows significantly greater rates of reduction in WASO relative to CBT-I group (Vanhuffel, Rey, Lambert, Da Fonseca, & Bat-Pitault, 2018).

- Thirty-six patients with chronic insomnia (suffering for greater than 6 months) were subjected to Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Therapy for Insomnia (MBTI).
    - Sleep **EEG spectral analysis** was performed by overnight polysomnography Pre- and post- MBSR, MBTI and at 6 months follow-up.

- After mindfulness-based therapy, **increases in absolute NREM beta** (16-25 Hz) power in EEG analysis was found in combined MBSR and MBTI group immediately post-treatment and after 6 months.
- The **improvement in gamma (25-40 Hz)** range was observed and maintained at the follow-up period for the MBTI group only.
- The mindfulness, as measured by **Five-Facet Mindfulness (FFM)** score, was positively associated with the increased in NREM beta power.
- Moreover, mindfulness was found to be negatively correlated with **ISI score** (Goldstein et al., 2019).

- Insomnia is a debilitating and common consequence in patients diagnosed with or survived from cancer. A study assessed mindfulness-based stress reduction in cervical cancer patients.
  - The result of this study established that the MBSR program influenced several sleep parameters in a positive way. Parameters such as **Total wake time, Sleep efficacy, Total sleep time** improved in a statistically significant manner in the MBSR group than in the control group.
  - However, no significant improvement of polysomnograph variables was found between experimental and control groups. In addition, no association between subjective and objective sleep parameters was observed (Zhang, Li, Li, & Chen, 2019)..

**Preparation for Surgery:**

Patients who are recommended surgery by a physician often undergo a complex psychological state of mind mixed with anxiety, panic, and mental distress. Mindfulness and mindfulness bases stress reduction therapy can help such patients not only ease their pre-surgical mental condition but can also improve post-surgery recovery and other surgical outcomes.

- A randomized controlled trial including 15 male and 45 female subjects undergoing **laparoscopic cholecystectomy** were subjected to a brief psychological relaxation and guided imagery intervention of 45 minutes and also subjected to listening to a relaxation CD 4 days prior and 7 days post-surgery.

- The result showed **marked improvement in stress-related symptoms** in the intervention plus medical care -group than those receiving only standard medical care.
- The deposition of **hydroxyproline** (an indicative molecule for collagen formation at a surgical wound site) in the wounds **was found to be higher** in the psychological intervention group than in the standard medical care group indicating a better wound healing (Broadbent et al., 2012).

- A study on 27 patients undergoing cardiac surgery divided into two groups, one receiving only information (Control) and another group receiving both information and subjected to light exercises and a mental relaxation program before and after surgery.
  - The result showed the reduced occurrence of **supraventricular tachycardia (SVT)** in the experimental group than the control group in spite of a few of them had SVT prior to surgery.
  - The SVT, anger, and anxiety reduced in the experimental group without showing any changes in other physiological parameters (Leserman, Stuart, Mamish, & Benson, 1989).
- Ninety-three patients were subjected to relaxation therapy (breathing exercise with guided imagery) in a medical care facility in Taipei from the day before surgery to the third day after surgery.
  - Patients who practiced relaxation therapy experienced a **lower score of least pain** but no significant difference was found in the worst pain and average pain between control and experimental group.
  - The mean difference in pain score before and after the intervention was significant for both pre-operative day and one day after surgery.
  - The **systolic blood pressure was better** in the intervention group than in the control group with no significant changes in **mean BP, HR and State-Trait Anxiety Inventory scores**.
  - Patients reported an **improvement in their sleep and relaxation** of mind (Lin, 2012)
- Mindfulness-based training was employed to patients who underwent **bariatric surgery**. Several outcome measures were taken into consideration to study the effect of

mindfulness such as weight, psychosocial parameters, eating pattern, and metabolic and inflammatory biomarkers.

  - The study showed a **marked reduction in emotional eating** post 6 months of intervention. However, no significant changes were observed regarding body weight, metabolic (**HbA1C and adiponectin**), and inflammatory markers [**tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and high-sensitivity C-reactive protein (hs-CRP)**]
  - Patients reported **reduced stress reactivity, improved eating behavior** after completion of the mindfulness-based intervention. Patients expressed **great satisfaction on the overall benefit** of the intervention and expressed their will to continue such therapy (Chacko, Yeh, Davis, & Wee, 2016).

- Twenty participants from an orthopedic surgery unit were included in this pilot study where the patients are recommended for surgery due to different musculoskeletal conditions.
  - Effectiveness of 60 seconds mindfulness video was assessed in terms of pain score and **reducing negative psychological factors**.
  - The result showed a **hundred percent feasibility of this short video**. Moreover, Usefulness, satisfaction, and usability were also found to be encouragingly high.
  - This study used the **STAI questionnaire** to measure state anxiety, Numerical rating scale to assess pain, **Emotion Thermometers tool**, a validated instrument to measure distress, anxiety, depression, and anger.
  - After watching the video, patients reported **less state anxiety, distress, pain intensity, anxiety, anger and depression** which is clinically and statistically significant (Chad-Friedman, Talaei-Khoei, Ring, & Vranceanu, 2017).

**Multiple Sclerosis:**

Multiple sclerosis (MS) is a poorly understood neurodegenerative disease that imparts a significant effect on the quality of life as it impairs physical functioning, mental health, and cognitive ability. This is an unpredictable, chronic and progressive disease with no cure but

treated with supportive therapies. Mindfulness-based stress reduction intervention can show physical, psychological and neurological improvement in MS patients.

- A systematic review evaluated the effect of mindfulness-based therapy majorly in relapsing-remitting MS.
    - A significant **reduction in body pain** was observed in patients undergoing mindfulness training as analyzed by **Visual Analogue Scale (VAS) score**.
    - Among the three RCTs analyzed, it was found that studies reported a marked **improvement in the quality of life (QOL), anxiety and depression, fatigue, standing balance**, and
    - Psychosocial measures as analyzed by Hamburg Quality of Life Questionnaire in Multiple Sclerosis; HAQUAMS) and generic HRQOL (Profile of Health-Related Quality of Life in Chronic Disorders; PQOLC) was found to be improved.
    - These **effects on QOL, mental health, and physical health remained statistically significant even after 3- and 6-month follow up** period (Simpson et al., 2014).
- A study evaluated the effect of 8-week mindfulness-based intervention called Mindfulness in Motion (yoga, mindfulness meditation, and relaxing music) in the psychological and physical parameters of MS patient.
    - Pre- and post-intervention comparison based on the **Mental Health Inventory, Modified Fatigue Impact Scale, Thirty-six-item Short Form Health Status Survey, and Five Facet Mindfulness Questionnaire** revealed that such intervention is useful to improve vitality, mental well-being and physical functions in MS patients.
    - The program imparted a **positive effect on reducing depression, fatigue, anxiety**, etc.
    - Overall cognitive and psychosocial improvement was observed after going through the mindfulness program.
    - Furthermore, MS patients showed improved mindfulness in qualities such as **observation, acting with awareness, non-judgment, and non-reactivity** (Gilbertson & Klatt, 2017).

- A study aimed at exploring the longitudinal data on the effect of mindfulness on Quality of Life, depression, sleep, anxiety, and fatigue in MS patients by comparing Langerian and Contemplative mindfulness.
    - **Langer Mindfulness Scale (Langerian approach)** and **Five Facet Mindfulness Questionnaire, or FFMQ (Kabat-Zinn Approach)** were used to assess the mindfulness in MS patients.
    - Both Langerian and contemplative mindfulness indicated the **improved quality of life as assessed by the Multiple Sclerosis Quality of Life-54 (MSQOL)** questionnaire.
    - Hospital Anxiety and Depression Scale was used to assess depression and anxiety. As expected, reduced anxiety and depression were observed in both the approach of mindfulness.
    - A **lower fatigue response was observed** as assessed by the Modified Fatigue Impact Scale (MFIS-5).
    - The **quality of sleep as assessed by Medical Outcomes Study-Sleep Measure (MOS-SM), and was found to be improved** in case of both the approaches (Pagnini et al., 2019).
- Many other studies have shown that different stress management program has a significant effect on neuroimaging signature for MS.
    - The stress management program resulted in a **reduction in gadolinium-enhancing (Gd+) brain lesions** as obtained by MRI at week 8, 16 and 24. A good number of participants also showed free of gadolinium-enhancing lesions.
    - There was also a **reduction in cumulative new T2 lesions** and also a number of participants were found free from new T2 lesion. After 24 weeks, no effects were visible (Mohr et al., 2012).

**Inflammatory Bowel Disease (Crohn's disease/Ulcerative Colitis) and Irritable Bowel Syndrome**

Inflammatory Bowel Disease (IBD) is an umbrella term comprising conditions involving chronic inflammation of the digestive tract such as ulcerative colitis, Crohn's disease, etc. On

the other hand, Irritable Bowel Syndrome (IBS) involves no inflammation but presents with a spectrum of functional disorder with symptoms that includes abdominal cramp, bloating, gas formation, mucus in the stool, diarrhea, constipation, etc. Mindfulness based program has proven to have beneficial effect on both the conditions according to existing research and literature.

- IBD involves severe psychological consequences such as depression, anxiety, stress etc. Mindfulness based interventions have been shown to improve these psychosocial aspects of the patients suffering from IBD and thus improve their quality of life.
    - A systematic review and meta-analysis study established a clear correlation between mindfulness based intervention and **improvements in anxiety, stress, depression, and quality of life in IBD.**
    - However, the changes in physical symptoms are not statistically significant. The study concluded that mindfulness based interventions can be a significant part of **integrative IBD care** (Ewais et al., 2019).
- A mindfulness based program comprising **Breath-Body-Mind-Workshop (BBMW)** enrolled 29 IBD patients and observed impact of the workshop in inflammatory markers (fecal calprotectin, C-reactive protein) of IBD, physiological parameters (body temperature, blood pressure, and pulse) and related psychological symptoms (anxiety, depression, stress etc).
    - The study showed remarkable **reduction in CRP** in IBD patients undergoing BBMW. In addition, a **decreasing trend in FCP** was also observed.
    - There was an improvement in all psychological symptoms such as **anxiety. mood disorder, depression** etc as assessed by different scales and scores (Beck Depression Inventory, Beck Anxiety Inventory, IBD Questionnaire, Brief Symptom Inventory 18, Perceived Disability Scale, Perceived Stress Questionnaire, Digestive Disease Acceptance Questionnaire, Brief Illness Perception Questionnaire).
    - No significant changes were observed in vital signs such as SBP, DBP or pulse rate.

- Long term benefit up to 26 weeks were observed in IBD patients undergoing BBMW workshop and thus establishes its usefulness as a integrative care in IBD patients (Gerbarg et al., 2015).

- A study has evaluated the role of mind body therapy in inhibiting the recurrence of ulcerative colitis.
  - The result showed significant improvement of mental health in the intervention group according to the assessment by **SF-36 mental health scale**.
  - A marked **improvement in Bowel Symptoms** was observed according to IBDQ scale in patients practicing mind-body therapy compared to the usual medical care group.
  - However, no significant changes were observed in **circulating lymphocyte subsets, endocrine parameters, basal levels of TNF-α, suppressive action of the β-adrenergic agonist isoproterenol on TNF-α production** (Elsenbruch et al., 2005).
- A prospective, randomized controlled trial evaluated the efficacy of a mindfulness based group program in improving psychological and physiological parameters in female IBS patients.
  - The study employed IBS-quality of life questionnaire, brief symptom inventory-18IBS severity scale (primary outcome), visceral sensitivity index, five-facet mindfulness questionnaire, and treatment credibility scale to assess 75 IBS patients before and after 3 months of a mindfulness based group program.
  - The result showed that there was a **marked reduction in IBS symptom** severity in women in the mindfulness group.
  - If not immediately, **the quality of life, psychological distress, and visceral anxiety improved at 3 months follow-up** in the mindfulness group.
  - There was a significant improvement in the mindfulness score (Gaylord et al., 2011).
- A study used multivariate path model to test the effectiveness of mindfulness training (MT) on the improvement of IBS symptoms.

- The result showed mindfulness-based training reduced **IBS severity** and thus improved IBS-related quality of life
- The psychological parameters of mindfulness such as **nonreactivity to gut focused anxiety, nonjudgment of experience, observing and attending to experience** were greatly improved in the MT group.
- In addition, **visceral sensitivity and catastrophic appraisal of pain** were shown to be reduced in the MT group.
- Other factors such as **psychological distress, and cognitive coping** through a reinterpretation of pain sensations were also remarkably improved in the MT group (Garland et al., 2011).

**Post-partum Depression**

It is a common complication in women just after giving birth to a child. The complication includes psychological disorders such as hopelessness, depression, sadness, etc. Mindfulness-based psychological intervention can be proven beneficial alone or adjunct to medical therapy.

- A study identified high-risk pregnant women for depression based on previous history and other psychological examination and subjected them to mindfulness-based cognitive therapy for perinatal depression control especially who denied pharmacological intervention.
  - The result showed significant improvement in the symptoms of depression than patients subjected to treatment as usual (TAU).
  - During the study, **lower rates of depressive relapse and recurrence** were found in pregnant women pre-and post-partum.
  - The severity of **depression was also lower** in women trained in mindfulness (Dimidjian et al., 2016).
- A study presented strong evidence in support of mindfulness-based therapy reducing severity, relapse, and recurrence of depression in pregnant women at high risk of depressive disorder during the perinatal period.
  - The result showed that the **participants self-reported interest, engagement, and satisfaction** in the mindfulness program indicating the feasibility and

applicability of such a program. In addition, a **high retention rate, completion of assigned task in time** bolstered the efficacy of such practice.

- Moreover, intent to treat analyses showed a **significant improvement in the spectrum of depression symptom.**
- An **18 % rate of relapse/recurrence** was observed through 6 months postpartum in the participants of mindfulness program which is **much less than a reported 30% relapse and recurrence** when they enter the post-partum naturally with a high-risk for depression without any intervention.
- Therefore, the mindfulness-based program holds a great prospect as a short term clinically feasible, acceptable, efficient intervention to prevent postpartum depression in pregnant women with histories of such disorder (Dimidjian et al., 2014).

- A pilot study measured the efficacy of an eight-week-long mindfulness-based program aimed at managing stress and elevating mood in pregnancy and early and three months postpartum.
  - At the time of pregnancy and the immediate post-partum period, a statistically significant reduction in **state anxiety and negative affect** was observed in mindfulness participant group than with wait-list controls.
  - An expected improvement was observed in other psychological variables such as **anxiety. depression, perceived stress, affect regulation, mindfulness**, etc
  - Highest effect size was observed in negative affect( 0.90) and least in perceived stress (0.39. Other variables that were improved were in the order of effect size as follows: depression (0.80) positive affect (0.73), mindfulness (0.68) and affect regulation (0.50).
  - Although changes observed at 3-month follow-up were not statistically significant, some variables were remarkably improved such as **anxiety decreased from 20% to 7%, depression reduced from 20 to 11%, the negative effect became 13% from 25%,** etc. Only the increase in mindfulness percentage made the differences statistically insignificant between the intervention and control group (Vieten & Astin, 2008).

- Many new breastfeeding mothers do not agree to increase the dose of anti-depressant during their treatment for postpartum depression. In a study, an eight-week mindfulness-based cognitive therapy (MBCT) was employed as an adjunct therapy for postpartum depression.
    - The result from the multivariate analysis showed there is a concomitant increase in the **level of mindfulness as measured by MAAS scale** with a **decrease in anxiety and depression as measured by the GAD-7 questionnaire**.
    - The effect size while analyzing from different dimensions exhibited a large difference between MBCT and control group in terms of anxiety, depression, and mindfulness (Shulman et al., 2018).

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