



“EFFECT OF FASTING ON STRESS, QUALITY OF LIFE & SLEEP PATTERN AMONG HEALTHY COLLEGE STUDENTS”

BY CHAITHANYA NAYAK

Dr. PUNEETH RAGHAVENDRA, BNYS, M.D. (YOGA) & Dr. SWATHI B.S, BNYS, M.D. (DIET AND NUTRITION)

ACNYS

Alva's College of Naturopathy & Yogic Sciences, Moodbidri- 574227, DakshinaKannada District, Karnataka, India

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA

ABSTRACT

Background: Fasting, or the voluntary restriction of solid food consumption, has been practiced widely by different cultures and religions and used in clinical treatments for a variety of reasons. It affects the psychological and emotional aspects of our lives. Fasting makes the sense organ energetic and enable one to get control over unsteadiness of mind. This study aims at assessing the effect of fasting on stress, quality of life & sleep pattern among healthy college students.

Materials & methods: 30 healthy individuals were randomly selected. Fasting was given as intervention for 8 days with 2 days (1st and 8th day) of boiled diet to assess the sleep pattern, level of stress and quality of life using PSQI (Pittsburgh Sleep Quality Index), PSQ (Perceived Stress Questionnaire) and SF-36 (Short Form Survey) respectively. Statistical analysis was performed by paired t-test using Statistical Package for Social Sciences version-26.

Results: Based on statistical analysis, p value of sleep variable is 0.001, p value of pain is 0.01, p value of general health variable is 0.054, p value of emotional wellbeing variable is 0.003 and p value of energy variable is 0.001 which indicates that there is significant improvement in quality of sleep, pain levels, general health and emotional wellbeing of the subjects.

Based on the statistical analysis, p value of stress variable is 0.38, p value of physical function is 0.556, p value of social functioning is 0.373 which indicates that there is no significant improvement in stress levels, physical functioning & social functioning.

Conclusion: It was observed that there was improvement in the quality of sleep and general health and reduction in pain and fatigue but there was no significant improvement in the level of stress level, physical functioning and social functioning among healthy individual who undertook fasting.

Key words: fasting, sleep pattern, stress, quality of life.

1.0 INTRODUCTION

1.1 FASTING

Fasting, or the voluntary restriction of solid food consumption, has been practiced widely by different cultures and religions and used in clinical treatments for a variety of reasons(1).

It has meaning in terms of overall well-being and affects the psychological and emotional aspects of our lives. Fasting, as we use the term here, means total abstinence from all food for a definite period. The word comes from the old English word *faesten*, which means firm or fixed. In other words, the fast is something we hold to on a firm basis under controlled and fixed conditions. In religious terms it may mean abstinence from certain food on certain holy days. But this is partial abstinence rather than total abstinence(2).

Fasting does not mean starving. Fasting and starving are two different conditions. It is true that in both the condition food is not taken; however, as their causes and purposes are different. Their meanings are also different. Fasting is a condition accepted voluntarily by an individual, while starvation is a condition arising out of circumstances which are external and beyond the control of an individual. DR. Edward Purington the author of "Philosophy of Fasting", states that physical health can be gained by various nature cure methods. But for mental health, fasting has no alternative. According to his opinion, fasting makes the sense organ energetic and enable one to get control over unsteadiness of mind. Fasting helps to develop such virtues as peace of mind, confidence, courage and respect. Fasting awakens natural instincts that formerly remained dormant. Thus, the faster morally and spiritually began to rise to sublimity (3)

In evolution, organisms able to tolerate environments devoid of nutrients for extended periods of time held an important survival advantage over those unable to do so. The evolutionary selection pressure to survive the stresses associated with low-energy environments has produced a number of fasting-induced metabolic mechanisms that have been conserved for millions, if not billions, of years in humans.(4)

Since early times fasting has been advocated for spiritual development and promotion of health. Fasting as religious as a religious practice developed independently among different people and religions worldwide. In ancient Greece the belief that taking food risked entry of demonic forces contribute to the popularity of fasting (5)

German physician Otto Bachinger, the first person to rigorously document the beneficial effects of fasting in many human diseases, wrote that “Fasting is, without any doubt, the most effective biological method of treatment”. Valter Longo, an Italian-born biogerontologist and fasting researcher in the 2000s, has recently suggested that fasting selectively activates multiple “longevity programs” which may lead not only to an extended lifespan, but also to an extended health span.

Table no.1- Types of fasting: Human fasting regimens (by intensity, frequency, and duration).(6)

Intensity of Food and Drink Restriction	Frequency and Duration of Fasting Periods	Common Combinations Used in Human Studies
“Pure” fasting (no food or drink, often in the context of religious practices)	Time-restricted feeding (daily four-to-twelve hour eating window)	Water/fluid-only time-restricted feeding
Water-only fasting (only water is permitted, plus salt and micronutrients)	Alternate-daily fasting (fasting every other day)	Water/fluid-only alternate-daily fasting
Fluid-only fasting (water-only fast plus calorie-free fluids, such as tea and black coffee)	Two-days-per-week fasting (fasting two consecutive days per week)	Limited calorie intake two-days-per-week fasting

While religious fasts are partaken primarily for spiritual purposes, they also have the potential to greatly affect one’s physical health. The following religious fasting periods are featured in this review: 1) Islamic Ramadan; 2) the three principal fasting periods of Greek Orthodox Christianity (Nativity, Lent, and the Assumption); and 3) the Biblical-based Daniel Fast.

There are three principal fasting periods for Greek Orthodox Christians. During the Nativity fast (40 days), fasters abstain from dairy products, eggs, and meat every day. Also, fasters abstain from fish and olive oil on Wednesdays and Fridays during this period. During Lent (48 days), fasters abstain from dairy products, eggs, and meat every day. Additionally, fasters abstain from olive oil on weekdays during this period and abstain from fish every day except for March 25th and Palm Sunday. During the Assumption (15 days), fasters abstain from dairy products, eggs, and meat. Also, fasters abstain from olive oil on weekdays during this period and abstain from fish every day except for August 6th. In addition to these principal fasts, every Wednesday and Friday that falls outside of a principal fasting period calls for the proscription of cheese, eggs, fish, meat, milk, and olive oil. Exceptions to these proscriptions occur on the week following Christmas, Easter, and the

Pentecost. Collectively, dietary consumption is restricted for 180 – 200 days each year. The Greek Orthodox Christian diet consists largely of bread, fruits, legumes, nuts, seafood,snails, and vegetables during fasting.(7)

Some of the benefits of fasting are reduction of weight, improvement of health,to remove certain ailments of the body, the organs and tissues of the body get rest during fasting, the body regains its full strength after it is cleansed.

The concept of healing crisis explains that during fasting there might be discomfort, sometimes they might become nauseous and vomiting may occur. They become irritable, sleeplessness, weak and there may be aches and pain in the body. The feeling of weakness, sometimes experienced during fasting is due to functional inactivity. Nausea and vomiting may develop on the 1st day of fast or at any time thereafter.(2)

Table no.2- Contraindication of fasting (8)

Potential Contraindications	Common Adverse Effects
People of low body weight	Fatigue
Breastfeeding or pregnant women	Insomnia
Extremes of age (children, the very old)	Nausea
People at high risk of malnutrition	Headache
Viral infections	Presyncope
Type 1 diabetes	Dyspepsia
Renal stones	Back pain
Gout	Pain in extremity

Studies involving fasting regimens in people of below-normal body weight, breastfeeding or pregnant women, children, and the very old have been relatively scarce; in these people, fasting should be initiated cautiously, or not at all. Individuals highly susceptible to malnutrition are not suitable for a fasting regimen, including those with a neurological disease; for example, fasting is contraindicated in certain people with PD or AD who may be malnourished (9)

Though the role of fasting in acute infections has not been fully elucidated in humans, fasting may be detrimental in viral infections (conversely, it may be protective in bacterial infections) (8)

Fasting and psychological responses show that, compared to consistent findings for physiological responses, there is less consistency in psychological responses to fasting. First, coincident with people's intuitive anticipations of food deprivation, research has found that short-term or intermittent fasting could induce irritability and negative mood states as well as subjective feelings of sleepiness and fatigue. In addition, research has found that fasting can result in positive experiences (e.g., achievement, pride, and control after 18 h of fasting and decreased negative mood states after practicing a 3-month calorie restricted diet, which is termed the mood enhancement phenomenon addition to varying experimental protocols, many factors may affect

psychological responses. First, motivations and expectations of fasting may play a critical role in psychological responses. For example, in various religions, fasting is considered a means to fortify the body, purify the spirit, and elevate consciousness. Additionally, fasting is considered a self-empowering, cost-free strategy of weight management. Hence, fasting may be experienced as pleasurable and tolerated by people who value their religion or aim to lose weight. In contrast, fasting may generate negative mood states for those who do not have religious and weight concerns.

Second, fasting is closely related to self-control. On the one hand, fasting is a process requiring considerable cognitive effort, including self-control (e.g., controlling desires to eat and maintaining fasting protocols for several days). On the other hand, successfully completing periods of fasting may increase feelings of self-control (1).

In recent years, it has been speculated that intermittent fasting may improve sleep. One of the postulated mechanisms involves improving circadian rhythmicity. Intermittent fasting may strengthen the peripheral circadian rhythm via limiting food intake during the evening and night time. Another mechanism by which intermittent fasting may improve sleep is by reducing bodyweight. Weight loss has been shown to improve several sleep parameters, including sleep quality, sleep duration, and the risk for obstructive sleep apnoea (10).

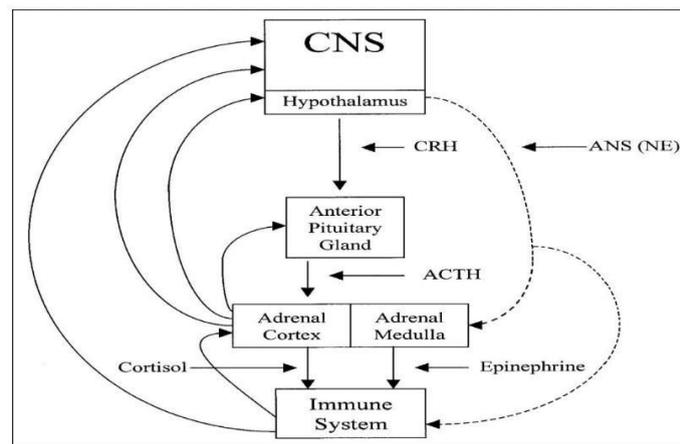
1.2 STRESS

Stress is defined as the state in which the brain interprets the quantity of stimulation as excessive or its quality as threatening, thus responding in a generalized way. (11)

The events that provoke stress are called stressors, and they cover a whole range of situations — everything from outright physical danger to making a class presentation or taking a semester's worth of your toughest subject. Some of the main stressor among students are academics, finances, relationships, career and time management. The worry about academic performance can cause stress symptoms such as anxiety, insomnia or changes in your appetite and overall mood. Last minute studying in the night before exams. The fear of exams and workload create stress among students. The first cause of stress among university students is a lot of assignment. All young people want to maintain the lifestyle and fulfil the demand of articles like mobile, bikes and cars etc. If they fail to fulfil the requirement, then it creates a stress. Relationships are another big aspect of stress. If a person finds that making friends is a bit harder than he/ she had expected, stress is present here as well. Job Stress is a chronic disease caused among the current youth that negatively affect an individual's performance and/or overall well-being of his body and mind. The students have fear of not getting the job opportunity and competition in the market. A lack of time management also causes stress on youth, whether secondary or tertiary. Balancing academics, peer activities, and home life can be difficult. Toss in a part-time job and the challenge increases (12)

There are two types of stress. They are, eustress and distress. Eustress is a positive cognitive response to the cognitive evaluation of a situation that can change during the time a stressor is present. Eustress is beneficial for performance until the optimum level is reached and after this peak performance declines, a process that is associated with distress. Distress describes negative kind of stress that most people associate with feeling stressed out. It tends to cause people to feel overwhelmed, anxious, and to experience physical and psychological symptoms like headache, insomnia, tension and irritability.(13)

Figure no. 1-schematic representation of interrelationship among CNS, hypothalamo- pituitary adrenal axis, ANS, and immune system. Dashed line indicate ANS neural pathway and solid line indicates hormonal pathways(14)



1.3 SLEEP

Sleep is a reversible behavioural state of perceptual disengagement from and unresponsiveness to the environment. It is also true that sleep is a complex amalgam of physiologic and behavioural processes. (15)

In addition to its role in the initial wake-to-sleep transition, stage 1 sleep occurs as a transitional stage throughout the night. A common sign of severely disrupted sleep is an increase in the amount and percentage of stage 1 sleep. Stage 2 NREM sleep, signalled by sleep spindles or K-complexes in the EEG, follows this brief episode of stage 1 sleep and continues for approximately 10 to 25 minutes. In stage 2 sleep, a more intense stimulus is required to produce arousal. The same stimulus that produced arousal from stage 1 sleep often results in an evoked K-complex but no awakening in stage 2 sleep. As stage 2 sleep progresses, high-voltage slow-wave activity gradually appears in the EEG. Eventually, this activity meets the criteria for stage 3 NREM sleep, that is, high-voltage (at least 75 μ V) slow-wave (2 cycles per seconds) activity accounting for more than 20% but less than 50% of the EEG activity (14).

Stage 3 sleep usually lasts only a few minutes in the first cycle and is transitional to stage 4 as more and more high voltage slow-wave activity occurs. Stage 4 NREM sleep—identified when the high-voltage slow-wave activity comprises more than 50% of the record—usually lasts approximately 20 to 40 minutes in the first cycle. An incrementally larger stimulus is usually required to produce an arousal from stage 3 or 4 sleep than from stage 1 or 2 sleep. The circadian phase at which sleep occurs affects the distribution of sleep stages. REM sleep, in particular, occurs with a circadian distribution that peaks in the morning hours coincident with the trough of the

core body temperature rhythm. Thus, if sleep onset is delayed until the peak REM phase of the circadian rhythm—that is, the early morning—REM sleep tends to predominate and can even occur at the onset of sleep.(16)

Narcolepsy is characterized by an abnormally short delay to REM sleep, marked by SOREMPs. This abnormal sleep-onset pattern occurs with some consistency, but not exclusively; that is, NREM sleep onset can also occur. Sleep apnoea syndromes may be associated with suppression of SWS or REM sleep secondary to the sleep-related breathing problem. Successful treatment of this sleep disorder, as with nocturnal continuous positive airway pressure, can produce large rebounds of SWS or REM sleep. Fragmentation of sleep and increased frequency of arousals occur in association with a number of sleep disorders as well as with medical disorders involving physical pain or discomfort. These disorders also often involve an increase in the absolute amount of and the proportion of stage 1 sleep. (12)

2.0 AIM & OBJECTIVES:

2.1 Aim: To know the effect of fasting on stress, quality of life and sleep patterns in healthy college students.

2.2 Objectives:

- To assess the effect of fasting on stress.
- To assess the effect of fasting on quality of life.
- To assess the effect of fasting on sleep pattern

3.0 LITERATURE REVIEW

Fasting does not do any harm to the body but gives mental and physical health and rest to the digestive tract and eliminates toxins. When the toxic element is eliminated from the body, there is an increase in the natural resistance power of the body. It has been observed that firmness of the mind and self-confidence increase during the fasting period. Complete peace and joy pervade the mind and the faster experiences spiritual joy.(3)

According to the theory of Fredrick Hallgel and Prof. Carlson, 'As age advances, the depletion of youthfulness increases. After thirty-five years, the hope for youthfulness recedes.' But there is a limit to rejuvenation. The transformation of the human body cells cannot be improved. There are many cases of rejuvenation in which symptoms of youthfulness were observed in men and women of more than sixty years, after their long fasts, yet the process of aging encroaching much earlier can be stopped with ease. (3)

Research was conducted by Rafael de Cabo, Mark P Mattson to know the effects of intermittent fasting on health aging and disease. Evidence is accumulating that eating in a 6h period and fasting for 18h can trigger a metabolic switch from glucose-based to ketone-based energy, with increased stress resistance, increased longevity. And a decreased incidence of disease, including cancer and obesity (17)

The research conducted by Motohiro Nakajima, Mustafa al'Absi to know the influence of fasting on stress response and withdrawal symptoms in habitual Khat users. The results demonstrate that fasting is associated with reduced negative affect and withdrawal symptoms in khat users(18)

Previous study on effects of short- term modified fasting on sleep patterns and daytime vigilance in non-obese subject, a pilot study conducted by A Michalsen, F Schlegel, A Rodenbeck et al demonstrates that along with a decrease in sleep arousals a 1-week fasting period promotes the quality of sleep and sleep and daytime performance in non-obese subjects(19)

A review of the literature by Andreas Michalsen made many clinical observations relate an early effect of fasting on depressive symptoms with an improvement in mood, alertness and a sense of tranquillity(20)

Research on effects of short-term fasting on quality of life and tolerance to chemotherapy in patients with breast and ovarian cancer: a randomized cross-over pilot study by Stephan P. Bauersfeld, Christian S. Kessler, and Andreas Michalsen. It has been observed that short-term fasting protects healthy cells against the adverse effects of chemotherapy while making tumour cells more vulnerable to it. By directly targeting Ras and mammalian target of rapamycin Short-term fasting during chemotherapy is well tolerated and appears to improve QOL and fatigue(18)

Fasting can bring about a virtual rebirth, a revitalization of the organism. As the fast progresses, all of the cells of the body undergo refinement and there is a removal from the protoplasm of the cells of stored foreign substance so that the cells become more youthful and function more effectively.(2)

A previous study on safety, health improvement and well-being during a 4 to 21-day fasting period in an observational study including 1422 subjects. They observed a significant decrease in the weight, abdominal circumference, blood pressure, glucose levels to low norm range and an increase in ketone bodies levels. The emotional and physical well-being also improved.(20)

Studies conducted by Longo VD, Mattson MP. have shed light on its role in adaptive cellular responses that reduce oxidative damage and inflammation, optimize energy metabolism, and bolster cellular protection. In lower eukaryotes, chronic fasting extends longevity, in part, by reprogramming metabolic and stress resistance pathways. Thus, fasting has the potential to delay aging and help prevent and treat diseases while minimizing the side effects caused by chronic dietary interventions(21).

The effects of short-term fasting (skipping breakfast) on the problem-solving performance of 9- to 11-year-old children were studied under the controlled conditions of a metabolic ward. These findings support observations that the timing and nutrient composition of meals have acute and demonstrable effects on behaviour. These findings support observations that the timing and nutrient composition of meals have acute and

demonstrable effects on behaviour(22).

The impact of religious fasting on human health by John F Trepanowski and Richard J Bloomer showed that the favourable effects of religious fasts include the lowering of body mass, total cholesterol, LDL-C, and the LDL-C/HDL-C ratio(7).

The research on the effect of fasting or calorie restriction on mitophagy induction by Sanaz Mehrabani and Mohammed Bhagernya, concluded that fasting or CR has a promising role as a novel, practical approach without any side effects in the regulation of health by inducing mitochondria autophagy in different organs of the body(23).

4.0 MATERIALS AND METHODOLOGY

4.1 STUDY SETTING & SOURCE OF THE SUBJECT:

Design: Pre-post experimental pilot study.

30 healthy individuals of age 21-24 years were recruited for the study. Study subjects were recruited from Alva's College of Naturopathy and Yogic Sciences, Mijar, Moodbidri where 30 subjects were given the intervention of fasting for 8 days with 2 days (1st and 8th day) of boiled diet.

4.2 INCLUSION CRITERIA

Following inclusion criteria were basis for selecting subjects

- Healthy participants were selected.
- Both males and females were selected.
- Age: ranging from 21-24 years.
- Willingness to participate as a subject

4.3 EXCLUSION CRITERIA

The following criteria were used to exclude the volunteers:

- Volunteers with any underlying disease conditions.
- Weak and debilitated individuals.

4.4 ETHICAL CONSIDERATION:

Subjects who fulfilled the inclusion and exclusion criteria were verbally informed regarding the details of the intervention to be conducted. They were given a chance to ask any queries regarding the experiment. Informed consent was obtained from them along with permission from the head of the institution and subjects were given a chance to withdraw at any time of their inconvenience.

4.5 INTERVENTION:**Table no. 3-** Diet Chart

Day	7:30 a.m.	9:30 a.m.	11:30 a.m.	2:30 p.m.	5:30 p.m.	7:30 p.m.
1		Breakfast		Lunch		Khichdi & Soup
2	Lemon HoneyJuice	Lemon HoneyJuice	Raw Diet +Butter Milk	Lemon HoneyJuice	Lemon HoneyJuice	Fruit Salad+ Soup
3	Lemon HoneyJuice	Lemon HoneyJuice	Lemon Honey Juice	Lemon HoneyJuice	Lemon HoneyJuice	Lemon HoneyJuice
4	Lemon HoneyJuice	Lemon HoneyJuice	Lemon Honey Juice	Lemon HoneyJuice	Lemon HoneyJuice	Lemon HoneyJuice
5	Lemon HoneyJuice	Lemon HoneyJuice	Lemon Honey Juice	Lemon HoneyJuice	Lemon HoneyJuice	Lemon HoneyJuice
6	Lemon HoneyJuice	Lemon HoneyJuice	Lemon Honey Juice	Musambi Juice	Musambi Juice	Lemon HoneyJuice
7	Lemon HoneyJuice	Lemon HoneyJuice	Fruits +Butter Milk	Lemon HoneyJuice	Lemon HoneyJuice	Raw Diet +Soup
8	Lemon HoneyJuice	Lemon HoneyJuice	Curd rice			Dinner

Fasting intervention was given for total 8 days with 2 days (1st and 8th day) of boiled diet as a

constructive diet in order to adjust for what was happening for the next 6 days. All the students voluntarily participated in 8 days of fasting, they started fasting with boiled diet on 1st day and following 6 days they did juice fasting. On the 8th day, they broke fast by taking boiled diet. Prior to the fasting the participants were received detailed information about experimental aims, procedure and schedule and a study setting. The whole experiment lasted for six days and involved 3 sessions. First day evening kichadi was given, from second day they were only allowed to take lemonhoney juice, raw diet, buttermilk and vegetable soup and the participants are restricted to take other food. Next 4 days they were completely under lemon honey juice at interval of 2 hours for 6 times. On 7th day participants were given lemon honey juice, raw diet and vegetable soup followed by curd rice on the last day to break the fast.

During fasting the participants were not allowed to eat anything but they were allowed to drink water at any time they wanted and they were encouraged to do so to avoid dehydration during fasting. Participants were at complete rest during fasting.

The fasting experiment required intensive monitoring of the participant's physical status because participants had to avoid any solid food intake and to take care of the participants and to avoid dehydration. Therefore, participants were made to stay in designated area for 6 hours.

4.6 ASSESSMENT TOOLS

1. PSQI (Pittsburgh Sleep Quality Index): to measure the patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction (24)
2. Perceived Stress Questionnaire (PSQ): Consisting of 30 items, the PSQ was developed as an instrument for assessing the stressful life events and circumstances that tend to trigger or exacerbate disease symptoms. With stress bearing significantly on the quality and consistency of the sleep cycle, the PSQ is a potentially valuable tool for evaluating the underlying causes of sleep disturbances. The scale is specifically recommended for clinical settings, though it has been employed in research studies as well. Scoring- Score 5- circled number for items 1, 7, 10, 13, 17, 21, 25, 29 Score circled number for all other items .PSQ Index = $(\text{raw score} - 30) / 90$. (25)
3. Short Form Survey (SF-36): A 36-item short-form (SF-36) was constructed to survey health status in the Medical Outcomes Study. The SF-36 was designed for use in clinical practice and research, health policy evaluations, and general population surveys. The SF-36 includes one multi-item scale that assesses eight health concepts: 1) limitations in physical activities because of health problems; 2) limitations in social activities because of physical or emotional problems; 3) limitations in usual role activities because of physical health problems; 4) bodily pain; 5) general mental health (psychological distress and well-being); 6) limitations in usual role activities because of emotional problems; 7) vitality (energy and fatigue); and 8) general health perceptions.

Scoring- Scoring is a two-step process. First, precoded numeric values are recoded per the scoring key. Note that all items are scored so that a high score defines a more favourable health state. In addition, each item is scored on a 0 to 100 range so that the lowest and highest possible scores are 0 and 100, respectively. Scores represent the percentage of total possible score achieved. In step 2, items in the same scale are averaged together to create the 8 scale scores. Items that are left blank (missing data) are not taken into account when calculating the scale scores. Hence, scale scores represent the average for all items in the scale that the respondent answer(26).

5.0 RESULTS

Table no. 4 - Comparison of mean values of pre-test and post-test values of stress, sleep & QOL using paired T test:

Variables	Pre-test mean	Post-test mean	Pre-test standard deviation	Post-test standard deviation	P- value
Sleep	6.87	4.70	2.432	3.175	0.001
Stress	0.50	0.47	0.141	0.174	0.38
Quality of life					
Physical functioning	76.5	78.00	21.502	17.695	0.556
Role of limitation due to physical functioning	47.17	60.17	36.191	33.592	0.166
Role of limitation due to emotional health	43.66	55.96	42.814	41.137	0.192
Energy\fatigue	48.83	60	19.9	17.617	0.001
Emotional well being	53.93	61.97	17.518	19.319	0.003
Social functioning	173.42	62.72	667.311	22.428	.373
Pain	56.88	70.30	23.101	21.470	0.01
General health	57.73	62.67	17.418	14.606	0.054

Analysis was done using SPSS paired t test to find out the effect of fasting on stress levels, sleep pattern & QOL among healthy individuals. Based on statistical analysis, p value of sleep variable is 0.001, p value of pain is 0.01, p value of general health variable is 0.054, p value of emotional wellbeing variable is 0.003 and p value of energy variable is 0.001 which indicates that there is significant improvement in quality of sleep, pain levels, general health and emotional wellbeing of the subjects respectively.

Based on the statistical analysis, p value of stress variable is 0.38, p value of physical functioning is 0.556, p value of social functioning is 0.373 which indicates that there is no significant improvement in stress levels, physical functioning & social functioning.

Fig-2 - comparison of mean values of sleep quality

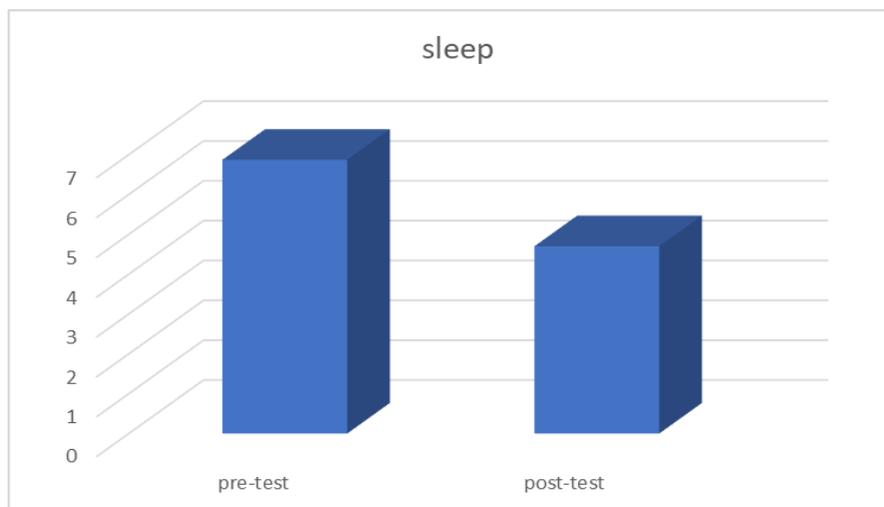


Fig-3- comparison of mean values of energy/ fatigue levels

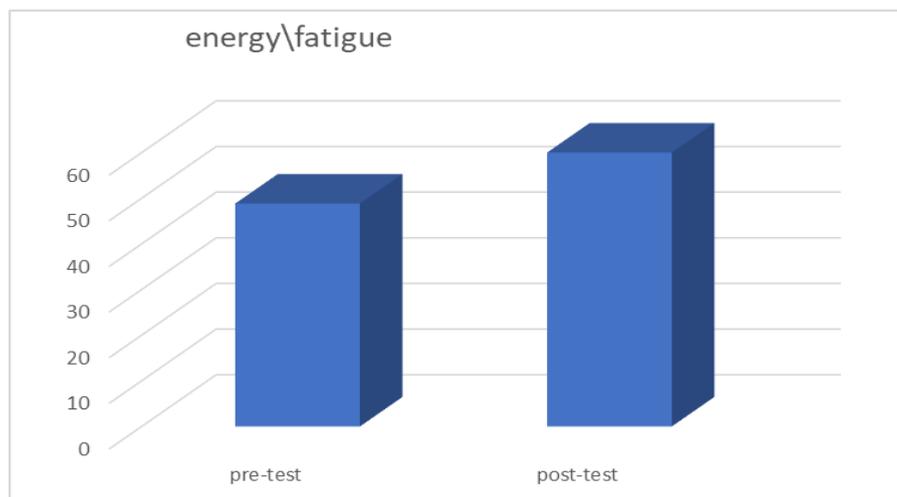


Fig-4 - comparison of mean values of emotional well-being

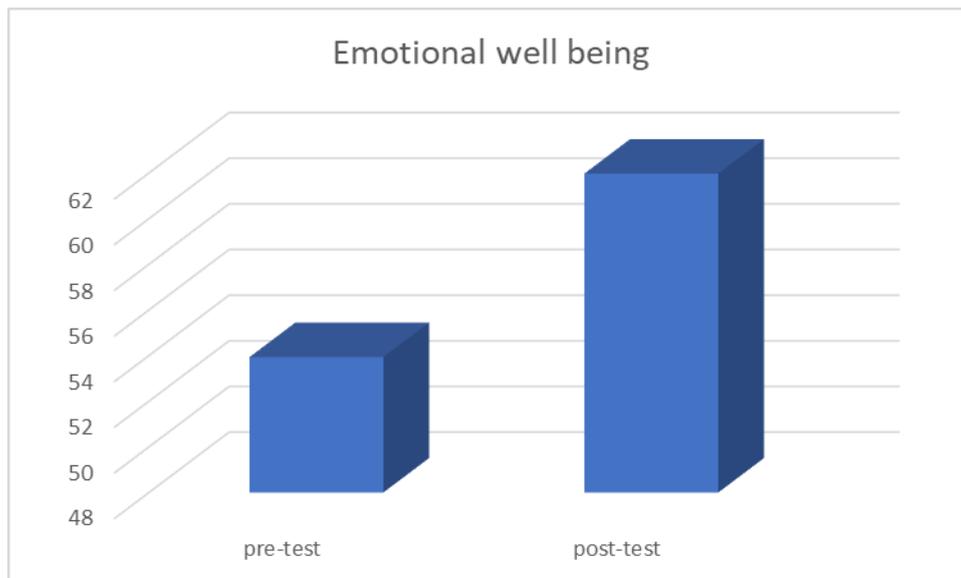


Fig-5 - comparison of mean values of pain levels

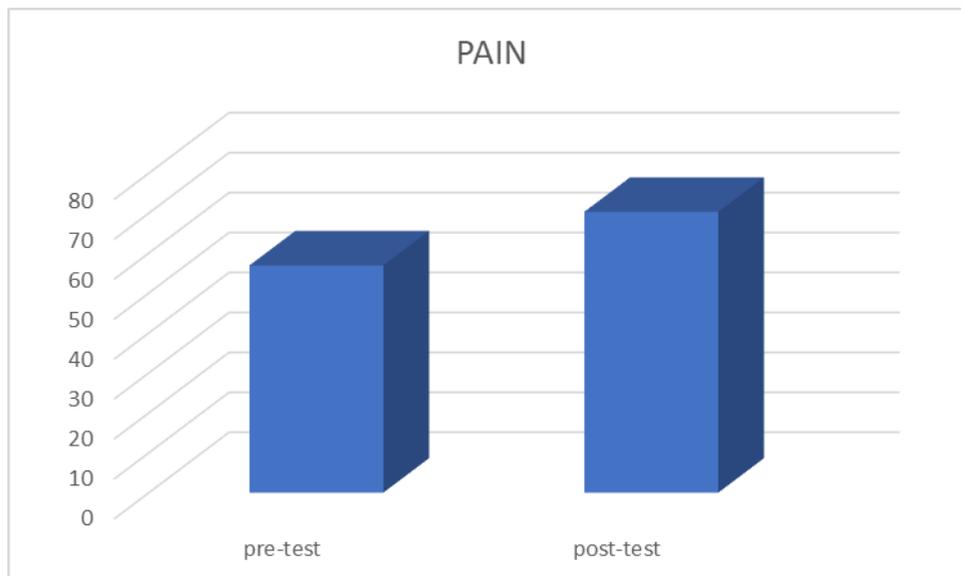
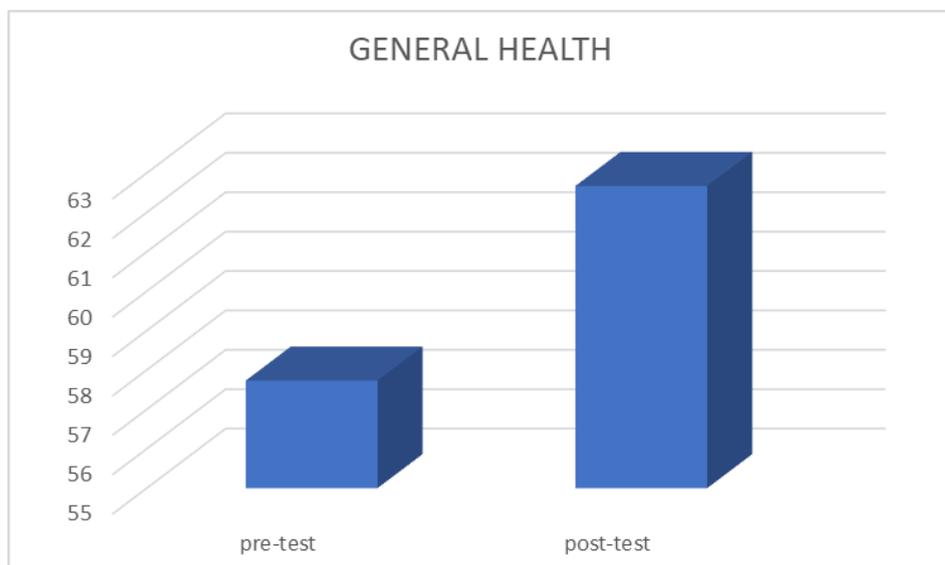


Fig-6 – comparison of mean values of general health



6.0 DISCUSSION

The study was conducted with the aim of understanding the effect of fasting on stress, sleep and quality of life of healthy individual. There were 30 subjects selected from ACNYS, Mijar, who were healthy with no other clinical manifestation. They undertook fasting for 8 days with 2 days (1st and 8th day) of boiled diet. There was significant improvement in quality of sleep, general health, emotional wellbeing and reduction in fatigue and pain but there was no significant improvement in stress levels, physical functioning & social functioning.

Fasting induces the coordinated alteration of many metabolic and transcriptional mechanisms that may influence neurons. Collectively, these alterations produce a whole-body, altered metabolic state that optimizes neuron bioenergetics and resilience to stress, culminating in maintained or even enhanced cognitive performance. (24). A Whole-Body, Altered Metabolic State Following 12–36 hours of fasting, the human body enters a physiological state of ketosis characterized by low blood glucose levels, exhausted liver glycogen stores, and the hepatic production of fat-derived ketone bodies, or ketones, which serve as a major energy source for the brain(27)

The liver is the primary site of ketogenesis, but brain astrocytes also generate ketones. Within several days of initiating a fast, ketones become the brain's preferred fuel source, providing up to 70% of its energy requirement. Ketones constitute a more efficient source of energy per unit oxygen in muscles, and possibly in the brain,(28).

The primary blood ketone, beta-hydroxybutyrate, also serves important signalling functions(27). In hippocampal and cortical neurons, BHB plays a vital signalling role by inducing the transcription of brain-derived neurotrophic factor (BDNF) via its inhibition of histone deacetylases, enzymes that repress BDNF expression. BDNF is a pivotal regulator of neuron function; it stimulates mitochondria biogenesis, maintains synaptic structure, spurs the production and survival of new hippocampal neurons, and enhances neuron resistance to injury and disease.(29). In addition to BHB and BDNF, fasting induces the expression of a master regulator of mitochondria, the transcription factor peroxisome proliferator-activated receptor coactivator 1 α (PGC1 α)(29). PGC1 α is a central inducer of mitochondria biogenesis, increasing mitochondria biomass, which in turn enhances neuron bioenergetics and enables synaptic plasticity. PGC1 α also modulates the composition and function of mitochondria. Thus, PGC1 α not only stimulates mitochondria biogenesis, it also stimulates the formation of mitochondria with altered intrinsic properties; both have a positive effect on neuron bioenergetics. Fasting displays potent effects on glucose metabolism and insulin signalling. In humans, fasting for three-to-five days decreases blood glucose levels by 30%–40%, and inhibits glycolysis(30). Fasting on alternate days for three weeks decreases insulin levels by 50%–60% on the fasted day. In general, three-to-five days of fasting in humans also results in a 60% decline in insulin-like growth factor (IGF-1), the chief growth factor in mammals, a five-to-ten-fold increase in IGF-1 binding protein (IGFBP1), one of its main binding proteins, and a two-to-three-fold increase in growth hormone (GH), which rises to preserve muscle mass(31). Fasting therefore prevents the development of chronic, excessive, and potentially dysregulated glucose

metabolism while concurrently preserving insulin sensitivity and growth factor signalling, all of which may benefit neuron bioenergetics. Fasting also exerts a powerful influence on cell synthesis and degradation processes. The balance of cell synthesis versus degradation is regulated by the respective activities of two master regulators of metabolism, mammalian target of rapamycin (mTOR) and AMP-activated protein kinase (AMPK)(32). Under high-nutrient conditions (particularly amino acids), mTOR stimulates protein synthesis and cell growth; in contrast, when cell energy reserves are low, AMPK down regulates mTOR to minimize energy consumption and stimulate autophagy, an intracellular degradation pathway that clears misfolded proteins and damaged organelles, recycles nutrients, and bolsters energy production. Fasting suppresses mTOR and elevates AMPK, thereby limiting nutrient consumption and growth in favour of autophagy and survival; although mTOR and AMPK have mostly been studied in muscle cells, recent evidence suggests these two antagonistic master metabolic regulators may also mediate fasting responses in neurons(33).

Fasting influences fat metabolism by altering the hormonal activities of leptin, adiponectin, and ghrelin. Leptin is associated with a pro-inflammatory state, whereas adiponectin is associated with enhanced insulin sensitivity and suppressed inflammation. Ghrelin is also associated with enhanced insulin sensitivity moreover; ghrelin may stimulate hippocampal synaptic plasticity and neurogenesis. Fasting decreases leptin but increases adiponectin and ghrelin, alterations that are probably beneficial for neuron bioenergetics and the maintenance of neural pathways. Short-term partial sleep deprivation resulted in elevated high-sensitivity CRP concentrations, a stable marker of inflammation(34). Thus fasting helps in reducing inflammatory markers thereby improving the quality of sleep.

Lastly, fasting suppresses inflammation, reducing the expression of pro-inflammatory cytokines such as interleukin 6 (IL6) and tumour necrosis factor α (TNF α) (6).

Also, previous studies on the effect of fasting on stress levels showed that there was significant improvement in the stress levels. But in this study, there was no significant improvement seen in the stress levels. This may be due to the lack of efficient data collecting tools assessing stress levels, serum markers for inflammation were not checked, only questionnaire was given which would not have been efficient enough, and also study could have been done for longer duration.

Strength of the study:

- There were no any adverse effects during the experiment
- There were no any dropouts during the study

Limitations of the study:

- Applied on small sample size.
- Better data collecting tool could be used for assessment (serum markers of inflammation like ESR, CRP, Cortisol levels)
- Better environment could be chosen

- Could be done for longer duration

Future prospects:

- Study can be done on larger sample size.

7.0 CONCLUSION

It was observed that there was improvement in the quality of sleep and general health and reduction in pain and fatigue but there was no significant improvement in stress levels, physical functioning & social functioning among healthy individual who undertook fasting.

8.0 REFERENCE

1. Ma Q, Yang C, Wu R, Wu M, Liu W, Dai Z. How Experiences Affect Psychological Responses During Supervised Fasting: A Preliminary Study. *Front Psychol.* 2021 May 19;12.
2. SHELTON HM. Fasting can save your life: 3rd edition . America: American natural hygiene society;1998:8-25.
3. Gala DD. Efficacy of fasting: 1st edition. Ahmadabad: navneet publication limited; 2004.13.
4. Brandhorst S. L V.D. Fasting and Caloric Restriction in Cancer Prevention and Treatment. *Recent Results Cancer Res.* 2016;207:247-266
5. Peter R. Kerndt, MD, James L. Naughton, MD, Charles E. Driscoll, MD, and David A. Loxterkamp M. Fasting: The History, Pathophysiology and Complications. *West J Med.* 1982;47:78-89
6. Phillips MCL. Fasting as a therapy in neurological disease. *Nutrients.* MDPI AG; 2019:11
7. Trepanowski JF, Bloomer RJ. The impact of religious fasting on human health. *Nutr J .* 2010 Nov 22;9(1):1–9.
8. Phillips MCL. nutrients Fasting as a Therapy in Neurological Disease. 2019;45(12):23-78
9. Włodarek D. Role of Ketogenic Diets in Neurodegenerative Diseases Alzheimer's Disease and Parkinson's Disease. *Multidiscip Digit Publ.* 2019;
10. McStay M, Gabel K, Cienfuegos S, Ezpeleta M, Lin S, Varady KA. Intermittent fasting and sleep: A review of human trials. *Nutrients.* MDPI. 2021;5
11. GP C. Stressors, stress, and neuroendocrine integration of the adaptive re-sponse: Hans Selye Meml Lect *Ann N Y Acad Sci.* 1997;
12. Lavie P, Gertner R, Zomer J, Podoshin L. Breathing disorders in sleep associated with “microarousals” in patients with allergic rhinitis.” *Acta Otolaryngol.* 1981 Nov 1;92(5–6):529–33.
13. Eustress vs Distress: Positive & Negative Types of Stress. 2020 Apr 17;42(7):5-9.

14. Kemeny ME. The Psychobiology of Stress. 2016 Jun 22;12(4):124–9.
15. Keenan SA, Hirshkowitz M, Casseres H. Monitoring and Staging Human Sleep. *Encycl Sleep*. 2013;71–9.
16. Weitzman ED, Czeisler CA, Zimmerman JC, Ronda JM. Timing of REM and stages 3 + 4 sleep during temporal isolation in man. *Sleep*. 1980;2(4):391–407.
17. Rafael de Cabo. Effect of intermittent fasting on health aging and disease. *the new england Jr*. 2019;318:2541-2551.
18. Nakajima . Influence of fasting on stress response and withdrawal symptoms in habitual khat users. *Eur Addict Res*. 2021;27(1):49-57.
19. Michalsen A, Schlegel F. Effects of short-term modified fasting on sleep patterns and daytime vigilance in non-obese subjects: results of a pilot study. *Ann Nutr Metab*:2003;47(5):194-200.
20. De Toledo FW, Grundler F, Bergouignan A, Drinda S, Michalsen A. Safety, health improvement and well-being during a 4 to 21-day fasting period in an observational study including 1422 subjects. *PLoS One*. 2019 Jan 1;14(1).
21. Longo VD, Mattson MP. Fasting: Molecular Mechanisms and Clinical Applications. *Cell Metab*. 2014 Feb 4;19(2):181–92.
22. Pollitt E, Lewis NL, Garza C, Shulman RJ. Fasting and cognitive function. *J Psychiatr Res*. 1982 Jan 1;17(2):169–74.
23. Mehrabani S, Bagherniya M, Askari G, Read MI, Sahebkar A. The effect of fasting or calorie restriction on mitophagy induction: a literature review. *J Cachexia Sarcopenia Muscle*. 2020 Dec 1;11(6):1447–58.
24. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193–213.
25. Levenstein S, Prantera C, Varvo V, Scribano ML, Berto E, Luzi C, et al. Development of the perceived stress questionnaire: A new tool for psychosomatic research. *J Psychosom Res*. 1993;37(1):19–32.
26. Wang R, Wu C, Zhao Y, Yan X, Ma X, Wu M, et al. Health related quality of life measured by SF-36: A population-based study in Shanghai, China. *BMC Public Health*. 2008 Aug 19;8(1):1–8.
27. Puchalska P, Crawford PA. Multi-dimensional Roles of Ketone Bodies in Fuel Metabolism, Signaling, and Therapeutics. *Cell Metab*. 2017 Feb 7;25(2):262–84.
28. Veech RL, Chance B, Kashiwaya Y, Lardy HA, Cahill GF. Hypothesis Paper Ketone Bodies, Potential Therapeutic Uses.
29. Marosi K, Mattson MP. BDNF mediates adaptive brain and body responses to energetic challenges. *Trends Endocrinol Metab*. 2014 Feb;25(2):89–98.
30. UNGER RH, EISENTRAUT AM, MADISON LL. The effects of total starvation upon the levels of

- circulating glucagon and insulin in man. *J Clin Invest.* 1963;42(7):1031–9.
31. Ho KY, Veldhuis JD, Johnson ML, Furlanetto R, Evans WS, Alberti KGMM, et al. Fasting enhances growth hormone secretion and amplifies the complex rhythms of growth hormone secretion in man. *J Clin Invest.* 1988;81(4):968–75.
 32. Herzig S, Shaw RJ. AMPK: guardian of metabolism and mitochondrial homeostasis. *Nat Rev Mol Cell Biol.* 2017 Oct 4;19(2):121–35.
 33. Mattson MP, Moehl K, Ghena N, Schmaedick M, Cheng A. Intermittent metabolic switching, neuroplasticity and brain health. *Nat Rev Neurosci.* 2018 Feb 1;19(2):81–94.
 34. Meier-Ewert HK, Ridker PM, Rifai N, Regan MM, Price NJ, Dinges DF, et al. Sleep Loss and Inflammatory Markers Effect of Sleep Loss on C-Reactive Protein, an Inflammatory Marker of Cardiovascular Risk. 2004; 98:46-78

9.0 ANNEXURES

ANNEXURE 1: CONSENT FORM

INFORMATION SHEET & WRITTEN INFORMED CONSENT FORMSIGNED INFORMED CONSENT FORM

ALVAS COLLEGE OF NATUROPATHY & YOGIC SCIENCES,

MOODABIDRI- 574227, DK DISTRICT, KARNATAKA, INDIA

Phone: 08258 262142, Email: acnys@gmail.com, Website: www.alvas.org

Title of the project: A STUDY TO EVALUATE “EFFECT OF FASTING ON STRESS, QUALITY OF LIFE & SLEEP PATTERN AMONG HEALTHY COLLEGE STUDENTS

Investigator:

Name of the participant:

Date & Time:

About the project:

In order to understand the effect of fasting on sleep, stress, quality of life . Goal is to apply these interventions as treatment mode in future, which might be effective in improving the quality of life, quality of sleep and to reduce stress level.

Please note:

- All information obtained during the study will be kept confidential.
- You can withdraw from the study at any point of time unconditionally
- In case the study does cause any adverse effects, the institution is not liable.

I hereby have understood the above and consent voluntarily to participate in the study.

ANNEXURE 2- RAW DATA

Raw data of PSQI & PSQ

Number	PSQI		STRESS	
	PRE TEST	POST TEST	PRE TEST	POST TEST
1	7	4	0.322	0.255
2	9	3	0.588	0.4
3	10	4	0.877	0.555
4	6	3	0.5	0.4333
5	6	4	0.388	0.244
6	6	2	0.577	0.366
7	7	3	0.366	0.288
8	8	7	0.311	0.355
9	4	1	0.422	0.366
10	8	5	0.533	0.455
11	4	0	0.333	0.95
12	4	3	0.6	0.366
13	9	4	0.622	0.744
14	11	5	0.511	0.577
15	8	9	0.411	0.4
16	7	6	0.366	0.833
17	5	4	0.555	0.644
18	11	12	0.577	0.533
19	7	5	0.566	0.488
20	6	9	0.444	0.488
21	4	1	0.66	0.466
22	5	1	0.6	0.311
23	4	5	0.255	0.311
24	7	13	0.533	0.5
25	5	2	0.511	0.33
26	6	7	0.3	0.522
27	12	5	0.57	0.5
28	11	9	0.7	0.611
29	3	3	0.344	0.155
30	6	2	0.633	0.555

Raw data of SF-36

Sub.	Role of limitation due to physical functioning		Role of limitation due to emotional health		Energy/Fatigue		Emotional well-being		Social functioning		Pain		General Health		Physical functioning	
	pre test	post test	pre test	post test	pre test	post test	pre test	post test	pre test	post test	pre test	post test	pre test	post test	pre test	post test
1	75	100	66.3	100	55	70	52	76	37.5	64.5	45	57.5	70	75	55	65
2	25	100	33.33	100	50	50	36	56	62.5	62.5	35	67.5	40	45	55	60
3	75	25	0	33.3	45	45	48	40	50	50	45	45	10	40	35	65
4	75	100	100	100	60	70	56	84	62.5	100	55	100	66	65	85	95
5	100	75	100	100	55	50	60	64	62.5	67.5	77.5	100	55	60	95	100
6	100	40	100	30	80	95	76	96	87.5	100	90	100	80	75	100	100
7	75	50	33.3	66.6	45	65	40	75	50	67.5	90	80	70	75	60	65
8	100	0	100	33.3	65	60	72	64	75	50	66.5	55	80	55	85	50
9	25	100	33.33	100	85	85	84	88	87.5	87.5	100	100	75	85	100	100
10	50	100	33.33	100	65	85	76	80	62.5	100	35	35	65	85	100	80
11	50	75	0	66.6	10	50	20	44	25	50	0	64.5	25	40	85	60
12	0	75	33.3	66.6	25	50	44	52	37.5	64.5	55	57.5	45	65	70	60
13	50	50	0	66.6	40	65	44	80	50	37.5	67.5	90	45	65	85	95
14	75	75	0	0	0	40	50	44	68	62.5	62.5	67.5	50	75	95	100
15	75	50	100	100	50	75	40	44	25	87.5	45	65	50	60	60	80
16	0	75	100	100	50	45	36	45	25	37.5	22.5	29.5	50	60	70	70
17	100	75	100	30	80	80	76	68	24.5	20	67.5	90	80	80	95	95
18	0	100	0	0	45	35	48	52	50	62.5	37.5	67.5	50	60	70	75
19	25	50	66.6	66.6	60	60	52	64	50	47.5	62.5	90	55	50	90	80
20	75	0	33.3	0	30	40	40	32	37.5	37.5	35	55	60	50	85	70
21	50	0	100	0	30	30	24	28	50	37.5	32.5	45	35	45	40	55
22	40	100	0	100	60	75	60	84	50	87.5	55	100	60	65	100	100
23	25	50	0	0	60	75	80	80	62.5	37.5	45	62.5	95	80	95	100
24	25	40	0	0	65	55	60	76	50	50	67.5	57.5	70	70	75	85
25	25	50	0	33.3	60	45	60	56	67.5	87.5	100	100	56	65	60	65
26	100	100	100	100	55	75	80	76	75	100	77.5	80	55	60	90	100
27	0	75	33.3	30	25	45	56	48	37.5	50	45	45	50	30	35	50
28	0	0	0	0	50	55	36	55	37.5	50	77.5	80	65	45	100	85
29	0	50	0	100	45	90	76	84	75	75	67.5	77.5	70	80	90	85
30	0	25	0	0	20	40	36	24	0	50	45	45	55	75	35	50

ANNEXURE 3 ASSESSMENT TOOLS

The Perceived Stress Questionnaire*Instructions for the General questionnaire*

For each sentence, circle the number that describes how often it applies to you in general, *during the last year or two*.
Work quickly, without bothering to check your answers, and be careful to describe your life *in the long run*.

	Almost	Sometimes	Often	Usually
1. You feel rested	1	2	3	4
2. You feel that too many demands are being made on you	1	2	3	4
3. You are irritable or grouchy	1	2	3	4
4. You have too many things to do	1	2	3	4
5. You feel lonely or isolated	1	2	3	4
6. You find yourself in situations of conflict	1	2	3	4
7. You feel you're doing things you really like	1	2	3	4
8. You feel tired	1	2	3	4
9. You fear you may not manage to attain your goals	1	2	3	4
10. You feel calm	1	2	3	4
11. You have too many decisions to make	1	2	3	4
12. You feel frustrated	1	2	3	4
13. You are full of energy	1	2	3	4
14. You feel tense	1	2	3	4
15. Your problems seem to be piling up	1	2	3	4
16. You feel you're in a hurry	1	2	3	4
17. You feel safe and protected	1	2	3	4
18. You have many worries	1	2	3	4
19. You are under pressure from other people	1	2	3	4
20. You feel discouraged	1	2	3	4
21. You enjoy yourself	1	2	3	4
22. You are afraid for the future	1	2	3	4
23. You feel you're doing things because you have to not because you want to	1	2	3	4
24. You feel criticized or judged	1	2	3	4
25. You are lighthearted	1	2	3	4
26. You feel mentally exhausted	1	2	3	4
27. You have trouble relaxing	1	2	3	4
28. You feel loaded down with responsibility	1	2	3	4
29. You have enough time for yourself	1	2	3	4
30. You feel under pressure from deadlines	1	2	3	4

Instructions for the Recent questionnaire

For each sentence, circle the number that describes how often it applied to you *during the last month*.

Work quickly, without bothering to check your answers, and be careful to consider only *the last month*.

Score 5-circled number for items 1, 7, 10, 13, 17, 21, 25, 29

Score circled number for all other items

PSQ Index = (raw score-30)/90.

Name _____

Date _____

Sleep Quality Assessment (PSQI)

What is PSQI, and what is it measuring?

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. What time have you usually gotten up in the morning? _____
4. A. How many hours of actual sleep did you get at night? _____
 B. How many hours were you in bed? _____

	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
5. During the past month, how often have you had trouble sleeping because you				
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)

Scoring

- | | | |
|--------------------|--|----------|
| Component 1 | #9 Score | C1 _____ |
| Component 2 | #2 Score (<15min (0), 16-30min (1), 31-60 min (2), >60min (3))
+ #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3) | C2 _____ |
| Component 3 | #4 Score (>7(0), 6-7 (1), 5-6 (2), <5 (3)) | C3 _____ |
| Component 4 | (total # of hours asleep) / (total # of hours in bed) x 100
>85%=0, 75%-84%=1, 65%-74%=2, <65%=3 | C4 _____ |
| Component 5 | # sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3) | C5 _____ |
| Component 6 | #6 Score | C6 _____ |
| Component 7 | #7 Score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3) | C7 _____ |

Add the seven component scores together _____ **Global PSQI** _____

**A total score of "5" or greater is indicative of poor sleep quality.
 If you scored "5" or more it is suggested that you discuss your sleep habits with a healthcare provider**

SF-36 QUESTIONNAIRE

Name: _____ Ref. Dr: _____ Date: _____
 ID#: _____ Age: _____ Gender: M / F

Please answer the 36 questions of the Health Survey completely, honestly, and without interruptions.

GENERAL HEALTH:

In general, would you say your health is:

Excellent Very Good Good Fair Poor

Compared to one year ago, how would you rate your health in general now?

Much better now than one year ago
 Somewhat better now than one year ago
 About the same
 Somewhat worse now than one year ago
 Much worse than one year ago

LIMITATIONS OF ACTIVITIES:

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Lifting or carrying groceries
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Climbing several flights of stairs
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Climbing one flight of stairs
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Bending, kneeling, or stooping
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking more than a mile
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking several blocks
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Walking one block
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

Bathing or dressing yourself
 Yes, Limited a Lot Yes, Limited a Little No, Not Limited at all

PHYSICAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

Cut down the amount of time you spent on work or other activities
 Yes No

Accomplished less than you would like
 Yes No

Were limited in the kind of work or other activities
 Yes No

Had difficulty performing the work or other activities (for example, it took extra effort)
 Yes No

EMOTIONAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

Cut down the amount of time you spent on work or other activities
 Yes No

Accomplished less than you would like
 Yes No

Didn't do work or other activities as carefully as usual
 Yes No

SOCIAL ACTIVITIES:

Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all Slightly Moderately Severe Very Severe

PAIN:

How much bodily pain have you had during the past 4 weeks?

None Very Mild Mild Moderate Severe Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all A little bit Moderately Quite a bit Extremely

ENERGY AND EMOTIONS:

These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.

Did you feel full of pep?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Have you been a very nervous person?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Have you felt so down in the dumps that nothing could cheer you up?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Have you felt calm and peaceful?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Did you have a lot of energy?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Have you felt downhearted and blue?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Did you feel worn out?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Have you been a happy person?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

Did you feel tired?

- All of the time
 Most of the time
 A good Bit of the Time
 Some of the time
 A little bit of the time
 None of the Time

SOCIAL ACTIVITIES:

During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- All of the time
 Most of the time
 Some of the time
 A little bit of the time
 None of the Time

GENERAL HEALTH:

How true or false is each of the following statements for you?

I seem to get sick a little easier than other people
 Definitely true
 Mostly true
 Don't know
 Mostly false
 Definitely false
I am as healthy as anybody I know
 Definitely true
 Mostly true
 Don't know
 Mostly false
 Definitely false
I expect my health to get worse
 Definitely true
 Mostly true
 Don't know
 Mostly false
 Definitely false
My health is excellent
 Definitely true
 Mostly true
 Don't know
 Mostly false
 Definitely false
SCORING OF SF-36**Table 7- Step 1: Recoding Items**

Item numbers	Change original response category*	To recoded value of:
1, 2, 20, 22, 34, 36	1 →	100
	2 →	75
	3 →	50
	4 →	25
	5 →	0
3, 4, 5, 6, 7, 8, 9, 10, 11, 12	1 →	0
	2 →	50
	3 →	100
13, 14, 15, 16, 17, 18, 19	1 →	0
	2 →	100
21, 23, 26, 27, 30	1 →	100
	2 →	80
	3 →	60
	4 →	40
	5 →	20
	6 →	0
24, 25, 28, 29, 31	1 →	0

	2 →	20
	3 →	40
	4 →	60
	5 →	80
	6 →	100
32, 33, 35	1 →	0

Item numbers	Change original response category*	To recoded value of:
	2 →	25
	3 →	50
	4 →	75
	5 →	100

Table 8- Step 2: Averaging Items to Form Scales (24)

Scale	Number of items	After recoding per Table1, average the following items
Physical functioning	10	3 4 5 6 7 8 9 10 11 12
Role limitations due to physical health	4	13 14 15 16
Role limitations due to emotional problems	3	17 18 19
Energy/fatigue	4	23 27 29 31
Emotional well-being	5	24 25 26 28 30
Social functioning	2	20 32
Pain	2	21 22
General health	5	1 33 34 35 36

ANNEXURE 4 – IMAGES OF INTERVENTION



