CHAPTER 4

4. 0 Aim and objectives

4.1 Aim

- To evaluate the effect of yoga on psycho-motor and cognitive functions among substance abuser

4.2 Objectives

- To evaluate the effect of the yoga-based intervention on anxiety and depression among substance abuser
- To estimate the effect of the yoga-based intervention on self-control in substance abuser
- To investigate the effect of the yoga-based intervention on mindfulness among substance abuser
- To understand the effect of the yoga-based intervention on sleep among substance abuser
- To explore the effect of the yoga-based intervention on the attention, response inhibition, and working memory
- To estimate the effect of the yoga-based intervention on strength, steadiness, dexterity, and fatigue among substance abuser

4.3 Research questions

4.3.1 Research Question 1: What is the effect of yoga on psychological function of substance abuser?

4.3.2 Hypothesis 1: Yoga practice will improve the psychological well-being of substance abuser.

4.3.3 Research Question 2: What is the effect of yoga on cognitive function of substance abuser?

4.3.4 Hypothesis 2: Yoga practice has a positive impact on the cognitive function of substance abuser.

4.3.5 Research Question 3: What is the effect of yoga on the Motor function of substance abuser?

4.3.6 Hypothesis 3: Yoga practice enhances the motor function of substance abuser.

4.3.7 Null hypothesis

- Yoga practice does not have a positive impact on the psychological function of substance abuser.
- Yoga practice will not influence the cognitive function of substance abuser.
- Yoga practice will not enhance the motor function of substance abuser.

4.4 Operational definition

4.4.1 Mindfulness

Mindfulness is conceptualized as a state of attentiveness to present events and experiences that are unmediated by discursive or discriminating cognition (Brown, Ryan, & Creswell, 2007).

4.4.2 Self-control

The self's capacity to inhibit its antisocial impulses and beneficial adaptations of

human psyche (Tangney, Baumeister, & Boone, 2004).

4.4.3 Anxiety& Depression

Anxiety is an emotional and cognition response to a perceived thread characterized by an unpleasant state of inner turmoil, often accompanied by nervous behaviour (Seligman & Csikszentmihalyi, 2000). Depression is a mental and mood disorder that causes an insistent feeling of sadness and loss of interest.

4.4.4 Sleep

Sleep is a state of mind characterized by reform consciousness, relatively inhibited sensory activity over all in voluntary muscles. Sleep is associated with a state of muscle relaxation and reduced perception of environmental stimuli (Chokroverty, 2010).

4.4.5 Response Inhibition

Response inhibition refers to the suppression of actions that are inappropriate in a given context and that interfere with goal-driven behaviour (Mostofsky & Simmonds, 2008).

4.4.6 Selective attention

Selective attention is the act of focusing on a particular object in a period of time by ignoring other in which cognitive process utilize the selective attention to focus on specific target on input (Deutch & Deutch, 1963).

4.4.7 Working Memory

The short-term mental storage and manipulation of information in mind are collectively called working memory.

4.4.8 Immediate Memory Span

The concept of immediate memory which dedicated the maintain system and stores information in the short term, and underlies human thought processes (Baddeley, 2003).

4.4.9 Dexterity

Dexterity is defined as fine voluntary movements used to manipulate small objects during a specific task (Backman, Gibson, & Parsons, 1992).

4.4.10 Motor speed

The ability to execute coordinated pattern of movements to achieve intended outcomes and the ability to perform skill oriented task.

CHAPTER 5

5.0 Methodology

5.1 Source of subject
The participants were recruited from Asara Sudhar Kendra drug rehabilitation center in Nepal.

5.2 Sampling
Convenience sampling

5.3 Sample size
Ninety six substance abusers from a residential drug rehab center were recruited for this study. Participant's age ranged from 18 to 40 years.

Yoga group (n–48)

Physical exercise group (n-48)

(Sample size was limited by the center available)

5.4 Selection criteria

5.4.1 Screening
The baseline evaluation consists of Medical history, Physical examination, Psychiatric interview and Substance use history of substance user (Battjes et al., 2004).

5.4.2 Inclusion criteria
- Age-between 18-40 years
- Males
- Fluently speaking, reading and comprehend English
- Those participants who can stay minimum 4 months in rehab centres

5.4.3 Exclusion criteria

- ❖ Having a legal case that may interfere during the study period
- ❖ Evidence of self-harming and/or suicidal ideations as noticeable due
- ❖ An acute major psychiatric disorder associated with psychosis
- ❖ Any other psychiatric disorder that requires inpatient hospital treatment with medication or therapy
- ❖ Chronic infections such as HIV, Tuberculosis etc.

5.4.4 Ethical consideration

Signed informed consent was obtained from the participants at the time of registration after they had to read the proposal that involves noninvasive data collection methods and risk-free intervention. All procedures were reviewed and accepted by the institutional ethical committee of the Nepal health research council (NHRC), (Ref. no 631, 02/10/2016), Kathmandu, Nepal. The participants were explained in detail about the nature of the study and the voluntary nature of participation and were not provided any incentives for their participation.

5.4.5 Design

Prospective, Randomized, Open Label, Active Control design

[Table 13]

<table>
<tr><td colspan="4">Design</td></tr>
<tr><td rowspan="2">Pre-data collection</td><td rowspan="2">Randomized</td><td>Experimental group
Yoga Training for 12 weeks</td><td rowspan="2">Post-data collection</td></tr>
<tr><td>Physical exercise group
Physical Training for 12 weeks</td></tr>
</table>

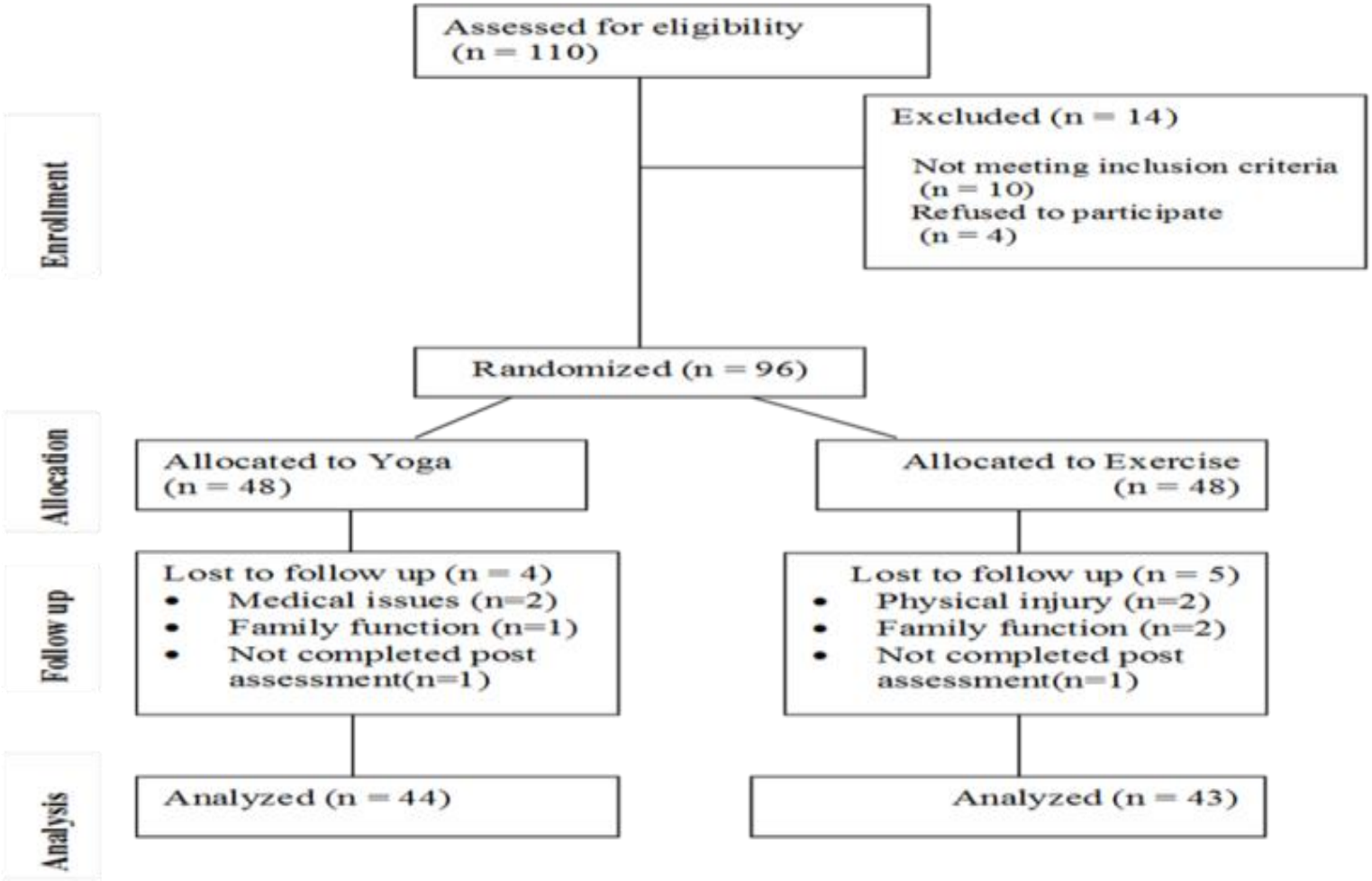
5.4.6 Randomization

All subjects were randomized by a statistician using a computerized random number from www.randomizer.org and allocated in to Yoga group & Physical exercise group. The Yoga group underwent the yoga module for 12 weeks. Standard exercise module for 12 weeks was administered among physical exercise group. Assessments were done before and after the 12 weeks.

5.4.7 Trail profile

The trial profile is shown in Pic. 1, of 96 recruited participants, data for 87 substance abusers were available, yoga (n=44) and physical exercise (n=43) for final analysis. The reason for dropout enlisted in the trail profile.

[Pic **1]**


Assessed for eligibility
(n = 110)
Excluded (n = 14)
Not meeting inclusion criteria
(n = 10)
Refused to participate
(n = 4)
Enrollment
Randomized (n = 96)
Allocation
Allocated to Yoga
(n = 48)
Allocated to Exercise
(n = 48)
Follow up
Lost to follow up (n = 4)
Medical issues (n=2)
Family function (n=1)
Not completed post assessment(n=1)
Lost to follow up (n = 5)
Physical injury (n=2)
Family function (n=2)
Not completed post assessment(n=1)
Analysis
Analyzed (n = 44)
Analyzed (n = 43)

5.5 Intervention

The yoga-based program and physical exercise were supervised by a trained yoga therapist and a physical instructor at a rehabilitation center. The training included weekly six sessions of 90-minute duration over 12 weeks. The sessions were conducted in the morning at 6.30 am to 8.00 am. There were structured protocols for the exercise and yoga tasks, criteria for progression and guidelines for durations and levels. Intervention programs began at a light intensity and gradually increased over the first month of the intervention. Training sessions were administered in groups, whereas each group had 8 to 15 participants and one trainer. Also, participants received standard rehabilitation treatment such as psychosocial intervention, educational lectures, and recreation at the treatment unit. The yoga module was based on concepts from ancient yoga scriptures and developed specifically for SUDs. Yoga module consisted of various components such as loosening practices, sun salutations, *yogic* postures (*asanas*), breathing exercises, regulation of breath (*pranayama*), the comfortable dwelling of the mind in a single thought with awareness while practicing unbroken concentration (meditation) and relaxation techniques. The exercise program included loosening, warm-up, moderate aerobics which included types of walking (drill, brisk) and jogging (forward, backward, side) stretching module to enhance flexibility and strengthening exercises.

The 90-minutes daily Interventions practiced by yoga and physical exercise groups [Table 14]

Yoga group practices	**No of rounds**	**Time (min)**	**Physical group practices**	**No of rounds**	**Time (min)**
Opening *Yogic* prayer & instructions of class	1	5	Opening prayer & instructions of class	1	5
ॐ सह नाववतु ।सह नौ भुनक्तुसह वीर्यं करवावहै			Rehabilitation center opening prayer		
तेजस्वि नावधीतमस्तु मा विद्विषावहै					
ॐ शान्तिः शान्तिः शान्तिः ॥					
Loosening practices (Standing)			**Loosening practices (Standing)**		
Neck movement (*Greevasanchalana*)	5	1	Warm up (movement of all body parts)	1	5
Finger movement (*Angulisanchalana*)	5	1	Jogging (forward, backward, side)	3	5
Wrist rotation (*Mani bandhachakra*)	5	1	Jumping	1	2
Shoulder rotation (*Skandhachakra)*	5	1	Jumping and clapping	1	3
Hands twisting	5	1	Hopping	1	2
Hip rotation (clock & anti clockwise)	5	1	Side bending	1	3
Forward & Backward bending	10	1	Forward & Backward bending	1	3
Patella (knee cap movement)	10	1	Twisting	1	2
Toes, ankles, & fingers	10	1	Alternate toe touching	1	3
Instant relaxation techniques			Side bending	1	2
Tighten whole part of body & relax	1	1	Hands rotation	1	2
Breathing practices			Drill walking	1	3
Hand in & out movement (*Hasta ayamasvasanam*)	5	1	Brisk walking	1	3
Hand stretch breathing (*Hasta vistarasvasanam*)	5	1	Running (35 meter)	10	5
Ankle stretch breathing (*Gulphavistarasvasanam*)	5	1	**Sitting exercise**		
Rabbit breathing (*Sasankhasana breathing*)	5	1	Sitting twisting exercise (left & right side)	1	2
Tiger breathing (*Vyaghrasvasanam*)	5	1	Sitting side bending	1	3

			by hand rising		
Bridge posture, breathing (*Setubandhasvasanam*)	5	1	**Supine exercise**		
Sun salutation with opening prayer (Ten counts)	10	10	Cycling	1	3
Hand rising posture (*Hastuttanasana*)			Alternate leg rising	1	3
Hand to foot posture (*Padahastasana*)			Both legs rising	1	3
Rose riding posture (*Aswosanchalanasana*)			Rocking & rolling	1	3
Plank posture (*Chaturdandasana*)			Face up supine bridge	1	3
Cobra posture (*Bhujangasana*)			Supine abdominal exercise	1	2
Mountain posture (*Parvatasana*)			**Prone exercise**		
Quick Relaxation Techniques	1	3	Push up	2	3
Feel the breath			Prone alternating leg lifts	1	3
Synchronized the breath with abdominal breathing			Prone alternate knee bends	1	3
Positive thinking			**Supine rest**	1	10
Asanas (postures)			**Closing prayer**	1	1
Standing postures			***ॐ सर्वे भवन्तु सुखिनःसर्वे सन्तु निरामयाः***		
Tree posture (*Vrikshasana*)	5	1	***सर्वे भद्राणि पश्यन्तुमा क श्चिद्दुःखभाग्भवेत् ।***		
Half waist rotation posture (*Ardhakatichakrasana*)	5	1	***ॐ शान्तिः शान्तिः शान्तिः***		
Triangle posture (*Trikonasana*)	5	1			
Half wheel posture (*Ardhachakrasana*)	5	1			
Warrior postures (series 1,2,3,4) (*Birbhadrasana* 1,2,3,4)	5	1			
Sitting postures					
Thunderbolt - Diamond (*Vajrasana*)	5	2			
Camel posture (*Ustrasana*)	5	1			
Posterior stretches *(Paschimottansana*)	5	1			
Spinal twist posture *(Ardhamatsyendrasana)*	5	1			
Cow face posture *(Gomukhasana*)	5	2			
Twisted pose (*Vakrasana*)	5	1			
Rabbit posture *(Shashankasana*)	5	2			
Supine postures					

Shoulder stand posture (*Sarvangasana*)	5	1			
Fish posture *(Matsyasana*)	5	1			
Bridge posture (*Setubandasana*)	5	1			
Folded cross leg lumbar stretches	5	1			
Boat posture *(Naukasana)*	5	1			
Prone posture					
Bow posture (Dhanurasana)	5	1			
Grasshopper posture *(Salabhasana)*	5	1			
Cobra posture *(Bhujangasana)*	5	1			
Crocodile posture *(Makarasana)*	5	2			
Deep Relaxation Technique					
Relax whole parts of the body (lower, middle, upper parts)	1	10			
Pranayama					
Breathing with forceful exhalation with passive inhalation *(Kapalabhati)*	3	3			
Breathing with rapid inhalation & exhalation *(Bhastrika)*	3	3			
Cooling *pranayama (Sitkari, Sitali, Sadanta)*	3	3			
Honey bee sound *(Bhramari)*	3	3			
Alternate nostril breathing *(Nadisuddhi)*	7	3			
Meditation					
Om Meditation *(Aum Dhyana*) Cyclic meditation *(Avartan Dhyana)*		20			
Closing prayer	1	1			
ॐ सर्वे भवन्तु सुखिनःसर्वे सन्तु निराम याः ***सर्वे भद्राणि पश्यन्तुमा कश्चिद्दुःखभा ग्भवेत् ।*** ***ॐ शान्तिः शान्तिः शान्तिः***					
Yoga & Physical exercise session 6 days per/week					
Om meditation & Cyclic meditation every Friday					

5.6 Outcome measures

5.6.1 Cognitive variables

5.6.1.1 Stroop Color-Word Test (Golden, 1978)

Golden's version of the Stroop Color-Word Test was used in this study (Golden, 1978).The Stroop test includes three time-limited (45-s) subtests (word, color & color-word). Task 1 consisted of the words red, green, and blue in the random order printed in black ink (capital letters) on the white sheet of paper. The subjects are asked to read the list of words. Next, subjects were presented with a list of "XXXX"s that differs in ink color (e.g., XXXX in red, blue, or green ink). The individual is asked to name the color of the ink for each "XXXX"s. The final page is the color-word task on which the individual is shown the names of colors printed incongruent ink colors (e.g., the word "RED" in green ink). The participants were asked to call out the color of the ink rather than the word. Each sub-test contains 100 items, presented in five columns of 20 items. Subjects were instructed to read down the columns starting with the top word in the leftmost column. The item named last on each stimulus card after 45-s was noted. Stroop possesses adequate test retest reliabilities of 0.89 (word), 0.84 (color), and 0.73 (color word).

5.6.1.2 WAIS-R Digit Span Task (Weschler, 2008)

The test consists of two parts, digit forward and digit backward. The Digit Span Task assesses attention, immediate memory span, and working memory. The participants were administered the test following the standardized instructions. The participants listen to verbally present digits' sequences (e.g., 6 -9 -4) at a rate of one per second. After every sequence, the participants were asked to reproduce the string in the same order as given by the examiner (forward span; e.g., 6 -9 -4), or in the reverse order (backward span; e.g., -4 -9 6). The digit sequences consist of a

randomly picked number from 0 to 9, so that no calculation or serial association can be performed. The first span includes two numbers. The consecutive span has one more digit added and so on until the last span included nine digits in the forward test while two to eight digits in the backward test. Further, in each trial, no repetition of the digit was present in the sequence. Each span size has two trials. The score was the total number of correct trials, before failing two consecutive trials at any one span size or when a full digit number is repeated successfully. Relatively stable threshold value was found to be .83.

5.6.1.3 Six Letter Cancellation Task (Natu & Agarwal, 1997)

Cancellation tasks (Uttl & Pilkenton-Taylor, 2001) are widely used to evaluate sustained and selective attention, psychomotor speed, visual searching and motor coordination (Lezak, Howieson, Bigler, & Tranel, 2012). The cancellation worksheet consists of the six target capital letters printed at the top of the working section. Subjects required searching and marking as fast and as accurately as possible, target letters arranged randomly in 22 rows and 14 columns. After the 90s, the task was interrupted. Subjects were instructed regarding two possible strategies to cancel target letters: focuses on all target letters at once or select a single target letter at a time. Further, it is suggested that they can adopt different searching strategies (randomized or organized searching: horizontal scanning, for example, from left to right, or vertical scanning) according to their own choice. The total cancellation attempted, and incorrect canceled targets are recorded. The net score is calculated by deducting the incorrect cancellations from the total cancellations attempted. The six letter cancellation reported the adequate amount of stability over time 0.78 (Pradhan & Nagendra, 2008).

5.6.2 Motor Functions

5.6.2.1 Finger Tapping Test (Ruff & Parker, 1993)

The finger-tapping test provides an easily quantifiable measure of fine motor speed. Subjects were seated in optimal comfort position with forearms laid on a table in front of them. Participants were instructed to rest their hand on the wooden board raised on one side, and place the index finger on a small lever connected to a mechanical counter. When the lever was pressed down all the way and released, the counter increased the reading by one. Further, participants were tutored to oscillate the index finger as quickly instead of the wrist. After explaining the procedure, a brief practice session was given before the actual recording. Readings of taps at the interval of 10, 20 seconds, and final, reading in 30 seconds were noted. Higher the scores better the fine motor skill, Test-retest reliability between 0.84 and 0.99 (Dash & Telles, 1999).

5.6.2.2 Tweezer Dexterity Test (Lundergan, Soderstrom, & Chambers, 2007)

Subjects sat comfortably in front of a table on which the dexterity board was placed. The board consists of two halves. One half has a square plate approximately 15 ×15 cm with ten rows of 10 holes to insert the pins, and the other half contains a shallow tray to keep the sufficient number of pins. The test required the use of tweezers, in placing a single pin in each approximately 0.16 cm diameter hole, as quickly as possible. The individual is instructed to fill the holes beginning left to right and from the top row to the bottom. Familiar with the test, participants were given trials of filling two rows before the actual test. Timing measured in seconds lapsing between when the subject picked up the tweezers and finished the 100 holes. The lesser the score, the higher the efficiency in performance (Tiidus, Brown, Brant, Enns, & Bryden, 2008).

5.6.2.3 Automatic Mirror Tracer (Lafayette, Model 58024C)

The subjects were asked to take a seat restfully in front of a table where the Automatic Mirror Tracer was set up. The Automatic Mirror Tracer (Lafayette, Model 58024A) consists of an aluminum plate with a non-conducting black star pattern anodized into the surface. A metal shield on the instrument prevents the subject from viewing the black star pattern. Subjects were able to see the pattern by looking in a mirror placed vertically behind the star. Participants were instructed to hold a metallic-tracing stylus in their preferred hand and trace as fast and accurately as possible, attempting to stay within the pattern, from a starting mark. The aluminum plate and the metallic-tracing stylus are both connected to the Silent Impulse Counter (Lafayette, Model 58024C); errors tallied automatically when stylus touches outside the margins of the non-conducting black star pattern. The time and error committed were recorded (Telles, Praghuraj, Ghosh, & Nagendra, 2006).

5.6.3 Psychological variables

5.6.3.1 Self-control (Tangney, Baumeister, & Boone, 2004)

Self-control was measured using a brief thirteen-item scale. Participants used a Likert scale ranging from 1 (not at all like me) to 5 (very much like me) to rate their general self-control tendencies. After reverse-scoring 9 items, the 13 items were added to calculate total self-control score. Higher the score, higher the individual's self-control.

5.6.3.2 Hospital Anxiety and Depression Scale (Zigmond et al., 1999)

The Hospital Anxiety and Depression Scale were at 14-items scale designed to measure anxiety (7 items) and depression (7 items), independent of somatic symptoms. Participants reflect how they have been feeling during the past week on 4-point severity

scale (from 0 representing the absence of symptoms to 3 representing maximum symptomatology. Summing of subscale yield separate score ranging from 0 to 21. Scores of greater than indicated higher levels of disorder.

5.6.3.3 Medical Outcomes Study Sleep Scale (Hays & Stewart, 1992)

The MOS-Sleep is a 12-item instrument to assess the quality and quantity of sleep. Instrument scoring results in six subscales: sleep disturbance (4 items), snoring (1 item), shortness of breath, or a headache (1 item), sleeps adequacy (2 items), somnolence (3 items), and quantity of sleep (1 item). Ten of the scale's 12 items are scored using a categorical scale ranging from "all of the time" to "none of the time." One item about time to fall asleep uses a five-point Likert scale ranging from ''0 to 15 min" to ''more than 60 min". Further, sleep quantity is an open-ended question recording the average number of hours they slept each night. All domains except sleep quantity transformed with a 0–100 scale to represent the percentage. Lower scores for the domains of sleep disturbance, somnolence, sleep-awakening and the snoring show enhancement of sleep, whereas higher scores for sleep quantity and sleep adequacy, indicates an improvement of sleep.

5.6.3.4 Freiberg Mindfulness Inventory-Short Form (Walach & Schmidt, 2006)

Freiberg Mindfulness Inventory Short Form was a 14-item version to assess a one-dimensional domain from people without any background knowledge of mindfulness. Each self-descriptive statement evaluated using a four-point Likert scale ranging from 1 = ''rarely" to 4 = ''almost always". Scores range from 14 to 56. Higher scores indicate higher levels of mindfulness.

5.7 Data Scoring

Data extraction was done accordingly as mentioned in the manual of each instrument used in the study.