

Stress :

The term stress is used to describe certain types of agents which act on people or to refer the responses of the people to certain types of agents. The initiating factor in the stress phenomenon is the stressor. A whole range of physical stimuli act as stressors. Workload, restraint, heat, cold, noise, pain, shock, injury and the infection can all elicit stress responses. Certain factors or situations such as surgical trauma, burns, emotional arousal, mental or physical effort, fatigue, pain, fear, loss of blood, intoxication by drugs etc., may serve as stressors (Cannon - 1929). A stressor of any kind first of all acts on mind and its impact is observed on the somatic structure of an individual.

Investigations have proved that any change in physiological functioning under stressful state is precipitated at metabolic level through an integrated series of neurohumoral and endocrinal alterations. Hence stress is the systemic biological response of an individual to a variety of provocative situations; which consists of a sequence of physiological changes involving almost all body parts and systems.

Different researchers have worked on an experimental set up examining an impact of physical stressors on the biological systems. Lalitha et al. (1988) have chosen the flickering light as an acute stress producing stimulus and its effects on plasma

corticosterone, total cholesterol serum triglycerides, and SGOT and SGPT of laboratory animals (albino rats). They showed an increase in plasma corticosterone, cholesterol and enzymes SGOT and SGPT, while decrease in serum triglyceride level. Gwazdawska et al (1977) and File and Pello (1984) also found an increase in corticosterone on exposure to continuous flickering light.

Several workers have shown increased cholesterol with an exposure to stressor in human; viz. Berger et al. 1980 (psychological stress), Bijlani et al., 1985 (Exam Stress), Bhalia et al., 1985 and Sane and Kukreti, 1978 (post-operative stress). As early as in 1950 Selye also described a biphasic response of serum cholesterol and lipids during stress in men.

Mishra and Pandey (1996) studied the physiological changes in certain psychosomatic disorders in 115 patients. They reported that there is increase in Triglyceride, VLDL and LDL in rheumatoid arthritis patients compared to others.

Ramsey J.M. (1982) observed increased triglyceride with motor racing as stressor, similar results were obtained by Taggart (1973) in persons prior to public speaking; while Carruthers et al. (1973) and, Robertson and Smith (1976) showed decreased in serum triglyceride level in humans when exposed to psychological stress.

Bijlani et al (1986) found a significant rise in the total cholesterol, LDL-C and HDL-C before the examination. No significant change in HDL-C/cholesterol ratio associated with examination stress was noted (Bijlani, 1983).

V. Agarwal (1989a & b) attempted to study the effect of preoperative stress in 9 patients before operation and examination stress in 12 medical students, where they found increase in serum cholesterol and total lipids as well as triglyceride level. The result suggested that lipid metabolism is directly related with mental tension and girls are more adapted to stress than boys. Increase in SGOT and PT was observed by Moss and McMurray (1979) and, Nyandeika (1985) in albino rats, after nutritional stress.

Mental stress has been known in the etiology of hypertension and atherosclerosis. Individuals with a restless and achievement oriented personality (type-A) are more prone to atherosclerosis (Zelis, 1982).

Excessive heat had been proved as a stressor, and in support to it, Marya et al (1988) worked with acute heat stressor and its effect on urinary flow, excretion of electrolytes, where they emphasized that heat stress reduces the urinary volume and electrolytes like Na^+ and Ca^{++} , but not in K^+ and Mg^{++} . They concluded with the results that heat stress plays an important role in the genesis of urolithiasis. Severe reduction in urine flow and Na^+ excretion has been observed earlier in men exposed to acute stress and - attributed chiefly to a reduction in renal blood flow and GFR (Kanter, 1955). Collin et al. (1968) had found the increase in plasma cortisol on exposure to environmental heat stress.

Noise is defined as unpleasant, unwanted or intolerable sound and has come to be considered as a special form of environmental pollution (K. Prabhakaran; 1988). Noise of any source is proved to be harmful. Ramsey (1982) has suggested that noise not only produces hearing impairment but may also be responsible for widespread disturbances in various physiological and biochemical activities of the body. He found an increase in total serum cholesterol in rabbits due to noise stress.

Chakravarti et al (1984) have also found the similar type of increase in cholesterol in humans at high altitude. Prabhakaran et al (1988) studied the effect of acute noise stress in rats, where they found, a significant increase in the blood levels of corticosterone, total cholesterol, SGOT and PT and decrease in serum triglyceride level.

Saha et al (1996) suggested the noise as stressor which affects the individual's cardiac activity and reaction times. They showed an increase in heart rate, systolic and diastolic blood pressure, auditory and visual reaction times while decrease in galvanic skin resistance in 156 males. Many other studies also indicated increase in blood pressure due to noise stress (Johnson and Hansson, 1977; Park, 1994, Critz et al 1974; Tomei et al 1991; Andren 1983; Eggertsen, 1984; Armario et al, 1984; Schmid et al, 1988).

In industries the worker is not only exposed to noise but also to many other stressors such as heat illumination, chemical toxicants etc. In one of their studies, Bhattacharya et al (1990,

1991 and 1996) identified the effects of heat & noise individually and jointly on certain physiological responses viz. heart rate, O₂ uptake and body temperature, and, cognitive and neuromotor based functions.

The 'stress' enhances the activity of the cortico-hypothalamo-hypophysis-sympatho-adrenocortical axis resulting into increased liberation of catecholamines and corticoids in circulation. This causes increased hepatic glycogenolysis and gluconeogenesis, thus the concentration of glucose in peripheral circulation is increased. The stress also shows its effect on other metabolic products.

Jaysmita Mishra (1990) reported that foot shock stressor in rats, produced the changes like increased blood sugar (50%), serum creatinine (98%) and serum urea (87%). Saroja et al. (1989) studied the biochemical changes in patients with cardiac problems (17) and those who met with an accident (14) and found significant increase in blood glucose level in both the groups compared to normals. In the same study a significant increase in FFA in cardiac patients (myocardial infarction) was also found.

Many workers have shown that immunity is modulated by stress and related neuroendocrine mechanisms (Corotsel et al., 1989; Kryzhanovski, 1985; Stein, 1985; Monjan, 1977; Soloman et al., 1985 and Surkina et al, 1986).

Khatri et al (1977), studied 18 and 7 cases each of carcinoma and sarcoma types of cancer in respect to psychological aspects and biochemical changes. A comparison of the observations

with normals ascertained that, cancer patients were positively linked with psychosocial stress, malignancies exhibit elevated circulating levels of catecholamines and cortisol, acetylcholine and histamine.

Emotional reactions are usually expressed through bodily organs and genitourinary system is one of the most vulnerable of the body systems. Chaudhari (1977) demonstrated that in the patients with the complain of amenorrhoea, the psychic stress due to over work, anxiety, change in dwelling or occupation and 'confinement were prime factors responsible. Kobayashi and Yaginuma (1977) through their study on women with stress induced amenorrhoea, proposed that the amennorrhoea may be caused by the dysfunction of LH-RH release in the cyclic centre of the hypothalamus. Temporary emotional disturbances are also known to affect different bodily biochemical constituents. Sahani and Merchant (1977) observed that during difficult or prolonged stressful labour, maternal cortisol and fetal plasma levels rise compared to normal delivery.

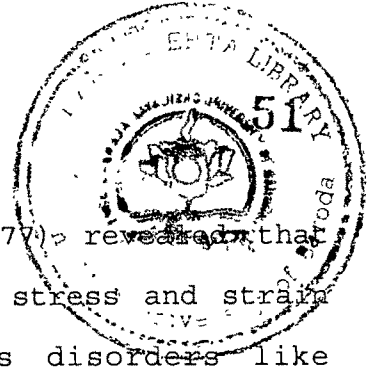
Clinical observations and experimental evidences have indicated that stress produces increased adrenocortical secretions which results in the causation and worsening of gastric ulcers. There is also an increase in histamine in the gastric area which results in the formation of gastric ulcers. Verma et al. (1977) found increased levels of acetylcholine, catecholamine, histamine and plasma cortisol in chronic ulcer patients (peptic) when compared with normal subjects. Gupta et

al. (1977) on the basis of their study with colitis patients, demonstrated a spectrum of aetiology ranging from infection to psychosomatic and stress factors. It was also found that ulcerative colitis and functional bowel disorder diseases have high histamine level, acetylcholine and cortisol level, thus, validating the role of stress diathesis in the causation of ulcer. Sanyal and Mitra (1977) conducted a study to assess the ulcerogenic effect of stress on albino-rats.

Jha et al. (1977) studied neurohumors such as histamine, histaminase, plasma cortisol, acetylcholine and catecholamines in 25 patients of bronchial asthma (after an acute attack). There was a definite increase in the levels of these except cortisol and catecholamine. Rai et al. (1977) noted that histamine is one of the most important biogenic amines which plays a significant role in the stressful state.

Kuman et al (1977) noted that stress is a causative factor in thyrotoxicosis, hypertension, peptic ulcer, ulcerative colitis, bronchial asthma, rheumatoid arthritis and CHD. They also studied the role of stress in the changed immune response.

Goindi (1977) studied the stress response to cold or surgery, Shet et al (1977) to over crowding stress (in rats), Chansouria and Udupa (1977) to immobilization and electric shock (in rats), Sharma et al., Dutta, and, Chinna et al (1977) to environmental stress and Udupa et al (1977) to surgical stress. The stress due to pollutants (toxicants, chemical and their residues) causes acute and long-term metabolic alterations in



tissues (Park - 1994). Singh and Dubey (1977) revealed that several psycho-social factors responsible for stress and strain which resulted in precipitation of stress disorders like bronchial asthma, rheumatoid arthritis and peptic ulcers. Senthamil et al (1989) observed the stimulated phagocytic activity in the tissues due to stress.

Surwit et al (1990) reported increases in heart rate, systolic and diastolic blood pressure, and blood glucose during stress. Similar results were found by Samo and Jensen (1990) in their study with diabetics and nondiabetic subjects.

The term stress has come into wide use in relation to work organisations (Agarwala, Malhan, and Singh, 1979). Beehr and Newman (1978) defined job stress as a condition wherein job related factors interacted with the worker to disrupt or enhance his psychological and physiological condition and he is forced to deviate from his normal functioning.

Reviews of research into occupational stress have identified a number of pressures in the work environment; including role strain (role conflict, role ambiguity), overload (combined family and employment demands), under utilization of skill at work because of domestic commitments, inequity (perceptions of the distribution of domestic and professional roles as being both unequal and unjustified) and, lack of control (lack of flexibility, autonomy and control to modify work schedules for family reasons or vice-versa) (Cooper and Marshall, 1976; French Caplan and Harrison, 1982; Singh and Singh, 1992). All these

pressures may be involved to some extent in work - family management problems facing dual earner couple and may be manifested in symptoms of stress (Lewis and Cooper, 1988).

Sham Batliwala (1990) compared the stressors experienced by the Indian executives at the organizational and at the personal level amongst 230 senior executives. He could identify insubordination, inadequate training, housing, demanding spouses and in-laws, integrity, noisy environment, and transfer for jobs as typical stressors.

The evidences suggest that occupational stress is a causal factor in physical disease (Margolis, Kroes and Quinn, 1974) and decrease job and life satisfaction (Davidson and Cooper, 1983). Light (1984) found that women who step outside the socially ascribed roles of wife and mother by placing careers before families will experience emotional turmoil and stress. The working housewives carry the burdon of two full time jobs : a career and a home. They are harshed, conflicted and feeling guilty about compromising both the qualities of their work and relationship with their family (Panda - 1989).

Shenoy (1987) conducted the study dealt with stressfulness of daily roles, personality and mental health of 135 women. He reported that there were no significant difference in the scores on occupational and household stresses of married and unmarried working women. Marital stress was higher and significant among housewives as compared to working women. He further concluded that married working women were significantly less distressed than housewives in spite of experiencing occupational stress.

Men appraise challenges to intellectual physical, occupational or sexual abilities and to situations requiring emotional expressiveness or subordination to women as more stressful than do women (Eisler and Skidmore, 1987).

Conversely, women appraise challenges to nurturing ability, evaluation of physical appearance, situations calling for detachment in intimate relationships or assertiveness and situation involving possible victimization as more stressful (Gillespie and Eisler, 1991).

It is estimated that 50% of executives suffer from emotional strain and anxiety. They are unaware that headaches, backaches, indigestion, hypertension and fatigue are not purely physiological but could also be psychological or psychosomatic in nature. These may be rooted in mental tension, anxieties and emotional stresses (Pestonjee 1992).

There are two major sets of variables which influence stress - well being relationship. First, individual differences in personality, motivation, involvement, job satisfaction level, sex, age, etc. and, second, socio-economic condition, interpersonal relationship etc. (Sharma, 1985).

Work related stress is becoming increasingly a prominent field of research in recent year (Ar Schnault and Dolan, 1983, Partor and Decolus, 1983; Singh and Singh, 1987). Negative affectivity has been recently recognized as a potential variable that may influence both on occupational stress and perception of strain and job satisfaction (Brief et al. 1988). High negative

affectivity is composed at terms reflecting a wide range of negative affective states including fear, nervousness, anger, guilt, conterupt, disgust, sadness, loneliness and self-dissatisfaction. Watson and Pennebaker (1989) found that trait negative affectivity measures are significantly related to self-reports of physical complaints.

The effects of occupational demands become manifest in such forms like, job-satisfaction, anxiety, depression, and in some cases even serious mental and physical disabilities (Jagdish, 1987). It is also found that stress reduces one's potentiality to perform and stressors in the work environment are much less potent than those encountered in personal life (Omer Bin Sayeed, 1985; Paykel et al. 1971). Acute need for a job, entering into a wrong job and hanging on to it add to the job stress. In reaction to it frustration through strained interpersonal relations under high level of stress reported more stress related aiments (Rajeshwari 1992).

The frontiers of knowledge on the concept of stress and its effects are expanding in all directions. There exists a multiplicity of theories and invalidated explanations to the term stress. But there is a general acceptance of the concept of stress as a description of the individual's reactions to the environmental demands and influences. Stressors combine to pressure an individual until stress develops.

Adjustment is a process by which a living organism maintains a balance between its needs and the environmental conditions that

influence the satisfaction of these needs. According to Lazarus (1961) failure of an adequate adjustment not only leads to deviant behaviour but also manifests itself in the form of physiological damage causing psychosomatic diseases.

Studies of patients in general and of psychosomatic patients in specific, point out close relationship between maladjustment and psychosomatic ailments (Healy, 1915; Alexander, 1950; Graham, 1962; Lipton et al. 1966; Olds, 1970; Araiyo et al. 1973; Kidson et al. 1973). Minor, everyday life stress may be more predictive of health status than major life stress (DeLongis, 1982). Richard Lazarus also agreed that the everyday annoyances of life or 'hassles' contribute more to illness and depression than major life changes.

Reiser et al. (1951) found emotional disturbance, tension, family and marital maladjustment in malignant hypertension. Shanmugam and Kaliapran (1982) found that asthmatic patients were poor in emotional and health adjustment as compared to ulcer patients and normals.

Changing social environments are thought of as precursors to biological changes that place persons at risk for illness (Holmes and Rahe, 1967). Holmes discovered that merely discussing upsetting events could produce physiological changes. In an attempt to measure the impact of life change events' Holmes and Richard Rahe, working together in the 1940s and 1950s, asked 5000 people to rate the amount of social readjustment required for various events. The result is the widely use of Holmes-Rahe's

Life-Event Scale. At the top is death of a spouse (100 stress points), followed by divorce (73), marital separation (65), imprisonment (63) and death of a close family member (63). Not all stressful events are unpleasant, marriage rates 50; pregnancy 40; buying a house 31; and Christmas 12. In a group of 88 young doctors who scored 300 or more points on the scale had a chance of suffering ulcers, psychiatric disturbances, broken bones or other health problems within 2 years of the various crises; those who scored under 200 had only a 37% incidence of such infirmities.

Shejwal (1984a) asked 113 college students (16-22 yrs) to write their own stressful experiences. The analysis revealed that 52% reported stress experience related to conflicts at home and with friends. Death of close one was reported to be stressful by 47% while 23% experienced stress regarding curricular activities, 18% experiencing stress in relation to changes in financial status, while 11% experienced stress in relation to plans for the future.

Dr. Joel Elkes concluded that our mode of life itself, the way we live, is emerging as today's principal cause of illness. According to the American Academy of family physicians, 2/3 of office visits to family doctors are prompted by stress-related symptoms. Stress is now known to be a major contribution either directly or indirectly, to CHD, cancer, lung ailments, accidental injuries, cirrhosis of liver, and suicide - six of the leading causes of death in the United States. Stress also plays a role in

aggravating such diverse conditions as multiple sclerosis, diabetes, genital herpes and even trench mouth (R.M. Galvin, 1983).

Engel (1977) proposed the bio-psycho-social model, where he pointed out that emotions, tensions, conflicts within individuals and society, are capable influencing not only the behaviour in ill persons, but also, the predisposition, course, and onset of many other illnesses.

A positive correlation has been found between stressful life events and a variety of disorders including heart disease, leukemia, multiple sclerosis and other physical illnesses and symptoms (Dohrenwend and Dohrenwend, 1974; Grant et al. 1974). Organic manifestation of anxiety and tension presented in the form of headache, in the back of the head, referred from the neck region and sometimes extending down to the back or into the shoulder, were well illustrated by Weiss and English (1957). People suffer from headache (tension headache, and migraine) have been found to have more stress in their daily routine, and, it is the result of their way to cope with it. (Halroyd, 1986; Holroyd and Andrasik, 1982; and, Holroyd, Holm and Penzien, 1988). Studies have shown that stress elevates the blood pressure and turns into hypertension on chronic exposure of stress (Pickering et al. 1988; Lazarus and Folkman, 1984; Taylor, 1986).

Depression, anxiety and neurosis are the psychiatric causes of insomnia (Coursey et al. 1975; Mark, 1982). It is also necessary to consider the important role of certain psychosocial

occurrence that involve a crisis or loss and may lead to sleep disorder (Nicassio and Bootzin, 1974). Monroe (1967) demonstrated that insomnies have higher level of physiological arousal compared to good sleepers.

Stressful states are thought to alter immune function through autonomic nerves that connect the CNS to immune tissue (Felten et al. 1985, Felten and Olschokwa, 1987). The altered immune function is due to the action of hormones whose release is associated with negative affectivity (Shavit et al. 1984). Jensen and Rasmussen (1990) suggested that a stressful stimulus at a critical time could alter the host's defensive mechanisms, allowing an in consequential exposure to a pathogenic organism to develop into a clinical disease. Stress and functions of immune systems have been found closely related (Glaser and Glaser, 1991).

Several workers (Cohen and Williamson, 1991; Graham et al. 1986; Meyer and Haggerty, 1962; Alenxander and Summerskill, 1956; and Cluff et al. 1966), have reported positive correlation between stress and respiratory positive correlation between stress and respiratory infection. Cohen et al. (1993) tested 394 subjects exposed to a common cold virus, and found that psychological stress increases susceptibility to infectious agents and, high stress causes greater risk of developing cold.

Stress is related to maladaptive eating habits among both animals (Donohoe, 1984), and, humans (Meyer and Pudal, 1977; Morley et al. 1983; Robbins and Fray, 1980; and, Strober 1984).

Anorexics reported high levels of anxiety and depression, higher levels of stress, lower levels of confidence in their ability to solve problems, and, feeling of being driven (Soukup et al. 1984).

Jones and Berglas (1978) suggested that psychosomatic symptoms serve a positive psychological function for an individual as they have the potential for allowing person to deny responsibility for their behaviour.

Glatt (1974) observed that emotional immaturity, low frustration tolerance, inability to cope with tension are the features found most frequently in drug addicts. Skinner and Lei (1980) have reported that personal and social problems, marital problems, family issues, are significantly associated with alcohol and drug addictions. Holmberg (1985) has pointed out that drug abusers were more often sick listed, had nervous complaints and have dissatisfied stressful home life. Drugs have been used to provide relief from stress and frustration (New-Comb and Herlow, 1986). Socio-demographic factors and life events were found to be correlated with drug consumption, alcohol abuse and minor psychiatric morbidity (Zimmermann et al. 1988).

The role of stressful life events in the etiology of various disease has been found a fertile field of research for the last 25 years. Schmallo and Engel (1967), Holmes and Rahe (1967) Grant et al (1974) have established a positive relationship between stressful life events and subsequent illness. These events serve as predisposing and/or precipitating factors for the subsequent

illness episode. Sharma and Dubey (1977) found that social factors, marital tension, economic crisis and strained interpersonal relationship were directly associated with the incidence of hypertension. They observed a higher incidence of IHD in urbanized than in rural areas.

There are some differences in the stress experience by men and women, which have been observed and researches continue to explore the utility of research on sex difference in various areas (Beena and Poduwal, 1992). Differences in stress appraisal, in coping or in one of many different forms of response or adaptation could singly or together predispose men and women to different illnesses and health problems (Baum and Grunberg (1991). Men are 2/3 times more likely to develop CHD than women (Truett et al. 1967; Wingard et al. 1983).

Men in response to acute behavioural stress, exhibit greater increases in cardio-vascular, neuroendocrine and some metabolic parameters than do women (Mathews 1989; Stoney et al. 1987). Men exhibit larger B.P. and Urinary epinephrine increase, during acute stress than do women (Stoney et al. 1987). Women are more likely to develop autoimmune disease : pneumonia and influenza than are men (Cleary, 1987), women are also more likely to visit physicians or seek health care. Women appeared to report relatively more distress (Collins and Frankenhauser, 1978 and Frankenhauser et al. 1976).

Another important factor contributing to stress related disease processes may be advancing age, with which ability to

cope with varying environmental demands is deteriorating (Folkman et al. 1987; Rodin, 1986). Kumary and Prakash (1986) observed a trend for life events to increase with age regardless of the sex of the subject (255 subjects in which 126 males and 129 females). The result revealed that the various age groups significantly differed in terms of number of life events experienced.

In recent years scientists have recognised Type-A behaviour to be significantly increasing an individual's susceptibility to heart attacks and other stress related disorders. Type-A behaviour was first identified by San Francisco cardiologists Meyer Friedman and Ray Rosenman. Type-A individuals have two main components. First, the tendency to accomplish too many things in too little time, and second, free floating hostility. These people are irritated by trivial things and exhibit signs of struggle against time and other people (Ruth and Dick, 1983).

Varkey (1988) carried out the study of personality, stress and coping in individuals with CHD, on 70 patients with myocardial infarction and 70 normals. The results indicated that myocardial infarction patients and normals differed with regard to the number of stressful life events experienced. Myocardial patients were found to score significantly higher on type-A behaviour pattern, extraversion and neuroticism.

Type-A men are more reactive psychologically as well as physiologically, to stress than are type-B men (Palsane and Evans, 1984; Harbin, 1989). Type-A individuals with high levels of job-stress reported more psychological and physical health

problems than Type-A with low stress or Type-B under high or low stress. Rhodewall et al. (1984) demonstrated Type-A administrators with high levels of job stress experienced the greatest degree of psychological impairment and cardiological symptoms compared to others.

Dr. Caroline Bedell Thomas correlated psychological factors with the long term health records of 1337 medical students between 1948 to 1964. One of the strongest prognosticators of cancer, mental illness, and suicide, she found, was 'lack of closeness to parents and a negative attitude towards one's family' (Ruth & Dick-report in 1983).

Booth Kewley and Friedman (1989) in their quantitative review of the psychological prediction of heart disease concluded that anger and hostility do seem predictive of CHD, while, depression also has relation with heart disease (Eysenk, 1988; Spielberger and London, 1982 & 1990).

Walker and Walker (1988) reported in their work on stress symptoms in 817 farmers and 109 urban residents. They found higher stress symptoms in women than men, and again higher in youngers than in old ones. They analysed the symptoms such as : 49.2% feeling tired, 50% trouble relaxing, 48.8% forgetting things, 49.4% losing temper, 40.5% trouble in concentration, 39.6% back pain, 31.7% sleep disturbance, 31.8% avoidance of decision making, 30.9% increase in arguments and 30.8% weight gain or loss.

Weigel (1981) also reported stress reactions like : physical discomfort, emotional outbursts, inability to relax, mental confusion, depression, anxiety, excessive fatigue and apathy, in general population. Knudson and Wilson (1985) reported 80% of their farmer subjects having headaches, fatigue and sleeplessness as major stress related symptoms. Anderson (1981), Ergonomics (1985) and Linton (1987) found low back pain as leading consumer of health care in industry, where occupational stress is the main cause for it. Rockville (1970) suggested that among 6000 insomnia patients 40% women and 30% men were suffering from psychological distress.

Winkleby et al. (1988) found risk for cardiovascular disease, hypertension, gastrointestinal illnesses and musculoskeletal problems related to stress, in bus drivers. Welch et al. (1985), Drosman et al. (1988) and Ford et al. (1986) reported, irritable bowel syndrom, bronchial asthma and rheumatoid arthritis are associated with psychological stress.

Khan and Husain (1990) reported that patients of hypertension, asthma, peptic ulcer and chronic gastritis had maladjustment in areas of social, emotional, health, home and financial areas.

Harris et al (1990) reported in their study on metabolic control in 62 IDDM patients that the chronic life stress appears to have long term effects on metabolic control even 2 years after stress have occurred. Delamater et al (1990) suggested that maladaptive coping and lack of family support are significant

correlates of poor metabolic control. Acute psychological stress has been found to impair the handling of a glucose load in normal weight individuals and to produce a delay in gastrointestinal transit time (Wing et al. 1990). Obese individuals are more likely to over eat than normal weight individuals. Rand and Stunkard (1978), Slochower (1976), Lowe and Fisher (1983) found that obese patients were more likely to report eating when they were depressed, anxious or angry and more likely to gain weight during negative emotional periods.

* Allen et al. (1987) demonstrated that mental arithmetic elevates cardiac output leaving vascular resistance unchanged, with the result that blood pressure increases more than it does during work on reaction time task.

A number of bodily responses such as changes in galvenic skin resistance, pulse rate, skin temperature etc. are associated with stress (Perry, 1978). Under stress or anxiety there is decrease in the G.S.R. which can serve as an important of the tension state (Welford, 1973). Pulse rate is also a recognized index of anxiety states (Welford, 1980).

Yoga :

The spiritual aspects of psychotherapy and the psychotherapeutic value of spiritual practices have been a matter of serious consideration among some psychotherapists (Frankl, 1975; Vaughan, 1991; Tart and Diekman, 1991).

The importance of yoga is coming into light in the west in the comparative analysis of different systems by psychologists to find out meaningful answers to some problems of life (Krishna Rao and K Sridevi, 1994). Meditation techniques like Zen and Transcendental Meditation (T.M.) have come to be used as adjuncts to psychotherapy (Goleman, 1971; Deathrager, 1975; Engler, 1984).

Geraldine Coster (1934) first appraised the therapeutic potential of yoga and presented an elaborate comparison of Freudian psychoanalysis and Patanjali's yoga. In the western countries, psychoanalysis, behaviour modification based on learning principles and existential humanistic psychology as well as autogenic training have been widely used as treatment modalities for neurosis and psychosomatic disorders. The oriental approaches like yoga, Zen, Acupuncture and fasting which are somatopsychic approaches, considered to be complementary to these (Nagakawa, 1982).

There are several studies by many researchers in India and abroad, which ascertain the importance of yogic practices in health and disease by producing a series of significant psychological, physiological, endocrinal and metabolic changes in

the body. Yogasanas and Pranayamas claim to have beneficial effects on the body such as :

- (i) improving functions of different systems and thereby increasing longevity (Iyenger, 1968; Kulvayananda Swamy, 1968).
- (ii) bringing an equipoise between psychic and somatic aspects of bodily functions (Anand, 1960 and 1961),
- (iii) helping in curing certain diseases (Datey, 1969; Wallace, 1972; Kulvayanand, 1968 and Robert, 1972),
- (iv) developing in some yogis the ability to exhibit certain unusual physiological phenomenon like voluntary stopage of heart and staying in closed chamber for long time (Anand, 1960; Wenger, 1963).

Swamy Rama and Swamy Ajaya presented a full fledged system of yoga therapy based on Samkhya yoga, hatha yoga, advita vedanta and tantra. The system encompasses a wide variety of mental (meditational) and behavioural techniques.

The integrated yoga therapy has been used with therapeutic benefits in the various conditions like, bronchial asthma, diabetes mellitus, anxiety neurosis, ischaemic heart disease, tension headache, and low back pain (Nagendra 1993). The yogic discipline of pranayama is claimed to have tonning effect on cardio-respiratory system (Gopal et al., 1975; Karambelkar et al., 1968). Pranayama has also been shown to improve the vagal tone and decrease sympathetic activity (Founderburk Janes, 1977; Lysebeth Andre Van, 1979).

Practice of yoga have been shown to bring about a

considerable improvement in cardiorespiratory functions, adrenocortical functions and number of metabolic correction in addition to remarkable psychological and neurophysiological improvements (Udupa, 1975).

Mishra (1980) found that rheumatic muscles or joint pains, arthritic pains, backache, neck stiffness are benefitted by asana, causing movement of joints. Sahasi (1984) reported improvement in patients suffering from various physical and psychological ailments with yoga therapy. Bhat (1982) has reported that yoga helps in the treatment of anxiety and OCN (Obsessive Compulsive Neurosis).

Crews and Landers (1987) found fit persons have a reduced stress response relative to controls. Fit individuals return to baseline levels of heart rate and blood pressure faster than unfit following stressful event (Blumenthal et al. 1988).

U.S. Ray et al (1989) found the similar pattern of physiological response to physical performance in yoga and physical training groups and suggested yoga may become substitute for physical training. Gore and Bhole (1980) compared heart rate during yogasan practice and physical exercise in 12 normal males. They observed increase in heart rate during practice of asanas (6.2%) was minimum in comparison to isometric exercises (31.8%) and isotonic exercises (13.2%).

Sahasi et al. (1984) have shown an improvement in general

health corresponding decrease in score on cornel index (Health questionnaire), while Deshmukh (1971, 1972) reported 82.5% and 72.58% improvement in psychosomatic complaints in 106 and 116 subjects through the regular practice of yoga.

In their study of sahaja yoga for stress management in 32 patients of epilepsy, Usha Panjwani et al., (1995) demonstrated increase in GSR (Galvenic skin Resistance) 55.5% after 3 months and 83.4% after 6 months. The study also indicated consistant decrease in blood lactate and urinary VMA as well as better adjustment in their family and society.

Increase in GSR is demonstrated after practice of Transcendental Meditation (Laurie, 1976), Sahaja Yoga (Rai et al., 1988) and Meditation, hypnosis and relaxation (Morse et al., 1977). Decrease in blood lactate and urinary VMA is reported after yoga practice (Udupa et al., 1975) and Transcendental Meditation (Khullar, 1982).,

Shanker and Bhanot (1994) found usefulness of yoga practice in 20 hypertensive subjects where they observed decrease in Blood Pressure and other related symptoms. Yogic exercise specially shavasana has been found to be quite to be quite efficient in treating the hypertensive patients (Datey, 1975).

Uma et al (1989) and Telles et al. (1993 and 1994) studied the effect of yoga in relation to motor control, and reported decrease in errors, increase in mental ability, intelligence and psychomotor co-ordination.

Gopal et al., (1973) and Stanescu et al. (1981) demonstrated decrease in respiratory minute volume, with decrease in respiratory rate. Allison (1970) and Wallace (1970) have shown the similar effect of transcendental meditation on respiration.

Gopal et al. (1973) found no change in heart, systolic blood pressure, maximum breathing capacity, maximum expiratory pressure and % of forced expiratory volume in one second, but, there was decrease in diastolic blood pressure and increase in vital capacity. Joshi et al. (1992) have studied the effect of pranayama on ventilatory functions in 33 males and 42 females, observed significant decrease in RR (respiratory rate), increase in FVC (Functional Vital Capacity), FEV_1 , % (% of Forced Expiratory volume in one second), MVV (Maximum Voluntary Ventilation) PEFr (Peak Expiratory Flow Rate) and Breath holding time.

Bhole and Karambelkar (1971-72), Gopal K.S. (1973), Makwana et al (1988), Bhole (1967) and Udupa et al (1975) also showed increase in FVC, MVV and PEFr, and, decrease in RR. Selvamurthy et al. (1981, 1983a and 1983b), indicated decreased ventilation, O_2 consumption, blood cholesterol and increased GSR with yoga practice.

Madanmohan et al (1992) presented the results of their study 'effect of yoga on Reaction Time, Respiratory Endurance and Muscle strength; as significant decrease in VRT (Visual reaction time, 270-224 msec) ART (auditory reaction time 194-157 msec), increase in MEP (92-126 mm Hg) and MIP (maximum inspiratory

pressure, 72-91 mm Hg), 40 mm Hg endurance (36.57-53.36 sec), BHT Exp. (Breath holding time after full expiration, 32-44 sec), BHT Insp. (Breath holding time after full inspiration, 63.7-89 sec) and HGS (Hand grip test, 13.78-16.67 sec) in 27 students who had the practice of yoga for 12 weeks. The results for reaction time was same as shown by Madanmohan et al. (1984) and, Malathi and Parulkar (1989), for BHT and MEP (Gopal et al. 1973 and Nayar et al. 1975) and for muscular efficiency (Udupa et al. 1972, and, Ray et al. 1986).

Decrease in blood pressure is observed after T.M. practice (Allison, 1970; Wallace, 1971), after yoga and biofeed back training (Patel, 1973) and, after relaxation training (Schapiro et al. 1969) Tandon (1978) reported increased exercise tolerance in chronic severe airway obstruction after yoga. Sahasi and Shambhunath (1984) indicated yogatherapy beneficial to orthoeadically afflicted patients. Bhatt (1982), Mishra (1982), and, Sahasi (1984) reported decrease in anxiety after yoga practice by acting on ANS through various asanas, and, increase in flexibility of joints and backbone.

O₂ consumption after yoga was noted differently by different workers, increased O₂ consumption during yoga (Miles, 1964; Shanker Rao, 1968), decreased O₂ consumption due to yoga practice (Anand et al. 1961, Salgar et al. 1975 and, Selvamurthy et al. 1983) and, no change (Santha Joseph, 1981, and Nayar et al., 1975).

Yoga trained persons seem to be able to utilize efficiently

larger amount of liberated energy for work at the low level of exercise (Salgar et al. 1975). Yoga practice is known to achieve a stable autonomic balance of a relative hypo-metabolic state and also an improvement in physical efficiency (Shankar Rao, 1988). Subjects trained in yoga can achieve a state of deep psychosomatic relaxation associated with a significant reduction in O_2 consumption (Madanmohan, 1983), which indicate that yoga has practical application for improving human performance.

M.M. Gore (1982) studied the effect of yogic treatment in lung functions of 52 asthma patients (28 males and 24 females for 6 weeks). He found an increase in ERV (expiratory reserve volume). MBC (maximum breathing capacity) in males and T.V. (Tidal volume). RMV (respiratory minute volume) ERV and VC in females. There were decrease in number of attacks, feeling of well being, fresh and freeness in breathing and improvement in general health (50%).

Bhole (1982) found no change in TV, ERV, IC (inspiratory capacity), VC and FEV_1 , but increase RMV and MBC in 32 asthmatics and 70 normals. Gore and Gharote (1981) reported increased PEF in 105 males and 30 females after yoga practice. Bhole (1976) studied the effect of Kapalbhathi in 30 male and 15 females for 2 weeks, where an increase in Breath holding time was significant. Bhole and Karambelkar (1971) reported in their study on yoga and blood picture in asthmatics (68 male and 38 female patients) for 4 and 6 weeks, that there was increase in Hb content, RBC count and Lymphocyte count alongwith decrease in total count and differential count after yoga training.

There are several studies showing the importance of yoga in autonomic functions, such as decrease in respiratory rate (RR), heart rate (HR) and increased skin resistance (GSR) (Wenger and Bagchi, 1961; V Pratap, 1969). Transcendental meditation and Zen meditation also have their effect on RR, TV, O₂ consumption and metabolism with decrease in them. (Kasamatsu and Hirai, 1966; quoted by V. Pratap 1971).

Singh and Udupa (1977) conducted a series of comparative psychophysiological studies on normal healthy individuals who were practicing certain meditative and cultural asanas, and pranayamas one hour daily for 6 months. They found that 6 months yoga practices induced a feeling of well being, a reduction in body weight and increased vital capacity (VC). It was also observed that blood sugar and serum cholesterol levels on fasting were lowered, and certain endocrine functions, specially adrenocortical, thyroid and testicular functions were accelerated. Psychological studies revealed an improvement in memory and performance, lowered mental fatigue rate, a reduction in neuroticism index and lowered incidence of physiological and psychological complaints.

Datey (1977) examined the comparative effects of relaxation practices on stress, in 86 hypertensive patients. After 3 months practice majority of patients reported marked improvement in symptoms like, headache, insomnia, nervousness. There was decrease in blood pressure, and drug intake. 27 patients were given bio-feed back training and there again 41% reduction in

blood pressure and drug requirement alongwith decrease in temperature.

In another study, Podder et al. (1984) investigated a variation in yoga and meditation in 32 patients of hypertension, 20 minutes practices for 20 days and follow-up after 12 weeks. Patients had shown decrease in blood pressure, drug dosage and increased sense of well-being. They concluded that for psychological stress induced essential hypertension shavasan meditation is effective in controlling blood pressure.

Nagarathna and Nagendra (1985) found decrease in number of attacks and severity of bronchial asthma in 53 subjects after 54 months practice of yoga. In another studies (1986, 1991) they reported the similar type of results with decrease in medication per week in 570 asthmatics with 3-5 months yoga practice. In the study with diabetic patients, they found decrease in PP₂BS level, oral drugs and insulin units in 82 patients after 2-4 weeks yoga practice. Another study on same line, there was decrease in body weight after 54-96 months. (Nagarathna and Nagendra, 1981 and 1984).. After 4-8 weeks practice of pranayama in 18 patients of anxiety neurosis had decreased GSR, PR, urinary VMA, anxiety and pathogenic arousal, which suggest reduction in pseudomotor sympathetic activity (Nagarathna and Nagendra, 1984). In 1983, in their study with IHD, they found yoga practice reduces the medication. Dharmaprakash (1990) and Kalpana (1990) have suggested yogatherapy decreases medication and pain in tension headache, low back pain, diabetes and IHD.

Latha and Kaliappan (1992) investigated the effect of yoga as a therapeutic aid in the treatment of migraine and tension headaches in 20 patients, subjects were assessed for headache activity (in terms of frequency, duration and intensity), sources of stress, coping patterns and somatic symptoms before and after therapy. There was significant reduction in headache activity, medication intake, symptoms and stress perception and increase in coping behaviour. It is suggested that yoga therapy is superior to drug therapy in controlling headache.

Latha and Kaliappan (1991) have investigated the effectiveness of yoga relaxation pranayama and thermal biofeedback techniques in the management of hypertension and stress 14 hypertensive patients (aged 45-70 yrs.) 7 subjects under went the training in yoga, and biofeedback techniques for 6 months, while 7 subjects served as controls. Results showed a significant reduction in systolic B.P. and moderate reduction in systolic B.P. and moderate reduction in diastolic B.P. There was significant reduction in the intake of antihypertensive drugs.

Stress reducing hatha-yoga techniques that have been demonstrated to managers, include, breathing exercises meditative exercises, relaxation, postures, and topic discussion (physiology of stress, yoga, stress management). Results show significant decrease in stress levels (Heibronn, 1992).

Nespor K. (1989) discussed the compatibility of yoga with other approaches treating back pain. Yoga's influence on musculo-skeletal, somatic, psychological, social and family, and,

transpersonal system is discussed. The author emphasized the usefulness of yoga in prevention of stress and burnout in health care professional (Nespor K., 1993).

Lerner and Remen (1987) described their personal experiences in a residential health promotion programme for cancer patients consisting yoga and meditation to reduce stress. The role of imagery and creativity in psychological healing and physiological recovery is discussed. Patients have indicated reduction in stress, fear, and isolation, and increase in a sense of control over treatment.

Dubey and Kumar (1986) in their study with 100 male executives, studied the efficacy of therapeutic techniques for reducing stress, like yoga, T.M., Autosuggestions and Relaxation therapy, where they found yogatherapy as a tool for stress management.

C. Patel (1975) described 2 studies in blood pressure patients. He taught his patients to relax and practice yoga in order to reduce blood pressure and medication requirements. First study involved 9 males and 11 females; the second study involved 12 males and 4 females. The therapy was effective in reducing resting blood pressure on a long term basis. He concluded that an important relationship between environmental stress and blood pressure elevation does exist and yoga is found to be an effective way to reduce stress.

Kabat (1982) used the mindfulness meditation in 10 weeks stress reduction and relaxation programme to train chronic pain

patients in self-regulation. Data are presented on 51 chronic pain patients of low back pain neck, shoulder and headache, chest pain and gastro-intestinal pain.

Selvamurthy et al. (1983) suggested that yoga is to achieve stable autonomic balance, a hypometabolic state and also improvement in physical efficiency.