

Eating and stress at work: The need for public health promotion intervention and an opportunity for food product development?

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Given the large proportion of time spent at work, it is surprising that relatively little research has been devoted to understanding food selection in the work place. A growing literature suggests that stress, particularly occupation-related stress, negatively impacts upon food choice and may contribute to population ill health. The consensus is that work stress induces consumption of foods that are high in sugar, fat and salt which are likely to contribute to overweight and have long-term detriment to health. The interaction between stress and eating appears to vary by sex and type of work undertaken. This paper argues an imperative for further longitudinal and intervention research to understand interactions between food choice and stress in the work context with a view to the design of dietary health promotion and the development of nourishing food products targeted at those experiencing stress and which could be made accessible in the work place.

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Introduction

More than two thirds of the population of the UK (71.4%) (ONS, 2013) and Europe (64.2%) (Eurostat, 2012) are currently in employment with average working hours per week ranging from 39 in Denmark to 42.7 in the UK and 43.7 in Austria and Greece (Eurostat, 2012). A large proportion of our lives, therefore, may be devoted to work and long periods of time spent in the work place. Our experiences in the work place and the feelings they evoke are likely to affect our health behaviour with implications for both our personal and public health. The Whitehall Studies (eg. Chandola, Brunner, & Marmot, 2006), for example, have indicated tenuous links between working conditions, stress and health. The link between shift-work (van Mark, Spallek, Kessel, & Brinkmann, 2006) and long working hours (van der Hulst, 2003) and ill-health has also been well-documented. The mechanisms driving the association between work and health, however, remain uncertain and require further research. Recent survey (Rosenthal, Carroll-Scott, Earnshaw, Santilli, & Ickovics, 2012) has suggested that working, particularly if full-time, is associated with more positive health behaviour. Cost benefit analyses are nevertheless convincing of the potential for increased productivity and enhanced employee performance as a consequence of work-site health-related intervention (Goetzel & Ozminkowski, 2008). The work place, therefore, constitutes an ideal environment in which to research and implement health promoting intervention (Siddiqui & Shahid, 2012).

For at least some of the time we are at work, we may experience stress. Stress has been defined as a response to demands made by the internal or external environment that affect physical and psychological wellbeing (Lazarus & Cohen, 1977, ch 3). Work-related perceived stress may be acute and/or chronic. Whereas acute stress is that which occurs in response to a specific incidental stressor, chronic stress is that which occurs in response to a continuous stressor and which endures over a period of time. Work-related stress may be acute or chronic and detrimental to health both through somatic pathways and as a driver and/or a consequence of unhealthy lifestyle practices. Meanwhile, there is a growing interest among nutritional scientists and the food industry in the interaction between stress and eating behaviour. Better understanding of the interaction between stress and eating behaviour at work could inform potential dietary health promotion work place

intervention and the development of health food products to consume when stressed at work.

Conceptual framework and method

This review article discusses the role of stress in eating behaviour and explores evidence for links between dietary habits and stress with special reference to the work place which is a topic of increasing interest and relevance to both dietary health promoters and food product developers. Technological advances, along with increasingly sedentari-ness within and beyond the work-place, are among many complex factors likely to interact with psychological well-being and dietary habits and which may contribute to poor health (Dunstan, Howard, Healy, & Owen, 2012). That not all of these factors are modifiable through dietary means, however, renders unbiased consideration of them beyond the scope of this paper. The purpose of this analysis has been to consider possible mechanisms through which stress, both acute and chronic, may impact upon eating behaviour and to evaluate the quality, strength and concensus of the evidence for stress as a driver of food choice in the work-place. The way in which stress impacts upon dietary habits and how convincing the evidence for stress as a driver of dietary habits in the work place are also analysed. Gaps in existing knowledge and the utility of existing studies to inform future dietary health promotion and healthy food product development have been discussed. Implications for health promotion and food product development have also been considered. Web of Science was searched using the key words Food/Diet/Nutrition entered with Psychological/Job/Work/Occupational Stress and limited to publications listed between January 1990 and July 2013. Studies of children and of clinical populations including those with eating disorders have been excluded. The overarching aim of this review has been to better understand the interaction between stress and eating behaviour at work and to determine how best to research and intervene to encourage healthy eating in the work place.

How does stress affect food choice?

The mechanism through which stress influences food choice is uncertain but is likely to be complex, multi-factorial and involve hormonal interactions and metabolic processes as well as individual differences in psychological and neurochemical response to stress and eating. Acute and chronic stress may impact differently upon food choice. Acute stress stimulates the hypothalamic pituitary axis (HPA) system to secrete the hormone cortisol which, through the action of insulin, mobilises energy stores to fuel the fight and/or flight response. That the paraventricular nucleus contains circuits that both stimulate the release of corticotrophin and control food intake adds weight to this theory (Maniam & Morris, 2012). Chronic stress, in contrast, although also associated with increased corticosteroid secretion, appears to disrupt homeostatic control of eating by bringing about insulin and leptin resistance

(Adam & Epel, 2007). Leptin is a hormone present in adipose tissue which is thought to act synergistically with neuropeptide Y (secreted by the hypothalamus) in the regulation of energy intake and body fat distribution. Chronic stress-induced cortisol secretion, therefore, is likely to be associated with reduced levels of insulin and leptin, which interact to bring about changes in appetite and fat metabolism (Lowden, Moreno, Holmbäck, Lennernäs, & Tucker, 2010). Evidence for this comes from observations in mice exposed to a stress challenge, after which they were fed a high-fat diet, which together were shown to produce lower levels of both insulin and leptin (Finger, Dinan, & Cryan, 2011). Stress-induced dopamine also appears associated with circulating leptin level in humans (Burghardt *et al.*, 2012). Ghrelin is a peptide secreted by the lining of the stomach (Uchida, Zigman, & Perello, 2013) which evidence from research in rats suggests, like leptin, is also involved in the regulation of appetite (Wang, Dong, Cheng, & Zhao, 2007). Stress is thought to elevate plasma ghrelin (Schellekens, Dinan, & Cryan, 2012).

The relationship between stress, inflammation and eating appears circular. Stress may not only drive unhealthy eating practices but also exacerbate pathological metabolic response to such foods (Kiecolt-Glaser, 2010). People who report high levels of stress tend to have elevated markers of oxidative stress which may be ameliorated by antioxidant consumption. The relationship between stress and eating is also likely to be bi-directional. Both rodent (Mitra, Crump, Alvers, Robertson, & Rowland, 2011) and human (Laugero, Falcon, & Tucker, 2011; Toda & Morimoto, 2007) studies have implied that snacking on high fat containing foods stimulates the release of cortisol. Another study (Lemmens, Rutters, Born, & Westerterp-Plantenga, 2011) which intervened with either a high protein or a high carbohydrate meal, however, observed no difference in salivary cortisol in healthy normal weight volunteers subsequent to a stressful task. This implies that the macro-nutrient content of snacks may be important in mediating the effect of stress. Another way in which stress may influence food selection is through altering sensory preference. One of the few existing human studies of the sensory experience of food under conditions of stress (Gibson, 2006), has suggested that the pleasant sensory properties and post-ingestion reward effects of eating certain foods may ameliorate stress by reducing the HPA axis stress response. Other research, in contrast, has observed no change in food preference in response to stress (Zellner, Saito, & Gonzalez, 2007). Future work directed toward developing diets and foods to be made available in the work place would do well to include sensory preference measures along with those assessing stress and dietary habits.

How do eating habits alter in response to stress?

Artificially induced acute stress has been shown to produce higher energy intake (Lemmens, Born, Martens,

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