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Impact of Stress on Healthcare Professionals

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Abstract: *Stress and illness are deep-rooted in a bio-psychosocial matrix of several system levels. Each system can be either a source of stress or a support system for stress. Stress being a part of feedback system in a community or family, is often associated with the onset of illness if demands for adaptation are excessive. Chronic psychological stress may reduce the biological resilience and disturb adrenocortical homeostasis leading to abnormalities in cortisol action. The subtle abnormalities in cortisol action may lead to Metabolic Syndrome (MS). Stress and MS being symbiotic, the current strategy for prevention and treatment of MS is rapidly shifting towards life style modification as the stress severity is influenced by life style. In view of this, a cross sectional study was done in health Care professionals working in a tertiary care hospital as theyare one among the groups who are facing a lot of stressors. By Holmes-Rahe Scale, the prevalence of stress was 16.4% among 303 participants. Trend Chi-Square test showed significantly increasing prevalence of MS as the level of stress increased (odds ratio-19.6, P<0.001) and severity of stress increased (odds ratio-28.3, P<0.001).In the search for better management of MS, the influence of lifestyle which includes diet, yoga, meditation, exercise, sleep, on stress were also analyzed. By multiple binary logistic regression analysis, subjects having stress along poor life style had high prevalence of MS than those having stress along good life style pattern (odds ratio-1.684, P<0.001).Thisemphasize the significant association between stress and MS and implies it is modifiable by good life style pattern.*

Keywords: *Cortisol, DASS score, Holmes-Rahe score, Life style pattern, Metabolic syndrome,Stress*

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I. Introduction

The present fast and challenging life style made stress as an essential event and is found as a widespread concept everywhere. Stress may be a consequence of an event, a general response to an action, situation that places special physical or psychological demands or both, on a person. As said by Hans Selye, one of the father of stress research, "stress is not necessarily something bad – it all depends on how you take it. The stress of exhilarating, creative, successful work is beneficial, while that of failure, humiliation or infection is detrimental"[(1)].Hence, stress is viewed as a process through which environmental events are interpreted by people in relation to their own values and resources. Stress has effect on structure and function of hippocampus and amygdala that are involved in multiple aspects of cognition, attention and emotion. There are various types of stress and levels of stress. It is the particular type of stress and level of stress that determines its impact on the mind and body.

1.1 Types of stress

Eustress, leads to immediate strength which in small amounts can have positive effects by energizing people towards goal whereas Distress, creates a discomfort feel. Hyper-stress might cause overloading and Hypo-stress, often makes an individual unchallenged or restless. This shows, too low or too high level of stress can be destructive. Every positive or negative life event being a form of stress may lead to some physical, bio-chemical and emotional reactions.

1.2 Response to stress

Stress is responded under three components - psychological, behavioral and biological (Cohen,Kessler, & Underwood Gordon,1995b). Under the psychological component, the concept of the "giving up/given up complex" or the feeling of hopelessness and helplessness following a loss or stressful life event was developed by George Engel at the University of Rochester [(2)].Human's reaction to major life events or daily events is based on their behavioral pattern and if it is negative emotion, it creates negative impact on life like eating unhealthy food, gaining weight, smoking, sedentary life style, not taking medications etc.As said by Toffler, when too much change (stress), too suddenly, and within too short period occurs, it precipitates a deleterious physical,

chemical, negative emotional reactions and disturbs the biological homeostasis[3]. When confronting environmental demands, first whether the demands pose a potential threat is evaluated, then whether sufficient coping resources to deal with it is available. If demands are taxing and coping resources are inadequate, stress is perceived. Appraisal of stress is presumed to result in negative emotional states. If extreme, these emotional responses increase the risk for affective psychiatric or behavioral or metabolic disorders. Hence, Stress could be a major factor leading to adverse health events which have been emphasized in many prospective and retrospective studies[4,5]. Among various adverse health events, a strong link between stress and metabolic syndrome is emerging like a pandemic.

1.3 Stress leads to Metabolic Syndrome

Persistent exposure to stress is found to directly affect the autonomic nervous system and neuroendocrine activity. Mainly the stress hormone, cortisol secretion increases and it alters the feedback mechanism of cortisol metabolism and/or increases the tissue sensitivity to cortisol. These are linked to insulin resistance, hypertension, and obesity[6] which are the major components of MS.Consequently, the cluster of risk factors in MS has increased the risk of the twin global epidemics - type 2 diabetes and cardiovascular disease.
It is essential to note that even before the levels of blood glucose are high enough for a person to be diagnosed with diabetes, the hyperglycemia and related changes in blood lipids (increase in triglycerides and decrease in the 'good' cholesterol HDL-c) increase a person's risk of CVD [7] .When many components of the metabolic syndrome are evident then higher is the cardiovascular mortality rate [8].

1.4 Coping mechanism of stress

The impact of life changing events depends on coping factorsor adaptive behavior of the person.Some major coping factors are social support, life style and their inherent personality that plays important role in balancing stress. Cobb studied social support under three components – 1. Emotional support: the sense of being cared for and loved, 2. Esteem support: the sense of self-esteem, value and recognition, 3. Network support: the sense of belonging to one or several network of mutual obligation [9]. Extensive literature demonstrate positive effects of social support on compliance, recovery from illness and on preventing illness from severe stressful life events.

The sedentary life style, unhealthy or high calorie diet contributes a lot in rising rates of obesity. Physical activity being defined as "bodily movement produced by skeletal muscles that require energy"[10] and exercise as a type of planned, structured, and repetitive activity to maintain or improve physical fitness and balance. The recommendation is, 150–300 minutes per week of moderate intensity physical activity on most days of the week is required to maintain health [11]. Regular exercise, yoga, balanced diet and good sleep pattern acts as good coping mechanisms.

Thus stress is always tricky. Because some people need certain amount of stress to work better as it gives motivation, euphoric feel and creativity but the concern lies when too much or repeated stress that leads to negative consequences on the body and mind. Stress along with increasing prevalence and severity of obesity, increase the risk of MS drastically.In this scenario the rising question is, could various coping mechanisms serve as balancing factors in helping people withstand high levels of change in their lives?

Hence, as the impact of stress is high on health care professionals with irrevocable consequences both in their personal life and in the health status of the nation, it was proposed to analyze the prevalence of stress in this population. Moreover the main purpose of this study was to see whether the level of stress affect the chance of getting MS and can life style be one better coping mechanism to overcome stress and its effect.

II. Research Methodology

2.1 Objective of the research

(a) To assess stress and estimate the prevalence of stress in health care professionals working in tertiary care hospital, by using internationally established guidelines, i.e. Holmes-Rahe Scale, DASS score
(b) To determine the association between stress and metabolic syndrome.
(c) To assess the influence of life style on the impact of stress.

2.2Sampling method

- This cross sectional study was carried out from April 2016 to September 2016, in a tertiary care hospital in Chennai.
- The samplesize for this research was 303 participants.
- The sample fraction(s.f)was calculated by the formula,s.f=sample size/study population size.
- The study population included participants from all three major category working in the hospital and had151 doctors, 101 nurses and 51 para-medicals. (sample size in each category= population size in each category x s.f).

- After getting clearance from Institutional Ethical committee, a systematic random method was applied to select eligible study participants. Based on the inclusion criteria, subjects with age more than 30 yrs working in health care department, willing for valid written consent and not suffering from severe mental illness were included in this study. The exclusion criteria were subjects suffering from psychoneurosis or having any congenital disorders.

2.3 Tools

2.3.1Investigation

Under strict aseptic precautions fasting venous blood sample was collected and the samples were analyzed for serum glucose by GOD-POD method, serum cholesterol and triglycerides by enzymatic kit method and HDL by direct method in Beckmann Coulter Auto analyzer AU480.The new International Diabetes Federation (IDF) definition was used to predict the presence of metabolic syndrome[12].Body mass index was calculated by Quetlet's formula using measured height(in cms) and weight(in kgs) values. Digital sphygmomanometer was used to measure blood pressure.

2.3.2 Questionnaire

A detailed questionnaire including life style, daily activity, exercise pattern, sleep pattern, health history and stress scoring scale were given to the participants and completed forms were collected and analysed.
The questionnaire for stress assessment under two scale were:

1. Holmes Rahe stress scale[13]
2. DASS[14]

2.4 Statistical analysis

Data were statistically analyzed using the Statistical Package SPSS version 22.0. Trend Chi-square test was used to find the natural trend in categorical variables and Odds ratio by simple and multiple binary logistic regression analysis were done. Significance level is fixed as 5% ($P<0.05$).

III. Data Analysis Andinterpretation

3.1 General demographic profile

In this cross sectional study, 303 subjects participated from a tertiary care hospital in Chennai which is well known for its well established infrastructure, advanced treatment facilities and enormous patient input from different parts of Tamilnadu.This included a sample fraction of 151(49.8%)doctors, 101(33.3%)nurses and 51(16.8%) para-medicals (Fig-1).There were 64(21.2%)males and 239(78.8%) females. The average age of this study population was 39years.

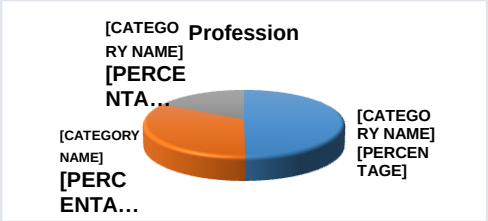

Figure 1: Demographic statistics for study population

3.2 Stress profile

3.2.1 Holmes Rahe stress scale[13]

The stressful life events that happened in last 2 years and the events that increased or decreased the stress resistance, were selected by the subjects. If the same event experienced for more than once, then to gain a more accurate total, it was added to score. The completed questionnaire form with events selected were collected, corresponding weightage were calculated and scored with the following cut-off.

- 0 to 150 - have only low to moderate(30%) chance of becoming ill in near future,
- 150-300 - have a moderate to high (50%) chance of becoming ill in near future,
- > 300- have a high to very high (80%) risk of becoming ill in near future.(12)

In this study, under the visible part of ice-berg nearly 30 to 40% of the participants were under no or mild stress but in invisible part almost 16.5% were under high stress, scoring >300 (Fig-2) which remains unnoticed and emerge as foremost risk factor leading to major illness.

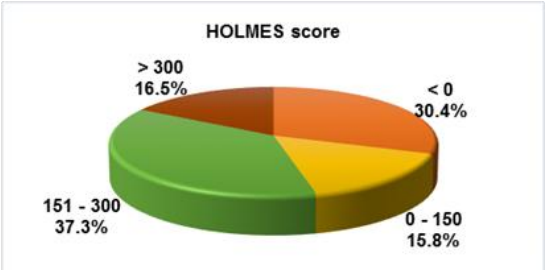

Figure-2: Holmes–Rahe score evaluation

3.2.2 DASS scale[14]

The Depression Anxiety Stress Scale-DASS scoring systemassess the severity of the core symptoms of depression, anxiety and stress by evaluating the events that happened over the past week and produce a composite measure of negative emotional symptoms.The cutoffs for conventional severity were labelled as 0to 14 - no/minimal, 15 to 18 -mild,19 to 25-moderate,>26 -severe, as given in the DASS Manual.In this population, 4.3% of participants were found under severe stress (Fig-3).It is very essential to note here is that the risk of getting illness becomes inevitable for these subjects.

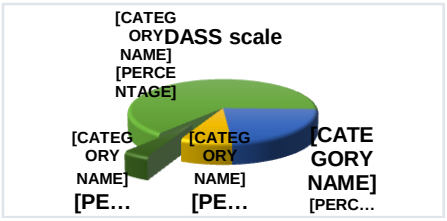

Figure-3: DASS scale-severity of stress evaluation

3.3 Stress and metabolic syndrome profile

The Trend chi square test significantly showed, increased prevalence of metabolic syndrome withincrease in stress level and severity of stress level (P<0.001)(fig 4,table 1).Simple binary regression analysis between stress and MS shows, an increased risk of MS if stress score is >300 by Holmes Rahe scale (odds ratio 19.6, P value <0.001) (table 2) and if severity of stress is very high by DASS scale (odds ratio 28.34,P value <0.001) (table 2).

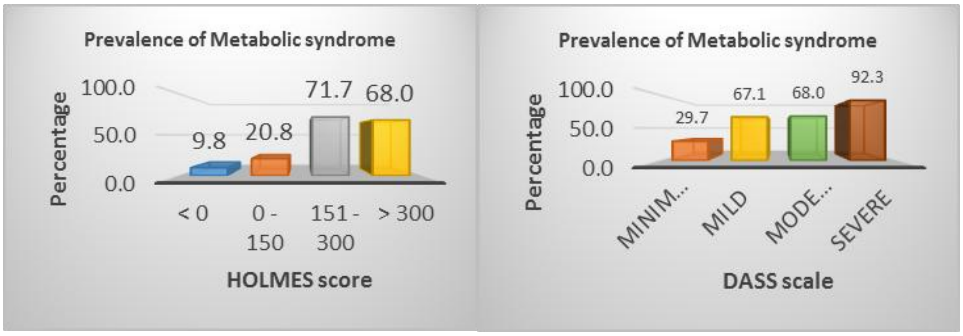

Figure-4: Prevalence of metabolic syndrome in different level of stress

Holmes score	Metabolic syndrome		Trend Chi-square test value	P-Value
	No (%)	Yes(%)		
<0 0-150 151-300 >300	83 (90.2) 38 (79.2) 32 (28.3) 16 (32.0)	9 (9.8) 10 (20.8) 81 (71.7) 34 (68.0)	84.74	<0.001**

Table-1: Association between stress and metabolic syndrome, ** highly significant

Factors	Odds ratio	95% CI		P Value
		LL	CL	
Holmes score				
<0	1.00			
0-150	2.43	0.91	6.46	0.076
151-300	23.34	10.48	51.97	<0.001**
>300	19.60	7.90	48.64	<0.001**
DASS scale				
Minimal	1.00			
Mild	4.83	2.69	8.67	0.001**
Moderate	5.02	2.05	12.28	<0.001**
Severe	28.34	3.60	223.1	<0.001**

Table-2: Simple Binary Logistic Regression Analysis to calculate the Odds for Metabolic Syndrome

3.4 Stress,Metabolic syndrome and Life style pattern profile

Subjects were divided into two groups – those with good and poor life style pattern, based on following criteria.

- good sleep for atleast 8 hrs every day,
- moderate daily activity
- regular physical exercise or yoga or both

In both groups the trend chi square test showed a similar trend where, as stress level increases the prevalence of MS increased (P<0.001) (table 3). Multiple logistic regression analysis was done to see if life style had influence on stress and MS. In subjects with stress score >300, when poor life style was adopted it increased the risk of MS (odds ratio – 22.97, P<0.001) (table 4). Life style significantly influence the impact of stress (odds ratio-1.684, P<0.001) (table 4).

Life style pattern	Holmes Rahe scale score	Metabolic syndrome		Trend Chi square test value	P-Value
		No (%)	Yes (%)		
Poor	<0	64 (91.4)	6 (8.6)	58.40	<0.001**
	0-150	23 (76.7)	7 (23.3)		
	151-300	28 (35.9)	50 (64.1)		
	>300	13 (31.7)	28 (68.3)		
Good	<0	19 (86.4)	3 (13.6)	28.234	<0.001**
	0-150	15 (83.3)	3 (16.7)		
	151-300	4 (11.4)	31 (88.6)		
	>300	3 (33.3)	6 (66.7)		

Table -3: Association between Holmes stress score, Metabolic syndrome and life style

Factors	Adj. Odds Ratio	95% CI		P-Value
		LL	UL	
HOLMES score				
< 0	1.00			
0 - 150	3.25	0.99	10.67	0.052
151 - 300	19.05	7.32	49.56	<0.001**
> 300	22.97	7.92	66.60	<0.001**
Life Style				
Good	1.00			
Poor	1.684	0.384	7.380	0.001**

Table-4:Multiple Binary Logistic Regression Analysis to calculate the Odds for Metabolic Syndrome

IV. Discussion

In our research for effective assessment of stress, two internationally established reliable guidelines, Holmes Rahe scale and DASS score were used.The stress analysis was done on healthcare workers who were more associated with identifiable risk factors.Results observed in this study were in line of proposed hypothesis. It showed high prevalence of stress which is parallel to previous studies done on similar population [15,16,17,18,19] .The results show moderately high prevalence when compared to previous studies done on different population [20].This emphasis the importance about stress evaluation as it is in increasing trend since last decade specifically in health care providers.

The Holmes Rahe stress scale or the Social Readjustment Rating Scalewas developed by Thomas H. Holmes and Richard H. Rahe in the mid1970s.This scalehad documented a sensitivity of 0.75 and specificity of 0.68.It is a modest questionnaire which is easy to use and quick to apply. Holmes and Rahe selected 43 life events that were expected to be more common and stressful where some of the events are traumatic and some are pleasant and joyful. This scale included not only external and uncontrollable events such as accidental injury

but also events which are within the individual's control, such as marriage, jail terms and divorce.All events require some change in a person's life to readjust to the situation. Hence this scaleexpress the stress score created by both positive and negative events that occurred in the past two years. This score is not final because the effect of this score depends on their personal level of stress resistance. The facts and events that serve to reduce the stress resistance will increase the score. Similarly, those events that strengthen the stress resistance helps to minimize the stress score. Notably in this scoring system, even with no recent stresses the score can be high, based on events in their life that weaken the stress resistance. DASS score is based on a dimensional rather than a categorical conception of psychological disorder. This scale is often preferable for clinical work and research purposes.

In today's life pattern, stress has become inevitable where it can be caused by illness or cause illness.Stress has a major role, though an interplay between a variety of factors such as genes, nutrition, immune mechanisms, social roles,stress, socioeconomic status, climatic and atmospheric conditions that operate within the individual and their environment, will determine whether or not one remains well or succumbs to illness.

The biological response for acute stress acts to protect the body from the threatening event.In acute stress, by direct neuroendocrine effect, activates sympathetic system resulting in release of catecholamine, cortisol and other stress hormones. But chronic stress, especially psychosocial stress have negative impact on health, where it disturbs specific neural and endocrine responses[21,22]. During chronic stress, the hypophyseal-pituitary-adrenal axis gets disrupted and result in abnormal circadian cortisol rhythms. Hormone profile show elevated and flattened diurnal cortisol levels and elevated overnight urinary cortisol. It also disrupts autonomic balance, resulting in increase in sympathetic versus parasympathetic function causing elevation of urinary catecholamine [23].It has been proposed that subtle abnormalities in cortisol action are a missing link between these factors in patients with the Metabolic Syndrome [6]. This MS can lead to life threatening major risk factors such as CAD, CKD and NAFLD etc.The Whitehall study showed that workers with high stress had higher incidence of coronary heart disease and death rate [24].Recently, many researches on the metabolic changes by stress have highlighted the association between stress and MS[4,5].

In MS, also known as Syndrome X or Insulin Resistance syndrome show an increased level of cortisol that was proved in the Whitehall II study.The prevalence of metabolic syndrome (MS) is estimated to be 20–25 percent [25].Researches show increased prevalence of MS in stressed population compared to general population [26]. The exact mechanism of MS is complex and not yet completely known. But stressors, faulty lifestyle, high calorie diet, aging and genetic factors found to contribute more in the path physiology of MS.

During stress, the sedentary life style and unhealthy food habits contributes a lot to obesity, which is a major contributor to develop MS[27,12]. A central or upper body fat distribution, more so than total fat mass, is a better predictor of metabolic complication of obesity such as insulin resistance, islet cell failure and type 2 DM, hypertension, dyslipidemia. Studies show that upper body obesity is associated with several abnormalities of adipose tissue lipolysis, which are regulated by insulin(inhibit), catecholamine (stimulate), cortisol(stimulate) and growth hormone [28].It is believed that adipocytes of visceral fat increases plasma level of TNF-alpha and alters the level of others substances (adiponectin, leptin, resistin, PAI-1 etc) which plays a series of event of chronic inflammation that may lead to increased risk of developing hypertension, atherosclerosis, diabetes.

The stress is responded by psychological response along with biological response. Psychological response depends on the social context and social support that may alter the stress reactivity. Adding to this, the emotional distressmay suppress or enhance a complex autoimmune, humoral and neuromuscular mechanisms. This produces a shift in expression of pro and anti-inflammatory cytokines from cellular responses to humoral immunity and leads to physical symptoms that may exacerbate diseases like rheumatoid arthritis, inflammatory bowel disease, and atherosclerosis [23,29].

The biomedical factors, the sickness role, individual and family coping styles, the degree of family and community support, and the characteristics of the stress must be considered when the stress-illness relationship is evaluated because each factor interrelates with others.Many studies have not analyzed the prevalence of MS in stressed healthcare workers and whether they are able to use adequate coping mechanism to overcome stressin healthcare professionals who are the chief health care providers for the whole society. Hence this study was proposed to analyse them.The Trend chi square test done in the study added further weight to the hypothesis that abnormalities in cortisol action produced by stress could be a factor that links insulin resistance, hypertension, glucose intolerance, and obesity and present as Metabolic syndrome [6,30]. The logistic regression analyses underscores the fact that risk of MS is increased many folds when the subject is under stress.The medical and economic system have to be imperious in identifyingindividuals under high stress especially medical professionals who face a lot of stressors like work overload, sleep deprivation, repeated exposure to emotional situations, tough cases that can seriously and negatively impact their health and job performance.

We have also attempted to evaluate if the lifestyle pattern had influence on stress in this study population. The multiple regression analysis showed increased prevalence of MS in stressed population with poor life style pattern than with good life style pattern.Though many coping mechanisms are available, why they

are inaccessible is debatable. The current strategy for prevention and treatment of metabolic syndrome is rapidly changing towards life style management. This highlights that the conventional management of MS are not satisfactory, that neither controls nor prevents MS. Hence, as life style has significant effect on Metabolicsyndrome, many investigators in this field are inclined to undertake scientific study on treatment development that may include life style modification or some of our ancient medicine resources[26].

V. Conclusion

Stress is emerging as a major concern of every individual in this changing life style pattern. Health care professionals are a known risk group for mental health disturbance. The employees in health care department are hampered by educational responsibility, patient management and with administrative commitments. Consequently, it is rationale to notice a high stress level in this population.This cross sectional study strengthens the hypothesis that stress and metabolic syndrome are interrelated as stated in previous studies. It alarms that medical and economic system have to be imperious in identifying individuals under high stress and with early metabolic syndrome especially in more susceptible groups that enables for early lifestyle interventions and treatment.The sedentary life style, unhealthy food habits and inability of a person to cope up with the life related events (stressors) contributes a lot in rising rates of obesity, which had determined an increased susceptibility to develop MS. Stress reduction can be achieved through better life style pattern, learning traditional medical systems that use yoga, meditation, prayer, guided imagery, recitation, singing, drumming, chanting that effectively build their present awareness, attention and harmony.

4.1 Internal validity

Methodologically, the questionnaire technique used in this study brings greater precision to this area of research and provides a quantitative basis for new epidemiological study of diseases. Neutrality was also observed by blinded data analysis. This report defines a method which achieves its requisite. Well established Holmes- Rahe Scale analyzed stress along stress resistance which helped to effectively score stress load. DASS scale measured current state or change in state over time (e.g., in the course of treatment) on depression, anxiety and stress. These scales have met the needs of both researchers and clinicians. IDF criteria and standard methods for estimation, provided an accurate analyzes.

4.2 Limitation of study

Perfect matching of the population with respect to age, sex, and occupationhas to be done. The significance of the study in each level of stress could have been achieved by increasing thesample size. A detailed history of life style pattern including their personal habitswas also required to improve the strength of the results.

4.3 Future scope of study

Biochemical markers of stress such as cortisol, catecholamine, cytokines etc.,can be measured for more specific correlation with level and severity of stress in prospective study pattern.

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Footnotes
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Conflict of Interest: None declared.

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