CHAPTER 2

LITERATURE REVIEW

The review of literature relating to background information categorized as follows:

Physiology of sleep

Factors affecting sleep

Sleep of the elderly

Sleep assessments

Anxiety and depression assessments

Exercise and sleep

Tai Chi Qigong

Physiology of Sleep

Sleep is complex and plays an important role in survival. Fordham (1988) cited in Potter and Perry (1995) defined sleep as "a discrete state of reduced responsiveness to external stimuli, from which a person can be aroused. It is a continuous cyclical change in the level of consciousness". Some functions of sleep are restoration, protection and energy conservation, all which are essential for recovery from illness (Ersser, et al., 1999).

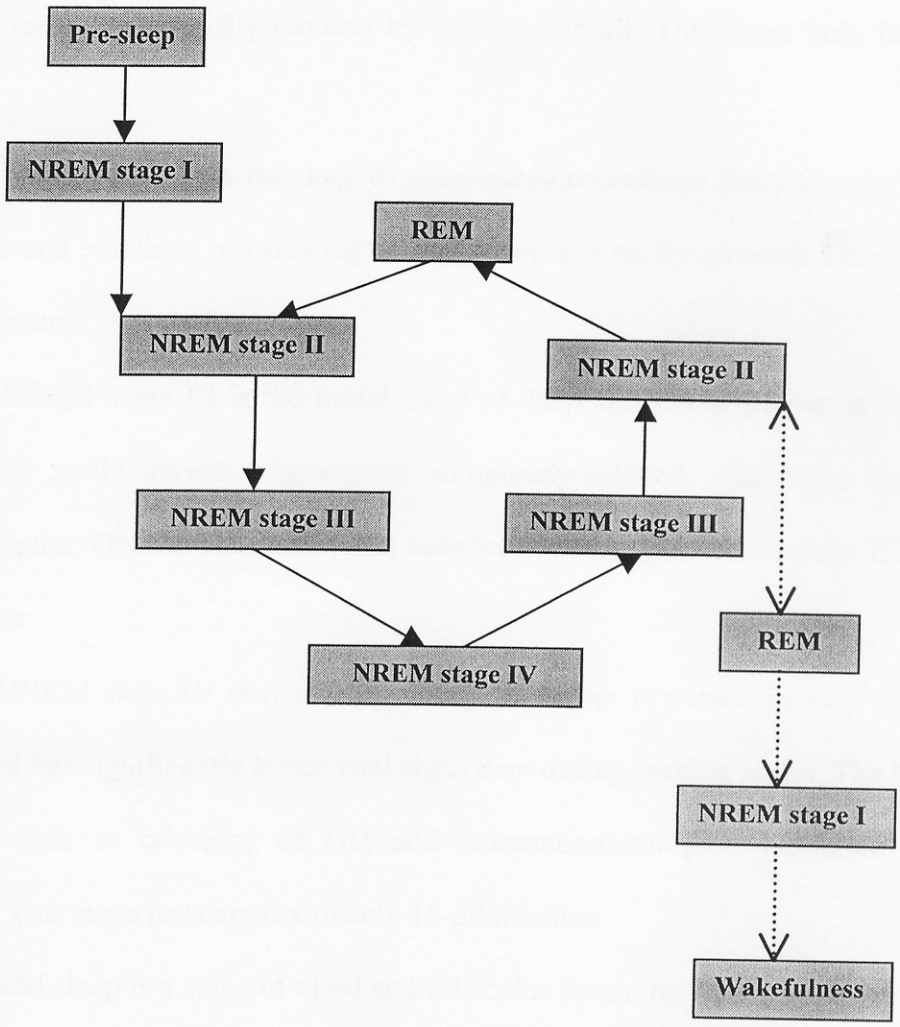
The cyclical phenomena of sleep is associated with neurochemical systems in the brain and the peripheral nervous system, endocrine system, cardiovascular system,

respiratory system and muscular system. Sleep and wake cycles have both circadian and sleep regulation components. A person's circadian rhythm is a series of cyclical rhythms which influences and regulates physiological functions and behavioral responses over 24 hours. The circadian rhythm is like a biological clock. Kryger, Roth, and Dement (2000) called the biological clock which related to Suprachiasmatic Nucleus (SCN). The SCN is in brain regions including the pineal gland. The SCN in the pineal gland responds to light-induced signals by switching off the production of melatonin hormone.

Normally Melatonin hormone levels decrease after darkness, making people feel drowsy. The SCN synchronized with the sleep/wake cycle influencing body temperature, mood, hormone secretion, urine production, electrolyte secretions, and changes in blood pressure (Potter & Perry, 1995). This sleep regulation influences sleep control centers, the Reticular Activating System (RAS) in the upper brainstem and the Bulbar Synchronizing Region (BSR) in the pons and medial forebrain. The RAS releases neurotransmitters such as norepinephrine, dopamine and Gramma-Aminobutyric Acid (GABA). Neurotransmitters such as dopamine and other amines promote wakefulness and maintain alertness. On the other hand, serotonin hormone, such as L-typtophan (5-hydroxytryptamine, 5-HT), secreted from the BSR is a natural hypnotic which induces sleep.

Sleep starts with a period of pre-sleep or sleep latency (see Figure 2); it is the transition from alert to stage I of the sleep cycle. Normally sleep latency lasts from a few minutes up to 30 minutes (American Sleep Disorder Association, 1990; Lee, 1997; Potter & Perry, 1995). Each sleep cycle is composed of 4 stages of Non Rapid

Eye Movement (NREM) and one Rapid Eye Movement (REM) periods (Chokroverty, 1994; Potter & Perry, 1995).



2 cycles of the sleep cycle during the early part of the night

3 cycles of the sleep cycle during the later part of the night

Figure 2. Diagram of the normal adult sleep cycles and stages of sleep.

Note. Modified from Basic Nursing: Theory and practice (p,723), by P.A. Potter and A.G. Perry, 1995, St. Louis: Mosby.

The four stages of NREM are as follows:

1. NREM stage I is the stage of lightest sleep with a decrease of physiological activities beginning with a gradual decrease in vital signs and metabolism. The person starts to relax, but is easily aroused by sensory stimuli. This stage lasts for about 5 minutes.

2. NREM stage II is the stage of progressive relaxation. Body functions such as heart rate and breathing are slowing and the sleeper is easily aroused. This stage lasts 10-20 minutes.

3. NREM stage III is the initial stage of deep sleep. The person is difficult to arouse and rarely moves. Muscles are completely relaxed; vital signs decline but remain regular. Growth Hormone (GH) secretes in this stage. NREM stage III lasts 15-30 minutes.

4. NREM stage IV is the deepest stage of sleep. A person is very difficult to arouse and has significantly lower vital signs than during waking hours. The hormonal response such as releasing of GH and Adrenocorticotrophic Hormone (ACTH) continue. This stage lasts approximately 15-30 minutes.

REM sleep is a stage of vivid and full-color dreaming. It occurs approximately 90 minutes after the beginning of sleep and after the end of each NREM cycle. During this stage, the large skeletal muscles are weak while eye movements and twitching of small facial muscles occur. REM density, heart rate, respiratory rate, and blood pressure fluctuate under the autonomic nervous system. Arousal is very difficult during this stage.

Lee (1997) classified sleep into 3 types: light sleep, deep sleep, and dream sleep. An Electroencephalogram (EEG) monitoring the sleep period illustrated each

stage of the sleep cycle. Light sleep occurred in NREM stages I and II. It was characterized by alpha waves. Deep sleep or slow-wave-sleep (SWS) was a combination of NREM stages III and IV and was characterized by delta waves. Dream sleep is likely to be reported when a person is awoken during a REM period (Cartwright, 1994; Kramer, 1994, cited in Lee, 1997).

Lee (1997) and Potter and Perry (1995) indicated that in the pre-sleep period, a person was aware only of gradually developing drowsiness. It was followed by a sleep cycle including both NREM stages I through IV and REM sleep. Sleep cycles were repeated 4-5 times over the whole night's sleep. The length of a sleep cycle varied but it ranged from 60 minutes during the early part of the night to 2 hours in the later part of the night. A person moves progressively through all 4 stages of NREM; then, the sleep patterns are reversed from stage IV, III, II, and ends with REM sleep. In later sleep cycles NREM stages III and IV are shorter while the period of REM is longer. REM sleep might last from 30-60 minutes during the last sleep cycle.

The average person needs 6-8 hours of sleep each night, which is 4-5 of sleep cycles (Potter & Perry, 1995). Good sleep usually refers to the adequate quantity and good quality of sleep. Poor sleep is a subjective complaint of sleep problems such as difficult sleep, discontinued sleep, difficult getting back to sleep, daytime sleepiness (Chieu, et al., 1999; Edell-Gustafson, 2002).

Factors Affecting Sleep

There are many factors which affect sleep; including age, gender, chronic illness and physical illness, psychological factors, hormones, medication, stimulant substance use, environmental factors, life style, and disrupted circadian rhythms.

1. Aging can cause degenerative changes in the sleep mechanisms of the Central Nervous System (CNS) (Closs, 1988; Ersser, et al., 1999; Stern & Herman ,2000). Specific characteristics of sleep in the elderly include spending more time in bed without sleep and a difficulty in getting back to sleep after waking during the night. Their sleep physiology is changed. NREM stage IV and REM sleep lasts for a shorter period. These changes cause frequent awakenings during the night; consequently, elderly take naps during the day.

2. Women complain more about sleep problems and tend to use more sedatives and hypnotic prescriptions than men (Gorbien, 1993; Kozier, Erb, Berman, & Burke, 2000). A study by Reyner and Horne (1995) found that among the elderly, females tended to go to bed earlier and took longer to fall asleep than males. Furthermore, elderly women reported waking more times than elderly men but sleep latency was significantly shorter in elderly men than elderly women.

3. Chronic illnesses such as cancer, chronic renal failure, chronic pain and invasive treatment such as coronary artery bypass grafts are reported to cause sleep disturbances (Edell-Gustafsson, Hetta, & Aren, 1999; NIH Technology Assessment Panel, 1996; Puntrino, 1998; Sheely, 1996). Physical illnesses such as respiratory disease, gastric or duodenal ulcer, hyperthyroidism, hypothyroidism can also cause sleep disturbance (Kozier, et al., 2000). A study by Reyner and Horne (1995) found that physical illness and toileting caused waking during the night. Elderly people with health problems such as arthritis, angina pectoris, Chronic Obstructive Pulmonary Disease (COPD), heart failure, diabetes mellitus are more susceptible to sleep problems, and in particular Parkinsonism causes decreased REM sleep (Ebersole &. Hess, 1998).

4. Psychological factors such as stress anxiety and depression can interfere with sleep. Stress is defined as our bodies experience as we adjust to our environment (Creek, 2000). Stress is possibly healthy as it increases awareness and ignites new perspective. Stress overload can lead to a decreased ability to cope effectively. (Ebersole & Hess, 1998). It is associated with insomnia, increased locomotor activity, and hormone changes (Kryger, et al., 2000).

Anxiety is an expected, normal, and transient response to stress (Stern & Herman, 2000). Johnson (1997) stated that anxiety had to be ascertained mainly through subjective experience and direct observation. The subjective experiences of anxiety were a feeling of vague discomfort, uncertainty, self-doubt, diffuse apprehension, dread, restlessness or jumpiness, jitteriness, helplessness, powerlessness, and irrationality. Anxiety can be ranged from mild to severe according to a person's behavior and response. Gelders, Lo'pez-lbor Jr, and Andreason (2000) stated that causes of anxiety can be physical illness, financial problems, crime, and family neurotic disorders Drugs such as oral hypoglycemic drugs and corticosteroids might cause anxiety. Also, excessive intake of caffeine, smoking, and alcohol abuse were causes of anxiety. Anxiety was associated with insomnia, it increased sleep latency, decreased sleep efficiency and poor maintenance of sleep. Closs (1988) indicated that during anxiety, high adrenaline levels in plasma increased sympathetic nervous system activity. This affected sleep by causing more frequent shifts of NREM stage IV and REM sleep, hence, more frequent waking times. Anxiety disorders are diagnosed when anxiety lasts longer than 3 months.

Depression is common in the elderly because of spousal bereavement (Rozenzweig, Prigerson, Miller, & Reynold, 1997). Depression may be caused by

psychologic stress or other causes such as genetic, physical, social, and cultural problems (Ebersole & Hess, 1998; Stern & Herman, 2000). Depression refers to the feelings of sadness and hopelessness. Depression is often associated with insomnia including early morning awakening, decreased REM latency, long first REM period, increased REM density, nocturnal restlessness and too much sleep (Gelders et al., 2000). Ebersole and Hess (1998) stated that 1%-2% of the elderly people they studied met the Diagnosis and Statistical Manual of Mental Disorder, 4th ed. (DSM-IV) criteria of depressive disorders. A depressed patient had to report at least 5 symptoms, of which, at least one symptom must be a depressed mood or a loss of interest or pleasure. DSM-IV criteria includes depressed mood, diminished interest, weight loss or weight gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, a feeling of worthlessness, or excessive guilt, diminished ability to think or to concentrate and attempted suicides. Many studies in Thailand reported about prevalence of depression in the elderly. There were 35% depressed patients in Thai community dwelling elderly in Bangkok (Tubmanee, 1998) and 12.78% depressed patients in 4 districts surrounding Bangkok (Thongtang, et al., 2002), are examples. In particular, the Bureau of Mental Health Technical Development indicated that people in residential care were at risk of major depressive disorders (Bureau of Mental Health Technical Development, 2001). In addition, anxiety was significantly found in depressed patients (Lenze, et al., 2000).

5. Several hormones have been connected to sleep patterns. Growth Hormone is secreted during the first half of night (Kryger, et al., 2000) while Thyroid Stimulating Hormone (TSH) levels decrease when a person is sleeping (Parekh, et al., 1998).

Melatonin hormone is associated with the regulation of the sleep-wake cycle. Haimov, et al. (1995) studied the effects of melatonin replacement therapy on melatonin-deficient elderly insomniacs. The study showed that melatonin replacement therapy was beneficial in the initiation and maintenance of sleep. Also, Hugues, Sack and Lewy (1998) found that melatonin reduced the period of sleep latency.

Cauter, Leproult and Kupfer (1996) explored 9 studies a 24-hour profile of cortisol in mormal drug-free subjects and depressed patients. They found that during aging, the endogenous inhibition of nocturnal cortisol secretion in both sexes progressively declined. Usually, plasma cortisol levels showed a sharp increase in the early morning but decrease in the late afternoon. Cortisol levels were quiescent activities when initiating sleep and throughout the night. It was found that abrupt cortisol levels occurred in a few hours before the usual waking time. In contrast, in the elderly cortisol levels in plasma increased during the night which caused sleep fragmentation.

Low endogenous estrogen levels can cause sleep complaints after menopause. Kanxola, et al. (1999) found that Estrogen Replacement Therapy (ERT) improved sleep quality by alleviating the frequency of the nocturnal movement arousal and reducing vasomotor symptoms.

6. Many drugs can either promote or reduce sleep. Benzodiazepine derivatives which are commonly prescribed for insomnia have 4 types of effects: sedative, anxiolytic, anticonvulsant and muscle relaxant (Lemoine & Allain, 1996). Benzodiazepine derivative withdrawal can cause rebound insomnia, with REM sleep rebound and sleep fragmentation during the latter part of the night (Obermeyer & Benca, 1996).

Antipsychotic drugs or major tranquilizers promote sleep but may slightly interfere with the sleep cycle (Obermeyer & Benca, 1996). The major effects of antipsychotic drugs on sleep include decreased sleep latency, increased total sleep time, and improved sleep continuity.

Antidepressants have a hypnotic action (Lemoine & Allain, 1996). Selective Serotonin Re-uptake Inhibitors (SSRIs) are a newer class of antidepressant (Richard, Kurlan, & the Parkinson Study Group, 1997). SSRIs were tested in 71 elderly patients who were diagnosed with Parkinson disease. It was found that SSRIs produced better sleep than tricyclic antidepressants.

A single dose of morphine or heroin improves sleep but repeated doses produce less sleep (Karch, 2000). Methadone is reported as slightly disturbing sleep (Obermeyer & Benca, 1996). Codeine in antitussis induces sleep (Brody, Larner, & Minneman, 1998). Herbs such as belladonna and hashish have the same benefits as morphine derivatives (Lemoine & Allain, 1996).

Antihistamine can also has sedative effect (Karch, 2000). Nonsteroidal Antiinflammatory Drugs (NSAIDS) which are widely used in elderly with arthritis can also promote sleep (Brody, et al., 1998).

On the other hand, many drugs are caused with insomnia. For instance, anticholinergic drugs reduced REM sleep of the 6 volunteers in the first two nights in the sleep laboratory but did not affect the third night (Salin-Pascual, Granados-Fuentes, Galicia-Polo, Nieves, & Gillin, 1993). Some beta-blocker such as atenolol commonly prescribed for hypertensive patients, are reported to reduce NREM stage II and IV and REM sleep (Karch, 2000) but a recent study by Planes et al. (1999) found that Celiprolol in Beta-blocker group did not affect sleep. Corticosteroid produces an

increased NREM stage II but slightly decrease REM sleep (Obermeyer & Benca, 1996). Hypoglycemic drugs can produce anxiety resulting in difficulty in falling asleep (Ebersole & Hess, 1998). Stimulant substances: Amphetamine reduces total sleep time and REM density, while Xantines cause fragmented sleep (Obermeyer & Benca, 1996). Diuretic drugs cause nocturia that can interfere with sleep (Karch, 2000).

7. Certain stimulant substances such as caffeine in coffee or non-herbal tea, alcohol, and nicotine stimulate CNS action, of which inhibits sleep (Chokroverty, 1994; Kozier, et al., 2000). Horne and Reyner (1999) indicated that 2-3 cups of coffee (100-200 mg) were effective in reducing sleep. Stern and Herman (2000) stated that small to moderate amounts of alcohol induced sleep but caused frequent waking times. Alcohol affects sleep by decreasing REM sleep and increasing NREM stages III and IV. Contrarily, acute alcohol withdrawal produces insomnia because of the increase of REM sleep and decrease of NREM stages III and IV. Nicotine in cigarettes can cause a difficulty in both getting to sleep and maintaining sleep (Obermeyer & Benca, 1996). Quitting smoking, using nicotine gum and nicotine patches also affect sleep. Obermeyer and Benca (1996) stated that nicotine gum increased light sleep and movements during sleep. Nicotine patches also cause prolonged sleep latency. The consequence of nicotine use is greater daytime sleepiness.

8. Environmental factors such as the sleep environment, position for sleeping, temperature, noise, light, privacy, and bedding, are all considered to influence sleep. Ebersole and Hess (1998) indicated that an unfamiliar environment such as a first admission to the hospital or after moving to a new residence could cause insomnia. Lee (1997) indicated that the first night in hospital was stressful for patients because a

new environment caused delayed sleep onset and frequent awakenings. A restricted position caused sleep disturbance. Body temperature influences sleep duration. Exposure to a warm or comfortable environment before bedtime leads to an increase in duration and percentage of REM sleep (Dewasmes, Telliez, & Muzet, 2000). Contrarily, exposure to an environment temperature at 26°C and below caused waking (Closs, 1988). Ounapirak and Khumtaveeporn (1996) studied the factors affecting sleep patterns in elderly residents of Siriraj Hospital. They found those ward-environmental factors affecting sleep were noise, light, noisy roommates and uncomfortable bedding.

9. Both diet and exercise affect sleep. Protein in the diet such as milk, beef, beans, peanuts, warm milk are the major sources of tryptophan (an amino acid precursor of 5-HT) (Closs, 1988). Davis Alderson and Welsh (2000) stated that increased 5-HT in brain causing fatigue and sleepiness. Low to moderate-intensity exercise also produces sleepy which complete exercise at least 4 hours before bedtime (Horne & Reyner, 1999; Monk, Reynolds III, Machen, & Kupfer, 1992; Youngstedt, Kripke, & Elliott, 1999).

10. Disrupted circadian rhythms, known as jet lag, often occur when travelers pass from one time zone to another. These people usually experience insomnia in the new time zone (Richardson & Tate, 2000). Similarly people who works shift or works all night have been reported as having sleep problems because the normal function of circadian timing in the context of extraordinary demands on their sleep-wake schedule is changed. A change of the sleep-wake schedule takes several days to adjust to the new time.

Sleep of the Elderly

Sleep dissatisfaction is a common complaint among the elderly (Gorbien, 1993; Ancoil-Isreal & Roth, 1999) They spend more time in bed attempting to sleep and are less successful when they try to sleep. They take a longer time to fall asleep and experience increasing amounts of waking time. Difficulty getting back to sleep and drowsiness or tiredness after waking up in the morning are also reported. As a result, the elderly take more frequent and longer daytime naps. Sleep dissatisfaction in the elderly are due to changes in the physiology of sleep, less adaptation to the physical environment and changes of circadian rhythm. Gorbien (1993) and Gelder, et al. (2000) stated that although the amounts of NREM stages III and IV and REM sleep declined in the first half of the night, while REM sleep was slightly increased in the second half of night. Mayer (1998) found that the elderly experienced more light sleep. They slept only about 4-6 hours a night. Quality of sleep is more satisfied among the elderly than amounts of sleep (Gorbian, 1993). The elderly have a greater susceptibility to external arousal from environment factors such as temperature, noise and light (Reyner & Horne, 1995). Inadequate sleep hygiene, hypnotic drugs and stimulant substances disturb sleep patterns among elderly individuals (Kryger, et al., 2000). In addition, changes of the circadian rhythm relate to their sleep habit. They go to bed early and wake up early because an advance phase of the daily temperature in the elderly is earlier than younger individuals by 1-2 hours (Ebert, Loosen, & Nurcombe, 2000).

Sleep promotion among the elderly could be many approaches as diet, exercise, and sleep hygiene (Monjan, 2000).

Sleep Assessments

Sleep can be measured subjectively and objectively.

1. Subjective measures are indirect measurement which relied on sleep data reported by each individual. This measure is simple and cheap. The reliability of the data is based on the subjects. Several studies take subjective measures with objective measures to assure the sleep (Frank-Stromborg & Pender, 1988).

There are varying features of subjective reports which have been used for sleep assessment (Frank-Stromborg & Olsen, 1997). For example:

1.1 St. Mary's Hospital Sleep Questionnaire consists of 14 items which evaluate sleep and early-morning behavior in the past 24 hours. It assesses 3 sleep parameters: sleep latency, sleep period time, and awake onset latency. It has good test-retest reliability.

1.2 Baekland/Hoy: the Unnaned Sleep Log was modified from Antrobus et al. (1992) which was also known as "sleep pattern questionnaire". It is a 2 week log of (A) 3 items; state of mind, fatigue before retiring, and on awakening, and (B) 8 items of awakening including time to fall asleep, number of awakenings, state of sleep, and dreams. It has a test-retest reliability of (A) 0.84, (B) 0.97 and a theta reliability coefficient of 0.76 for both sub-scales.

1.3 The Verran and Snyder-Halpern (VSH) Sleep Scale is validated on a 100 mm. visual analog scale. VSH was modified from Baekland and Hoy log consisting of 8 items sleep and 2 dreams. VSH can calculates total sleep time (TST). Factor analysis between St. Mary's Hospital Sleep Questionnaire and Baekland/Hoy log shows theta reliability coefficient of 0.82.

2. Objective measures are direct measurements of sleep. They are accurate and very useful, however, these measures can be biased by equipments and the observers. Moreover, they are time-consuming and costly. The followings are common uses.

2.1 Polysomnography (PSG) records sleep using standard sleep record equipments including electroencephalogram (EEG), electrooculogram (EOG), submental electromyogram (EMG) and a fingertip oximeter. PSG is recorded on at least 2 consecutive nights of sleep in the sleep laboratory (Chokroverty, 1994). Because during the first night, a person has enhanced sensitivity to the sleep environment; so sleep quality including sleep efficiency, sleep latency, number of arousals and percentages of slow-wave-sleep are recorded to validate the data (Elsenbruch, Harnish, & Orr, 1999; Woodward, Bliwise, Friedman, & Gusman, 1996).

2.2 A Nightcap was used to differentiate good sleepers from poor sleepers in the study by Pace-Schott, Kaji, Stickgold, and Hobson (1994). The Nightcap assessed sleep latency, sleep efficiency, sleep duration and number of awakenings for each subject. The Nightcap outputs consisted of 4 tracings. The first tracing was a histogram that detects eye movements. The second tracing recorded a hypnogram that represented the manually scored polygraph following the Rechtschaffen and Kales' criteria (A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects). The third tracing was another hypnogram which comprised of 3 levels: the top level represented waking, the second level represented REM, and the third level was NREM. The fourth level was the tracing of a histrogram for detecting head movements.

2.3 Observation by a trained observation. The subject is observed at 5-minute intervals throughout the night from sleep onset to termination (Frank-Stromborg & Pender, 1988). The observers could detect sleep onset, total sleep time, and behavior during sleep. This method has been used to assess the sleep of burn patients in ICU (Fontaine, 1989).

2.4 Video recording is a very instructive measurement and has been used to observe the circadian rhythm of sleep-wake patterns. Video is often used together with actigraphy which is an electric equipment for monitoring body movement (Gelder, et al., 2000). Reid and Dawson (1999) used an actigraphic technique to measure of sleep/wake behavior of younger and older subjects doing shift work. The subjects were recorded during the shift and in the following 12 hours. All subjects wore wrist activity Z80-32k V1 (Gaehwiler Electronic) monitors on their non-dominant hand. Their activities were recorded every 30 minutes.

Many equipments have been developed for monitoring sleep. However, they are all exactly and required a skillful technician to interpret the data.

Anxiety and Depression Assessments

Anxiety and depression usually can be assessed by a physical examination, interviewed personal, using construct interview as a guide. Self-reporting is also a measure with potential validity for clinical practice and evaluations (Stern & Herman, 2000). Various self-reporting instruments were developed to measure anxiety and depression (Frank-Stromborg & Olsen, 1997). The following are examples.

1. The Hamilton Anxiety Scale (HAS) was developed in 1995 as a clinical interview rating scale of psychic and somatic aspects of anxiety. The scale consists of

fourteen items or clinical symptoms with a 5-point rating response ranging from 0 (not present) to 4 (very severe). An interrater reliability Spearman test correlation of 0.78 has been reported.

2. State-Trait Anxiety Inventory (STAI) measures 2 distinct anxiety concepts (state anxiety and trait anxiety). Each scale consists of 20 statements, the subject responds on a 4-point scale, from 1 (not at all) to 4 (very much so). Test-retest reliability coefficients of 0.16 to 0.54 and 0.83 to 0.92 for the state sub-scale of 0.73 to 0.86 and coefficients 0.86 to 0.92 for trait sub-scale have been reported.

3. Hospital Anxiety and Depression Scales (HADS) consists of 14 items measuring anxiety and depression uniqueness. The internal consistency of 2 sub-scales was examined in 50 patients. It was found that correlation (Spearman) for anxiety items ranged from 0.76 to 0.41 and 0.60 to 0.30 for depression items, respectively. Also, HADS was examined indicators of anxiety and depression' s severity. Correlations (Spearman) of anxiety was 0.74 and 0.70 for depression, respectively. The HADS has been translated into several languages including Thai. The Thai Hospital Anxiety and Depression Scales (Thai HADS) was developed by Nilchaikovit, Lortrakul, and Phisansuthideth (1996). This scale consists of 7 items in each sub-scale and the potential scores range on 0-21. The cut off point for mood disorders is a score of 11 or more. It was a good internal consistency with Cronbach's alpha coefficient of 0.8551 for anxiety sub-scale and 0.8259 for depression sub-scale that administering in 60 in-patients with cancer. The Thai HADS has suggested for any patients and for screening psychological problems in the Thai community.

4. The Hamilton Rating Scale for Depression (HAM-D) is used to quantify the degree of depression in in-patients with major depression. There are several versions

of the HAM-D; however, the standard form for general use is the seventeen item Hamilton D (HAM-D-17) which focussed on atypical depression symptoms, psychotic symptoms, psychosomatic symptoms and also symptoms that are associated with obsessive-compulsive disorders (OCD). It has a rating scale 0-4.

5. The Zung Self-Rating Anxiety and Depression Scales are composed of twenty items. Ten items are positively worded and 10 items are negatively worded. The scale of 4 options ranges from none, or little of the time, to most, or all of the time. This scales was compared to the Diagnosis and Statistical Manual of Mental Disorder, 3rd ed. Revised (DSM-III-R) criteria for major depression (80) have sensitivity of 97%; specificity of 63%, positive predictive value of 77% and negative predictive value of 95%.

Exercise and Sleep

Exercise is classified into 2 categories: aerobic exercise and anaerobic exercise (Garrett, Kirkendall, & Squire, 2001).

1. Aerobic exercises are activities that involve large muscle groups over a prolonged period of time and offer the greatest improvement in maximum oxygen uptake ($VO_{2\ max}$). Aerobic exercises include walking, running, hiking, stair climbing, swimming, cycling, rowing, dancing, skating, cross country skiing, rope jumping, etc.

2. Anaerobic exercise is exercise that does not rely on oxygen. Usually, it occurs in prolonged exercise or when the body requires intense bursts of energy (American College of Sports Medicine, 1995). During anaerobic exercise energy source is produced from glycogen that is stored in the liver and skeletal muscles. Wheatchaphat and Palawiwhat (1993) stated that during anaerobic exercise, lactic acid

was produced after 30 minutes of exercise. Lactic acid produced peripheral muscle fatigue and delayed onset muscle soreness (DOMS). Examples for anaerobic exercise are weightlifting, high jump, speed running with or without hurdles, speed cycling, and speed skating.

Mechanism of DOMS involved physiology of exercise that The American College of Sport Medicine (ACSM) (1998) classified into 4 modes: isotonic, isokinetic, isometric, and plyometric. Isotonic: alternation concentric and eccentric muscle activation that moves a body part through an arc of motion against resistance. Isokinetic: exercise that involves specialized equipment to provides accommodating resistance so that the joint moves at a constant angular velocity. Isometric: muscle action that is performed against resistance for periods of 5-10 seconds at any point in a joint's range of motion, but produces no joint movement. Plyometric: exercise that requires eccentric activation of muscles against a resistance, then slows down the resistance, and followed by concentric activation. The eccentric muscle action occurs when a muscle produces tension which increases length. A study by O'Connor (2000) found that high intensity exercise caused small tears in the muscle and muscle pain which usually set in about 6-12 hours after eccentric exercise and peaked about 24-48 hours after exercise (Childs, 2000).

ACSM (1995) recommends that the intensity of exercise should elevate the heart rate from 40% or 50% (for a very low level of fitness) to 85% (for higher level of fitness) of maximum heart rate, which is calculated as 220 – age. On the other hand, Vuori, urponen, Hasan, and Partinen (1988) classified intensity of exercise into low, moderate, and high intensity exercise. Low intensity or light exercise was exercise that did not produce sweating or accelerated respiration. Moderate exercise produced some

sweating and acceleration of respiration. Walking, yoga, and Tai Chi are classified as low to moderate intensity exercise (Jitapunkul, 1999). High intensity or vigorous exercise such as running, rowing, and cycling produces heavy sweating and acceleration of respiration.

ACSM (1998) stated that although a moderate to high intensity program possibly improved cardiovascular and reduced risk factors, the elderly should perform a low to moderate intensity exercise which could reduce blood pressure and the rate of age-related deterioration in numerous physiologic functions. Regular exercise 3 times a week is recommended for the elderly; however, elderly people can exercise up to 5 times a week. It depends on personal factors such as tolerance or environmental factors, which influence a person's determination to exercise (Conn, 1998). The elderly need stretching exercise in a warm up and cool down period (Duthie & Katz, 1998). Elrick (1996) stated that correct breathing during stretching was important because muscle contraction and raising of blood pressure can occur when the practitioners hold their breath. Stretching exercise before and after any physical activities prevent muscle strain and increase flexibility, strength and circulation.

Acute exercise increases heart rate, blood pressure, and respiration rate that will stop after a few minutes of exercise cessation. Training exercise produces more effective adaptation and a decreased heart rate that is associated with increased cardiac muscle strength and heart contractility. Also, increased respiratory rate and deeper breathing returning acid-base balance to normal (Wheatchaphat & Palawiwhat, 1993).

Training exercise is classified into 3 categories (ACSM, 1998): strength training, balance training, and flexibility training. Strength training refers to lifting any given load; it should work the major muscle groups 2-3 times a week. The weight load

allows for 8-12 repetitions to get strength of muscles while those older than 50 are advised to perform 10-15 repetitions to get endurance of muscles. (Schnirring, 1998). Balance training such as Yoga and Tai Chi increase postural stability thereby reducing risk of falls (ACSM, 1998). Flexibility training starts with a few minutes for dynamic and static range-of-motion then stretching of all the body's major muscles, tendon groups that takes 4 repetitions per muscle group, 2-3 times per week (Schnirring, 1998). Flexibility training such as Yoga and Tai Chi increases the joints range of motion (Jitapunkul, 1999).

The exercise training program composes of an initial conditioning stage, improvement stage, and maintenance stage. The initial conditioning stage takes place from 4-6 weeks. The improvement stage takes place from 4-6 months. The maintenance stage takes place for 6 months of regular exercise. The duration of exercise should increase ideally from 20-30 minutes to 60 minutes before increasing intensity of the exercise. (Duthie & Katz, 1998; King, et al., 1991 cited in Barry & Eathorn, 1994).

Beside cardiopulmonary benefits and strengthen muscles, training exercise produces endogenous opiods, especially β-endorphine. Wheatchaphat and Palawiwhat (1993) stated that after training exercise β-endorphine is produced five times higher than acute exercise. It acts as a natural narcotic causing pain reduction and a sense of happiness.

Bird (1999) indicated that the mechanism of regular exercise on sleep goes hand in hand with the physical benefits and psychological benefits. Exercise reduces anxiety and improves mood in healthy as well as clinically depressed individuals. β-endorphins are released from the pituitary gland during exercise can reduce stress.

Some is discharged into the blood and some into the CNS that is the brain and spinal cord. The good feeling after exercise is due to distraction or timeout from our normal activities reducing concentration and promoting relaxation.

Another substance associated with sleep is serotonin or 5-HT which usually increases when a person performs 1-2 hours of low to moderate exercise (Davis, et al., 2000) or 15-20 minutes of vigorous exercise (Townsend, 1996). Serotonin is highly concentrated in the hypothalamus and can act as a neurotransmitter. During the darkness, enzymes convert serotonin into melatonin hormone (Singh, 1998). It benefits on sleep (Townsend, 1996).

Daytime exercise generally promotes sleep. High levels of activity during the waking period were associated with the length and depth of the following sleep period (Trinder, et al., 1988). Naylor, et al. (2000) assigned 14 elderly residents of continued-care retirement facilities to participate in an enforced schedule of structured social and physical activity in the morning and in the evening for 2 weeks. The researchers used a similar group of 9 elderly residents as a control group. The activities composed of 10 minutes stretching, 20 minutes walking and stationary upper and lower body exercises. Then 30 minutes of active games such as ball catching, croquet or dancing. Five minutes cool down of stretching exercises followed. Both groups were monitored in a sleep laboratory for 2 nights. They found that the 14 elderly in the experimental group had increased amounts of slow-wave-sleep and demonstrated improvement in memory-oriented tasks following the intervention. Tanaka, et al., (2001) studied the effects of short naps and exercise on elderly people having difficulty in sleeping. This research was done in 6 participants. They were requested to take a 30-minute nap after lunch and do moderate-intensity exercise including stretching and flexibility for 30

minutes in the evening. This study was for 4 weeks in the winter. All participants' physical activities were recorded for one week before intervention and after intervention using actigraph data. The researchers found that wake time after sleep onset was decreased while sleep efficiency was increased and sleep quality was improved.

There has been a lot of debate over whether vigorous exercise close to bedtime disrupts sleep or improves sleep. A higher frequency of difficulty in falling asleep was reported when exercise was done before bedtime (Youngstedt, 1997). The current recommendation is that exercise should be performed at least 4-6 hours before bedtime. During exercise, there is excessive sympathetic arousal and catecholamine secretion and body temperature may remaining markedly elevated during the night; but with a 4-6 hour break, the body temperature can return to normal before bedtime and so does not interfere with sleep. (O'Connor, Breus, & Youngstedt, 1998; Youngstedt, et al., 1996).

Tai Chi Qigong

Tai Chi is based on Eastern philosophy that originates from Taoism, an ancient form of Chinese martial arts (Lorenzi, 1999). Tai Chi is approximately equivalent to walking at 6 km/hr, and producing a maximum heart rate of 50%. (Kirsteins, et al., 1991) Lan, Lai, W, and Yu, (1996) found that Tai Chi training was able to produce 70% of maximal heart rate in the elderly.

Tai Chi Qigong (TCQ) is a style of Tai Chi that developed from the Yang style with accompanying breathing exercises (Leelarujijarean, 1995). The breathing exercises are inhaling deeply when the arms are contracted or pulled backward,

exhaling fully when they are stretched and pushed forward. The correct breathing is done through the nose and deep to the abdomen. Exhalation is not merely releasing inspired air but rather releasing only a portion at a time and remain (Galante, 1981).

Kruthong (1984) indicated that the benefits of practicing Tai Chi are brain relaxation, improved blood circulation, relaxation of the eyes, and inducing the salivary gland. During breathing exercise, the intercostal muscles and involuntary muscles of the internal organs of the abdomen also exercise.

Wolf, et al. (1997) indicated the three basic principles of Tai Chi. Firstly, extended and relaxed body with alignment of trunk and deep breathing. Secondly an alert but calm mind. Thirdly, all body movements require good-coordination and sequencing of segments that focussed on the waist as the center point of balance.

The best time to practice Tai Chi is either early in the morning or in the evening. Duthie and Katz (1998) suggested that Tai Chi should initially be practiced for 10-20 minutes a day then extended to 45 minutes a day. Tai Chi is a low impact and non-vigorous exercise that even wheelchair-bound individuals can practice (Lorenzi, 1999). For that reason, Tai Chi is recommended for the elderly who are often more accident prone (Jitapunkul, 1999).

Tai Chi is considered as a movement meditation (Kuhn, 1999). Meditation leads to the reduction of cognition and physical arousal. The practitioners gain gradual mental detachment, calming their mind and reducing stress. Parasympathetic activity becomes more active resulting in decreased oxygen consumption, decreased carbondyoxcide production, decreased blood pressure, decreased respiration rate and decreased lactic acid (NIH Technology Assessment Panel, 1996).

There have been many studies of Tai Chi. Ross, et al. (1999) studied the effects of Tai Chi training program on movement, pain, and mood. Ten minutes for warm up and 15 minutes of Tai Chi exercise, 3 times a week for 8 weeks. The subjects included 17 elderly volunteers living independently in a public housing facility. They found neither accident nor dizziness among the subjects during the study period. All participants had positive changes in anxiety, pain perception, flexibility, balance, and sway. Lai, Lan, Wong, and Teng (1995) studied 2 years of a regular Tai Chi group that did 20 minutes warm up and 24 minutes of Tai Chi Chun, 4-6 times a week. The participants were 84 community-dwelling older adults. They found that the 45 subjects who practiced Tai Chi regularly had a delay in the decline of cardiopulmonary functions measured by maximal oxygen uptake and maximum heart rate when compared with the 39 subjects in the control group.

Only a few studies have focussed on sleep. Chen and Snyder (1999) studied 11 undergraduate women who did 5 minutes of Tai Chi movements before bedtime for 20 days. They reported fewer nightmares than the control group. The results of this study showed that a good physical balance reduced nightmares. Recently, Li (2002) is conducting a 6-month Tai Chi training program among 50 elderly who agreed to practice Tai Chi for 60 minutes a day, 3 times a week. These 50 elderly will be compared with a control group. All subjects' sleep will be assessed at the beginning of program, at the third and the sixth month of Tai Chi training and 3 months after termination of Tai chi training. The results of this study are not yet published.