STRESS: METABOLIC AND NUTRITIONAL ASPECTS

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INTRODUCTION

Stress though inevitable in life is difficult to define precisely. Many events occurring in daily life, brings challenges that impinge upon our minds, bodies and emotions to different extents, subjecting us to stress of various types, namely mental, physical and emotional. Stress, therefore, is a state which an individual finds himself in, when his systems and faculties are unable to measure up to the challenge even by stretching their capacities to the maximum. As a matter of fact, there is an individual variation in stress perception and management, circumstances under which a person perceives stress also have a bearing on it extent and intensity. Consider, for instance, a long distance walk thrust upon an individual not used to walking marathon distance. The exercise proves patently stressful for him. But the same event causes little discomfiture, much less a stress, in a habitual jogger or sprinter. Consider another case, a person running a kilometer on a routine exercise schedule experiencing negligible stress. However, the same person, running the same distance, chased menacingly by a dog would experience an intense stress. Stress perception, therefore, varies from individual to individual and circumstances to circumstances and accordingly varies the body's response to it.

Alternatively, stress can be defined as the physiological response that results that results after one in exposed to some factor, agent or event that forces the body to change or adapt. These factors or events that produce stress are called stressors. Stressors are the cause, stress is the effect. So the event or factors confronted by the subject, real or imagined, that he interpret as disruptive, frightening or exciting becomes the stressor for the subject. Thus several persons may experience the some event but only a few, or even one reports it the stressful. Selye, the famous biologist, coined the term Eustress for positive stress. Stressors producing eustress enhance longevity, productivity, and life satisfaction, e.g. stress of examination, exercise. Likewise, harmful, unpleasant stress is called distress and results in maladaption, Sickness and even death, for instance stress of chronic pain, lack of meaningful relationship, living in an unpleasant environment.

Stress Coping :

To cope with stress, our body marshals it resources is a systematic and stepwise manner. First to respond is the endocrine system followed in close succession by metabolic machinery. Causative events that elicit anger, fear, anxiety, exhaustion, pain and the like, stirs up specific endocrine tissues to release their hormones into the blood circulation. Endocrine glands being ductless in nature, release their excedates (hormonal secretion) into the blood from where they picked up by the target tissues. The hormones acting as chemical messengers, trigger a series of metabolic changes in their target tissues, resulting in the mobilization of fuel substances (nutrients yielding energy on oxidation, mainly Carbohydrates and fats and to some extent amino acids building blacks of proteins), as also in readjusting the level of other nutrients and metabolites either by altering their excretion rates or mobilization extents from fluid compartments and tissues. Such metabolic upheavals provide a sort of combat gear to the body ensuring of effective stress coping.

Short form and long form stress

The long and short of stress story is that it is of two types, short lived and long lasting and so is the body response is the twin type, momentary and momentous in the former case and slow and lingering in the later. Events eliciting an instant fight or flee response cause short term stress, whereas conditions resulting in protected illness and immobility such as multiple fractures, severe burns, fevers of long duration etc. Cause stress of long duration. Since hormones play a pivotal role in stress management a key factor to determine an individuals ability to " Stress responding and coping" is the intactness and efficiency of his endocrine system. Metabolic alterations, occurring on the dictates of hormones, become instrumental in affecting body's response to stress.

Hormonal Interplay in stress

To understand the role of hormonal metabolic-nutritional axis in stress management, it is appropriate to begin with highlighting the role of stress glands, the adrenals, also known as the glands of emergency and hard times as described by Walter cannon (the wisdom of the body: New York, 1932). Human body has a pair of small golden coloured glandular structures called "Adrenals' that lie over the top of the kidneys. The glands mediate stress response through their hormonal secretions. Each gland comprises to portions, outer cortex and central medulla. Interestingly, the two portions secrete two different kinds of hormones differing in action, stimulus and chemistry. One Cells of medulla are known is secrete hormones epinephrine and non-epinephrine, collectively known as catecholamines. They bring about a number of biochemical changes that enable an individual is adapt as much as possible to a sudden short term stress. The hormonal secretions of the cortex, on the other hand, aid the body to adapt it self is a long term stress. Also in a sharp contrast to the rapid fire action of catecholamines, the cortical hormones act in a slow, steady and sustained manner.

Metabolic response to stress

Significance of adrenal having thus considered, we resume again the threads of the story. Events causing stress of short duration lead to the activation of the central nervous system including adrenal medulla, the neuronal transmission system and hypothalamus pituitary axis of brain. The activation of the sympathetic nervous system by the brain immediately results in the release of catecholamines (epinephrine and non epinephrine) into the circulation. This makes the heart beat faster, increasing the supply of blood to the tissues like liver and muscle. In a spilt second, the hormone epinephrine causes mobilization of fuels (largely glucose with fat and protein in receding proportion) in these tissues. Whereas glucose mobilization in liver and its subsequent release into blood enhances blood sugar levels, a similar process in muscles makes fuel ready for an impending muscular action. Another hormone, named glucagon, secretated by the alpha cell of pancreas, also gets, released in stressed situation and cause the mobilization of glucogen from liver, reinforcing the metabolic effects of epinephrine. Epinephrine also causes contraction of blood vessels supplying the skiing and gut, accounting for the pale colour of a frightened or anxious person and a feeling of emptiness (flying pigeon sensation) of belly or stomach. Its slows down digestion but allows the muscles and brain to receive more sugar and oxygen. This makes our body ready for any extra activity to fight if we are angry, to run if we are afraid and to demonstrate our feelings of compassion and remoarse if we are a emotional or passionate. People are known to perform superhuman feats of strength during periods of anger, fright or emotional turmoil by virtue of the changes occurring rapidly in the body tissues.

Stress Persisting for a longer duration elicits a response mediated by hypothalamus pituitary adrenal cortex endocrine troika in a hierarchical manner. The pituitary gets stimulated via a specific hypothalamic release factor to secrete adreno cortico tropin (ACTH), a tropic hormone. Adreno cortico tropin in turn stimulates the cortical portion of adrenal glands to synthesize and secrete adrenal cortical hormones. Also known as corticosteroids, these hormonal have been grouped into two categories, namely gluco corticoids

and mineral corticoids. The most important members of gluco corticoids group are cortisol, hydrocortisone and corticosterone. Aldosteron, on the other hand, is the important mineral-corticoid. Whereas gluco corticoids mobilize fuels by increasing catabolism of tissue proteins and initiating gluconeogenesis (synthesis of glucose from non carbohydrate substances like amino acids and fatty acid etc.): aldosterone takes care to affect a prompt renal excretion of extra potassium released into the extracellular fluid by gluco corticoid mediated cellular breakdown which otherwise would create an electrolyte imbalance. Further pituitary response to stress also includes the synthesis and release of growth hormone (somatotropin) Which regulates the work of synthesis and tissue repair in the recovery phase of stress. The main objective of such an exercise is to provide an uninterrupted energy supply to central nervous system and to take available the required input substances for the repair and functioning of traumatized tissues. In fact, a substained heat production (fever or pyrexia) and its dissipation in stress state, resulting from hormonal and inflammatory mechanism, brings in caloric in-efficiency, necessitating mobilization of fuel substances in a massive scale.

Another interesting aspect of stress management is that, apart from initiating fuel mobilization and tissue repairs, all the stress hormones vehemently oppose and antagonize the release and action of insulin, the all powerful, hypoglycemic, lipogenic and protein synthesis promoting hormone. This act of stress hormones, so vital in their fuel mobilization endeavour, makes diabetics more vulnerable to the vagaries of stress. Diabetics have been absorbed to experience a greater degree of rise in blood sugar levels in stress condition. Therefore, the important caution for them is to avoid intense stress as far as possible and to take appropriate medical measures to boost glucose tolerance in the face of an inevitable stress. Further, metabolic interplay in long term stress, also causes a mobilization and increase in blood free fatty acid and the resultant high levels as a result of the catabolism of adipose tissue fat. These fatty acids, intended to serve as fuel substance in stress management; in the event of excessive mobilization, may find a large scale entry into the liver and a part thereof (of fatty acids) becomes stored in the hepatic tissue after reesterification. The condition, such fatty accumulation in hepatic tissue causes, is termed as fatty liver and if left uncared for, results in cirrhosis of liver. Also a part of fatty acid gaining access into liver for oxidation and energy generation, do not get completely oxidized in the absence of enough glucose (a prerequisite for complete fatty acid oxidation) and end up getting oxidatively converted into ketone bodies. Excessive ketone bodies make the individual ketotic bringing the PH of the body fluids to the acidic side, a downright dangerous situation jeopardising survival, if the PH plummets 16 a value 6.o. However, instances of stress taking such disasterous dimensions are rare and most of the times our body manages to tide over the stress situations in a fairly effective manner.

Metabolic tides in the recovery phase of stress:

In a nut shell, one can say that metabolic events that follow the endocrine response to stress, amount to swinging the metabolic scales of the body towards catabolism to ensure effective coping (adult human body in normal healthy state is in a metabolic steady state with anabolic processes balancing the catabolic ones). However, during the recovery phase the tides of metabolism again shift back towards synthesis with anabolic processes taking over to restore the energy reserves and replace the lost and worn out tissues. glucocorticoids, acting as inducers of protein synthesis, accelerate the synthesis of proteins on a selective basis. Cortisol, for instance, has been known to induce the synthesis of enzyme proteins involved in the synthesis of fats, thereby shooting up fat synthesis. Growth hormone initiates the synthesis of proteins needed to repair the stress scarred tissues. The net effect of all this is manifested in the body regaining its lost weight. In many cases, the person becomes a little more fat vis-à-vis pre stress state, if he exogenous nutrient input (dietary intakes) is optimum. That is how as one gains in years; confronting, combating and coping the recurrent bout of stress of different durations and intensities, with each stress cycle one adds a

little increment to one's weight. The process is responsible for the so called "middle aged expansion in the waist line". Primarily due to increase in adipose tidied fats. This gradual increase in depot fat becomes a means for the body to meet the soaring energy demand in stress periods. That is how nursing-nature tends to make us emerge unscathed through the stress storms of life. It is another matter that the so called "sweet tooth" and "greasy palate" syndromes makes many of us overeat and over nourish consistently and to become fat, even obese and subject ourselves to the stress of obesity or overweight. In other words, normal fat depot, the very instrument that help body fight stress, on assuming excessive and unmanageable proportion becomes agent provocateur of another stress type for the body, the stress of obesity. It is also an instance how human beings from a nature endowed boon into bane by their unregulated living and eating habits.

REFERENCES:

[1] Sharma sheel (1983): Human Nutrition and Meal Planning Jhanada Prakashan, New Delhi PP, 490-497

[2] Pestonjee, D.M. (1992) : Stress and coping: The Indian Experience. New Delhi Sage Publication.

[3] Lazarus, R.S. and Falkman S. (1984): Stress Appraisal and coping New York: Springer

[4] Moss, I. (1981): Management Stress reading, M.A. Addison, Weekly.

[5] Williams, D.G. (1990): Effects of Psychoticism, Extraversion and neuroticism in current mood; a statistical review of six studies. Personality and Individual Difference, Vol. II (6), PP. 615-630.