46. Stress

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Summary

Stress can be defined as a state of increased psychological, physiological and behaviourial preparedness. A stress reaction is a normal reaction that is considered necessary rather than harmful. Physical activity is generally deemed a stress factor that activates our physiological stress systems in the same way as exposure to psychological stress. The following chapter describes acute stress reactions and the effect that physical activity has on our well-being, control and stress management. It is impossible to describe stress in relation to an individual diagnosis. Accordingly, only the general effects of physical activity are covered here. For a more in-depth discussion on the prescription of physical activity, please refer to the related chapters on pain and depression.

Definition

Stress is a commonly used concept in physics, but a much more complicated concept in medicine with a number of alternative definitions. In 1936, one of the pioneers of stress research, Hans Selye, described an unspecific and general syndrome (1), which he later referred to as stress. Selye referred to a reaction or physical strain as stress, but, according to the rules of physics, the correct definition of stress is the actual exposure. Subsequently, a more appropriate term for Selye's syndrome would have been "strain". Today, the term "stress" is used to describe exposure (stressors) and an individual's reaction to this exposure.

Stress can be defined as a state of increased psychological, physiological and behaviourial preparedness, i.e. the body's own alarm reaction. During stress, sensory impressions are processed by the brain, whereupon the brain's interpretation and coping with the situation influence the characteristics of a subsequent physiological stress reaction (2). The physiological stress reaction that is triggered is the body's way of responding and can be described as a survival reaction. Stress hormones are released to mobilise the energy needed

for coping with the stress, whereupon other systems that restore the balance are activated. A physiological stress reaction is therefore completely normal, helping the body to act and react appropriately to different threats and challenges. Our physiological stress system is adapted for a short period of activity. The risk of stress exposure leading to an illness only becomes relevant during long periods of exposure and when the stress level is so great that the physiological stress system is not given enough time, which all systems of the body need, to recover and function normally. It has been discussed whether this lack of recovery, often in the form of sleeplessness, is an important explanation to why some people suffer from fatigue/exhaustion, which regularly leads to reduced capacity and sick leave (3).

The physiological stress reaction and consequent adaptation are highly complex and influenced by a number of different factors that determine the degree of physiological activation and its consequences. Examples of such consequences include the ability to cope, the level of physical training, and sleep. Genetic factors and personality may also play an important role (2–7).

Prevalence/Incidence

Stress cannot be described as a specific diagnosis, making it impossible to discuss its prevalence. With regard to the increase in long-term sick leave seen in Sweden during the second half of the 1990s and beginning of the 2000s, most of the increase relates to diagnoses associated with mental illness. According to Swedish Social Insurance Agency statistics from 2006, the majority of sick leave taken in Sweden is due to pain diagnoses and mental illness. In 2005, close to 36 per cent of the sick leave taken was due to mental illness, a rise from approximately 28 per cent in 2002 (8). For December 2006, the two largest groups of mental illness were F32 (depressive episode) and F43 (adjustment disorders and reaction to severe stress), constituting approximately 22 per cent of the total number of diagnosed illnesses lasting 14 days or more (Source: Swedish Social Insurance Agency). A survey of 9000 county council employees from 1998 to 2004 showed that a total of 1483 people reported long-term sick leave (in excess of 28 days) during this 5-year period. The most commonly reported diagnoses were "musculoskeletal problems" (46%) and "psychiatric and stress-related complaints" (33%) (9).

Cause

According to Swedish Social Insurance Agency statistics, between 30–40 per cent of people on sick leave have been diagnosed with some form of mental illness. However, it is impossible at present to specify the percentage of mental illness and sick leave associated with stress.

Factors such as changes in working conditions including job cuts, reorganisations and added demands, are mentioned as contributors to the current ill-health in Sweden. An aging workforce, women working "double duty", fewer people expected to perform more complex tasks, increasing demands in private life and, not least, the absence of recovery are other factors that may explain the escalated numbers of people on long-term sick leave

(10, 11). Studies from other countries also suggest that psychosocial factors may be a contributing cause of the increase in long-term sick leave (12–15). A recent survey among county council employees reported an escalating situation, with one in five participants reporting an increase in stress levels. At the same time, it is important to note that a large majority (over 80 per cent) of the participants felt that their general state of health was good or very good (16).

Diagnosis

Stress is not defined as a separate diagnosis, but is often mentioned as a contributing causal factor in diagnoses such as depression and different pain conditions. How big a role stress plays as a contributing cause is not scientifically documented. The Swedish National Board of Health and Welfare's report on Exhaustion Disorder (ED, F43.8) suggests that the disorder may serve as a model for diagnosing mental exhaustion caused by stress (17). Clinical experience indicates that patients who fulfil the criteria for UMS often display a high burden of disease, sleep disturbances and other conditions in addition to depression and anxiety (18).

An important part of the diagnostic criteria is that the patient must have had physical and psychological symptoms of exhaustion for a minimum of 2 weeks, with the symptoms developing as a result of one or more identified stress factors that must have existed for a minimum of 6 months. Accordingly, the criteria incorporate at least one identified stress exposure (17). Exhaustion Disorder is a relatively new diagnosis and research studies relating to this diagnosis are therefore lacking. Thus, the knowledge in this area is based solely on clinical experience.

Effects of physical activity

Since stress is not defined as a separate diagnosis, only the general effects of physical activity on our mental well-being, ability to cope and physiological stress systems are discussed here. Regular exercise has been shown to an effect on a variety of conditions where stress is considered as one of many contributing causal factors. Examples of such conditions are cardiovascular diseases, diabetes, depression and pain.

Effects of physical activity on psychological well-being

A number of studies have shown that psychological well-being can be influenced by physical activity/training, and it is relatively well-documented that individuals who exercise regularly have better mental health than those who do not (19–23). Psychological well-being is a multifaceted phenomenon that can be described and validated in many ways, and the effects can therefore vary depending on the outcome measures. Many of these studies are also cross-sectional studies of a relatively healthy population. Subsequently, there is a need for long-term follow-up studies and randomised intervention studies of

patients suffering from fatigue and mental illness where stress is a possible contributing causal factor (23).

A recently published study by Heiden and colleagues showed no difference between physical activity or cognitive behaviourial therapy and so-called "standard" treatments in patients with long-term diagnoses such as exhaustion disorder or depression where stress was considered a possible contributing causal factor. The outcome measures were autonomic activity, sensitivity to pain, perceived stress and mental health. The physical activity consisted of two training sessions per week, one with low-intensity water exercises and one of the patient's choice (strength training, aerobics, walking or swimming) (24). More treatment studies are needed in this area. However, looking at the research to date, a number of studies on patients with depression have shown that physical training is of benefit to these patients, and that the intensity and duration of the training may also be of relevance (see chapter on Depression).

Acute effects of physical activity on physiological stress systems

Physical activation is very much a stressor that affects the body's physiological stress systems. Physiological stress reactions primarily involve the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system (ANS), the body's two fundamental physiological stress systems, and interact closely with one another. Corticotropin-releasing hormone (CRH) controls the release of adrenocorticotropic hormone (ACTH), which in turn stimulates the release of cortisol from the adrenal cortex. The release of ACTH and cortisol may also be controlled by other factors and arginine-vasopressin (AVP) has been shown to be even more important than CRH in the release of ACTH during acute physical exercise (25).

Activation of the HPA axis in connection with physical training is a complicated process. It is influenced by a number of factors, such as the intensity of the training, what time of day the training takes place, and the intake and composition of any meals consumed before the training (25). An acute physiological stress activation is also influenced by psychological factors such as motivation and competition. The release of cortisol varies substantially throughout the day and night, meaning that two identical training sessions may result in a varying increase of cortisol levels depending on what time of day the training takes place. A higher training intensity usually leads to a greater activation of the HPA axis. The sympathetic part of the ANS that releases noradrenaline and adrenaline is activated mainly in connection with acute physical and psychological stress, thus leading to, among other things, increased blood pressure and heart rate. The release of adrenaline, noradrenaline and cortisol that occurs during physical training is similar to the release that occurs in connection with an acute psychological stress reaction. Psychosocial stress often gives rise to an increased heart rate and blood pressure, and, contrary to fitness training, it also leads to increased vascular resistance (25, 26).

Long-term effects of physical activity on physiological stress systems

It has long been known that regular exercise lowers resting heart rate and blood pressure (25). The long-term effects of fitness training mean that a given workload is less physiologically demanding for a well-trained person. Thus, a less pronounced increase in the blood pressure, heart rate, vascular resistance and stress hormone levels is observed during physical activity. Also, compared to an untrained individual, the levels of catecholamines and cortisol released in a well-trained individual are lower when performing a physical activity of exactly the same intensity. In addition, well-trained individuals tend to display a less pronounced physiological stress activation in connection with a psychosocial stress load (4, 27–29). Regular activation of physiological stress systems by way of physical activity should benefit the systems even during psychosocial stress (30). The notion that regular training has an effect on individual stress reactions is based in part on the physiological mechanisms activated in connection with physical activity, such as sensitivity to hormones and influences on autonomic function (31, 32). However, physiological stress reactions are also influenced by an individual's psychological well-being and ability to cope.

Effects of physical activity on coping

Humans (and animals) may react differently to identical loads. The reason for this is that we assess a situation differently – what it means and what to do. This is in turn influenced by our personal experiences, expectations and actions. Physical activity has a positive effect on our expectations and actions in a specific situation. This positive expectation is defined as "coping", i.e. how we decide to solve a problem in a certain situation. A stress reaction is very much affected by the expected result. An individual who expects a positive outcome from a difficult situation tends to have a much less pronounced physiological stress reaction. Similarly, an individual who expects the "worst" outcome from a situation tends to display a higher level of physiological stress activation. This expectation is a learned behaviour and is often generalised to similar future situations (2).

The psychological well-being achieved through physical activity, providing the activity is perceived as positive, can in other words "spread" to other situations and thereby affect the actual stress reaction. Physical activity that is perceived as negative can likewise have a negative effect on other situations. An example of this are the expectations of parents and coaches on a child's training progress. If the objective of the training is to create a champion, then the child may perceive the situation (i.e. the training)as negative, with negative consequences for the training.

Controlled studies have shown that physical activity with realistic expectations and objectives may have an effect on the well-being and subjective health of an individual (33), regardless of the type of training carried out to achieve these expectations and objectives, at least in patients with muscle and back pain (www.backpaineurope.org).

Effects of physical activity on the brain

Long-term stress is thought to affect the functioning of the brain, including that of the hippocampus, which can lead to impaired regulation of the HPA axis and cognitive disturbances associated with memory loss and impaired learning (34–36). Some clinical observations and recently published studies indicate that long-term stress may have an effect on cognitive functions including the memory function (37, 38), but more scientific studies are needed to confirm this. A less pronounced reaction of the HPA axis resulting from physical training should therefore be good for the brain and any cognitive problems associated with long-term stress. However, randomised treatment studies are needed to confirm this. An interesting aspect of hippocampus function is the ability of nerve cells to regenerate in the adult brain (39). It is now well-documented, in animal experiments, that physical activity has a positive effect on cell proliferation in the hippocampus (40, 41). However, the clinical significance of the regenerated cells remains unclear.

Prescription

As this chapter does not address a particular diagnosis and there are no studies on the treatment of exhaustion disorder, the reader is referred to the prescriptions recommended for depression and pain diagnoses where stress may be one of many contributing causal factors.

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