

Can Stress Make You Fat?

Stress is an intrinsic part of life. Not just the lives of modern humans in modern society, but throughout history and prehistory, and for other animals too. Stress can be beneficial to motivate us, and is required for optimal learning and memory, protects against immediate physical dangers and can prepare the body for a future lack of resources. But chronic stress can have a detrimental effect and from the beginning of our life to its end – birth itself, childhood and adolescence, relationships, education, work, illness – stressors can multiply and become exceedingly demanding.

A working definition of stress might be as follows: the stress response is a response to a real or perceived threat to an organism's homeostasis (an ideal steady state that is optimal for the organism). More formally, neuroscientists refer to the stress response as activation of the hypothalamic-pituitary-adrenal (HPA) axis. The hypothalamus, an evolutionarily ancient part of the mammalian brain, signals to the pituitary, a hormone-releasing endocrine gland at the base of the brain. The pituitary signals to the adrenal glands, found atop the kidneys, to release corticosteroids into the blood. Corticosteroids act at numerous targets throughout the body to drive an adaptive response to the stressor.

Population growth, urbanisation, technological advance and changes in social

and family structures have been implicated in increasing the amount of stress we experience. Paralleling this perceived increase in stress in developed societies, there is most certainly an increase in obesity. In England the prevalence of obesity has increased from 6% in 1980 to 24% in 2009. This represents a massive public health problem - a long list of diseases are associated with excess adiposity. But what causes obesity? That is a simple question and on the face of it there is a simple answer – we gain weight because we eat more calories than we use. But this claim is rather unsatisfactory – if obesity is caused by overeating, what causes that? Much of the work needed to understand overeating is still ahead of us, but we already know of a large number of inter-related factors that drive eating. These include our age, gender, how active we are, the availability of food in society, social expectations, genetic predispositions to overeat, and many others. But attention has recently turned to the impact of stress on eating.

Stress can have a bidirectional effect on eating. It can increase or decrease food intake and, consequently, body weight. Studies using rodents, particularly those using chronic repeated stressors that resemble the patterns of stress we see in normal life, generally report a decrease in food intake. However, if during periods of chronic stress rodents are given a choice between high-sugar, high-fat palatable food and bland food, they often selectively increase their intake of palatable food and put on weight. There is an obvious parallel in human behaviour - emotional eating, a widespread behaviour where people who

feel chronically anxious or stressed seem to be motivated to consume palatable (rewarding) food. Eating behaviour can be conditioned, and we learn to associate the ingestive consequences of eating food (positive or negative effects) with changes in mood. Repeated exposure to rewarding foods will define our own food-mood related habits.



Stress affects people's eating behaviour in different ways. Imagine you are preparing for an important meeting; do you reach for the biscuit tin or go right off the whole idea of food? Intakes of high-sugar and high-fat foods that often accompany stress can lead to weight gain. Dieters tend to eat more under stress, and with a large proportion of the UK population on 'slimming diets' or 'watching their weight', this involves controlling the type and/or amount of food consumed. Successful dieters override their hunger signals in

Contacts

Project Coordinator | Suzanne Dickson | Suzanne.Dickson@neuro.gu.se
Stakeholder Engagement | Julian Mercer | j.mercer@abdn.ac.uk

order to eat less than they really want to. In other words they exercise restraint over their eating in order to control body weight. Conversely, people who eat according to their appetite eat in an unrestrained way. Studies have repeatedly shown that restrained eaters tend to eat more in response to stress compared to unrestrained eaters. Unrestrained eaters may be more tuned in to the biological signals influencing their appetite. These are the people who do not feel like eating food when they are stressed. Approaches to manage stress in the workplace and thus feeding behaviour can be a way of managing body weight.

One area of interest within the workplace is how stress affects the diets of shift workers. One in five workers in Europe is employed on a shift work basis and frequently eat one or two meals a day at work. Shift work comprises work patterns that do not follow the conventional 8-hour daytime working period, including night shifts, rotating shift work, and/or irregular working hours. Compared to individuals who work standard hours, shift workers may be at higher risk of a wide range of conditions such as obesity, type 2 diabetes, cardiovascular disease, digestive problems, sleep disorders, depression, and vitamin D deficiency (through lack of exposure to sunlight). For example, night shift work is estimated to increase coronary heart disease risk by 40%. The role of stress on ingestive behaviour (e.g. snacking, alcohol consumption) is important, as well as sleep patterns and physical activity. Often, the food available and time available to eat nutritious food is limited.

It's become fairly clear over the past few years, especially using rodent models of chronic stress, that access to palatable food can affect the stress response. For example, after an acute stressor, rats that have previously had access to a sweet-tasting solution, containing either sucrose or saccharin, show a suppressed stress response compared to rats that have not had a palatable food. It's worth noting first, that since the artificial sweetener saccharin is also effective, it seems to be a sweet taste, rather than calories, that is effective in reducing the stress response. Second, in these animal models other natural rewards, like sex, can also suppress the stress response.

Understanding influences on eating behaviour is a complex area, and particularly the role of stress on food intake and food choice, is a challenging research area. However, a multi-disciplinary team approach is beneficial to address both the psychological and physiological aspects and make recommendations about the management of stress for public health and policy practitioners.