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TABLE OF

CONTENTS

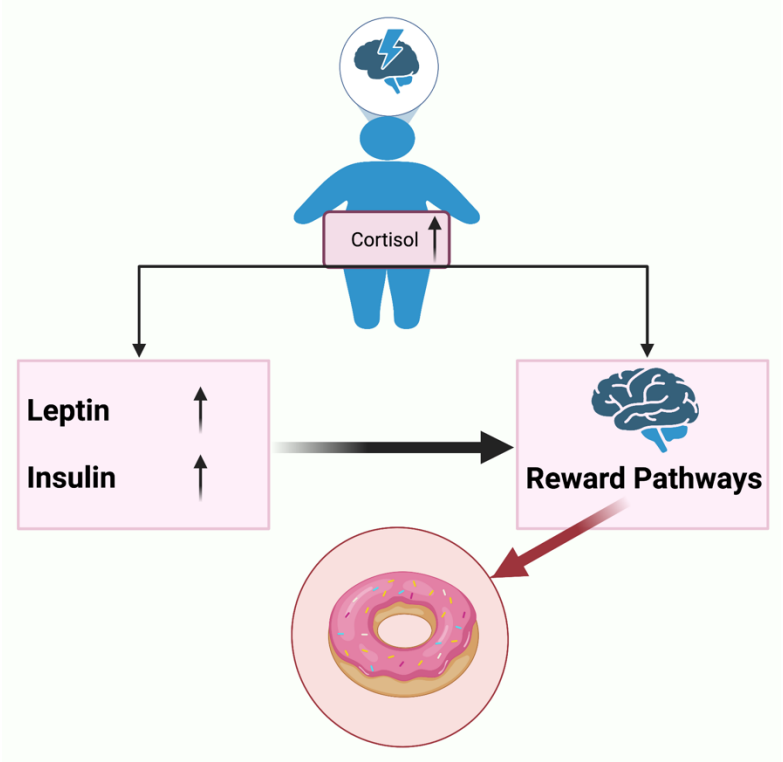
Miller AL, Riley H, Domoff SE, Gearhardt AN, Sturza J, Kaciroti N, Lumeng JC. Weight status moderates stress-eating in the absence of hunger associations in children. Appetite. 2019 May 1;136:184-192.

What We Know, Think We Know, or Are Starting to Know

What do we know about the impacts of stress on diet? As it happens, quite a bit. First, let's define "stress". Stressors that we experience may be considered an adaptive phenomenon; stress occurs where environmental demands challenge or exceed the adaptive capacity of an individual to adapt, resulting in behavioural, psychological, and biological responses that may adversely influence their health [(1)].

We have evolved mechanisms, such as the "flight or fight" responses of adrenaline, cortisol, and other related physiological responses, to react to and evade threats [(2)]. Generally, "flight or fight" nervous system responses in the body divert energy to the brain and skeletal muscle, away from "rest and digest" processes; the anticipated effect of "flight or fight" stress responses is to decrease appetite and food intake [(3)].

However, we know from the literature that humans respond both ways, i.e., some people respond to stress by *over-eating* while some respond to stress by *under-eating*, and the precise reasons for these divergent responses are not well understood [(2–5)]. Experimental evidence suggests a relationship with cortisol, which is increased in response to stress, and enhances preference for "comfort foods", while also promoting appetite and visceral fat deposition [(2)].



The Study

The study was a non-randomised experimental intervention in children recruited from the Head Start program, a federally funded preschool program for low-income children. The present study included 223 children who participated in an experimental stress protocol to investigate the effects of stress induction on eating in the absence of hunger [EAH].

The experimental stress test utilised a version of the Trier Social Stress Test for Children [TSST-C], which is designed to induce social and evaluative stress responses. Children had a 20min low-stress run-in period [i.e., playing board games, colouring] before a "strict teacher" role-play was introduced wherein the children were tested on public speaking [word fluency] and mental arithmetic tasks in front of the "strict teacher".

The children's responses were video recorded, and behavioural and facial indicators of anxiety [looking down to avoid eye contact, nervous eye movement, crying, dejected demeanour, etc.] were assessed by research assistants to determine stress response [termed "observed anxiety" in the results]. Subjective distress was also assessed by questioning the children before and after the stress induction, using a Likert Scale [1-5 point scale, 1 = "very calm and relaxed" and 5 = "very nervous, scared, or stressed"; termed "subjective distress" in the results].

To assess EAH, children consumed a standardised meal with their family members. Following the meal, the children reported their subjective fullness. Children were then moved to a separate room where they were offered dessert and told they could eat as much as they like for 5-minutes. The greater the energy consumed was indicative of EAH.

The aim of the study was to investigate whether the child sex and weight status moderated the response to the stress induction on subsequent dessert energy intake. The researchers hypothesised that stress would increase EAH, and the effect would be stronger in girls and children with overweight.

Results: Children in the study were aged 7.8yrs on average, 54.9% of the total sample were designated non-Hispanic White ethnicity, and 48% of children had overweight [defined as >85% of weight for age and sex]. More girls [27%] than boys [21%] were overweight.

***Effects of Child Weight Status*:**

- **Observed anxiety**: There was a significant interaction between anxiety and weight status, i.e., children with overweight increased EAH as anxiety increased. Conversely, children without overweight decreased EAH as anxiety increased [more under ***Interesting Finding***, below].
- **Subjective Distress**: There was no significant interaction between subjective distress and weight status. However, the directions of effect were similar, i.e., children with overweight increased EAH as subjective stress increased, while children without overweight decreased EAH as subjective stress increased.

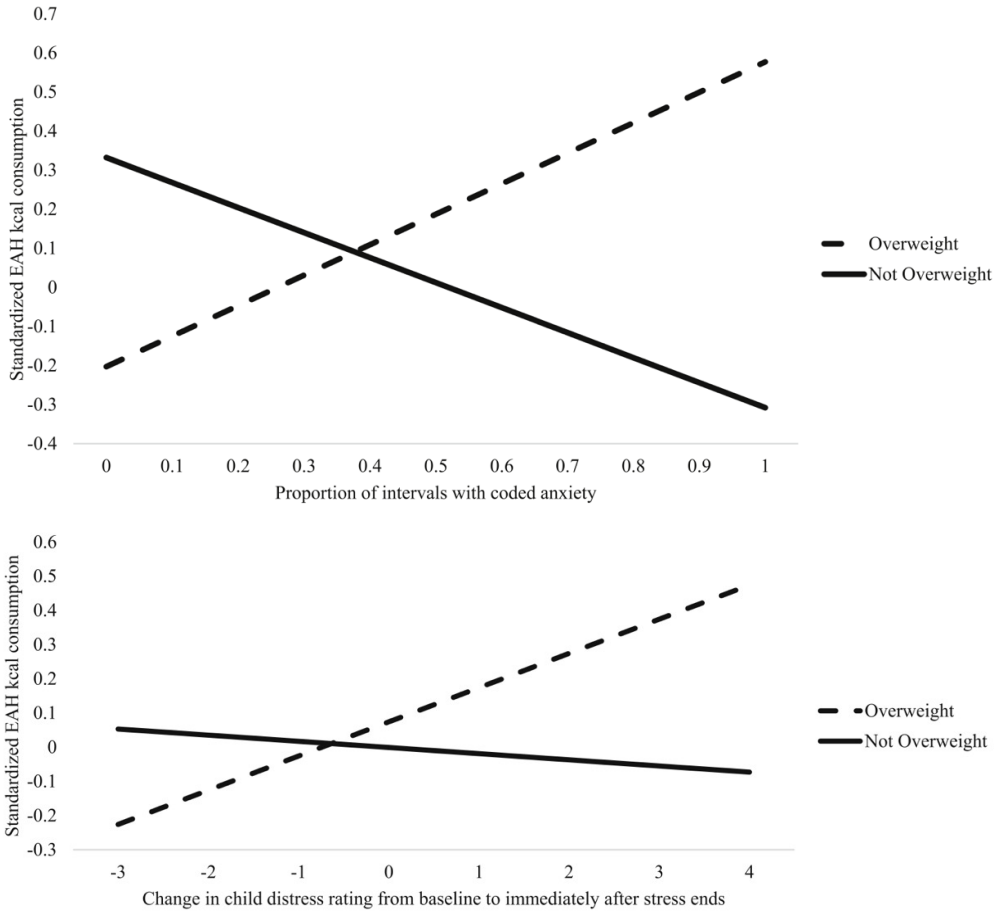


Figure *from paper illustrating [**top**] the direction of effects for increasing observed anxiety [X-axis; left to right] and increased EAH energy intake [**Y-axis, bottom to top**], and [**bottom**] illustrating the direction of effects of subjective distress and increased EAH energy intake. The figure clearly demonstrates that, in response to the stress inducing tests, the children with overweight increased EAH as observed anxiety and subjective distress increased, while children without overweight responded in the opposite direction. The crossing of the lines visual demonstrates what is meant by "interaction", i.e., the interaction of weight status and anxiety on EAH.*

The effect of child sex did not moderate the associations between either observed anxiety or subjective distress and EAH.

The Critical Breakdown

Pros: The study aims and hypotheses were clearly stated in the introduction. The sample size was large for a study in this age group, specifically focused on children from low-income families, broadening the applicability of the findings beyond the narrower, health-conscious demographics that typically participate in research. The study sample was well-balanced for male and female children [~50% each], and the ethnicity demographics were representative of the general U.S. population. The statistical analysis separately analysed the associations between stress, weight status, and EAH using the observed stress assessment and the subjective self-reported stress assessment, respectively [more under ***Key Characteristic***, below]. The fact that two measures of stress were assessed and yielded similar results is a strength for a study heavily reliant on subjective measures.

Cons: The main limitation is that the study was a non-randomised trial with no control groups. The assessment of fullness, using a 3-item question, does not appear to be validated and the reference provided did not include any validation of this hunger assessment. Using visual analogue scales would have been a simple, and more validated method to assess subjective hunger. The subjective distress scale also does not appear to have been validated. The paper does not present the actual levels of energy consumed during the experimental condition, and only presents the results as standardised regression coefficients, which are used to rank the relative importance of each variable included in the analysis but tell us nothing of what the effects would mean in "real life" calorie terms.

Key Characteristic

An important characteristic of this study is the fact that two different measures of stress were used, which was followed by two separate statistical analyses. The two different assessments of stress are important because *both* were subjective; the observed anxiety assessment was based on the subjective interpretations of the assessors [the reliability rating between assessors was 0.70, or 70%; this is considered a good level of inter-rater reliability, but clearly still contains ~30% error].

The analysis then included separate models for both observed anxiety and subjective distress, and each of these produced slightly different, but consistent, outputs. For example, we know from the data that weight status on its own had a weak effect on EAH in the observed anxiety analysis, and provided almost no explanation for EAH in the subjective distress analysis.

However, once the interaction between weight status and observed anxiety or subjective distress was analysed, the relationship which EAH was evident, and was stronger for observed anxiety than for subjective distress.

It is important to note that both tests were different assessments, so the consistency in the direction of effect, specifically the interaction between being both anxiety and distress, overweight, and increased EAH, lends more confidence to the finding that weight status moderated the association between anxiety/stress and overeating.

Interesting Finding

The direction of effect of EAH in response to stress was diametrically opposed relative to weight status, i.e., children with overweight consumed more in response to stress, while children without overweight consumed less.

It is a known feature of the research on stress and eating that humans may respond to stress by both over-eating and under-eating [5]. Prior research suggests that in response to stress, 40–70% of people may eat less while 30–50% of individuals may eat more [5].

However, previous research has also shown that having overweight or obesity predicts greater energy intake in response to stress [4]. This may be because their weight status acts as a form of chronic stress [6], and individuals experiencing *chronic* stress may eat more when exposed to *acute* stress situations [7].

The fact that children without overweight consumed less may reflect the anticipated effect of acute stressors on appetite, i.e., a downregulation of appetite [3]. It may also reflect differences in cortisol reactivity, which has been shown experimentally to correlate with higher energy intake in response to stress, i.e., those with higher cortisol responses ate more in response to stress than those without [3].

Ultimately, the present study did not measure cortisol, so we don' t know to what extent there was any correlation in these ~7yr old children. However, it is possible given what we know from wider research that the children with overweight consumed more in order to dampen the stress response [2–4].

Relevance

We can think about the relevance of a study like this by distinguishing what we know from the overall wider body of research. The first point is that stress clearly triggers divergent responses in appetite and energy intake, and that the stress eating response favours highly palatable foods [2–4].

The second is that weight status acts as a moderator of the stress response, i.e., individuals with overweight/obesity are more likely to eat more in response to stress [2,3]; the present study adds to this research by demonstrating this relationship in young children.

The other points of relevance, however, are speculative because the present study did not measure cortisol, which would have provided useful additional insights into the association [but is understandable because taking blood samples from children involves additional hurdles in ethics applications].

The experiment in the present study involved social stress, and this type of "threat stress" involving public embarrassment or failure may lead to greater cortisol reactivity [8]. When we add in the effect of weight stigma on cortisol reactivity [6], and the established experimental effects of elevated cortisol on increasing desire and intake of palatable foods [2–4], these stands of evidence provide a plausible explanation for the interaction of weight status and anxiety/stress on increasing EAH in the present study.

However, future research in children should expand the experimental measures to include cortisol and other related objective stress markers, in order to better characterise this relationship in children.

Application to Practice

It is crucial for practitioners to understand, and have empathy for, the fact that food in the context of stress is a coping mechanism to respond to the stressor. The issue that arises in the context of chronic stress is where this pattern of stress-response eating is maladaptive, e.g., visceral fat gain, stigma, etc. While referring out to mental health professionals may be necessary, from a nutrition perspective, encouraging brief mindfulness interventions may improve enjoyment of palatable foods while also regulating overall intake [9]. An example of such mindfulness instruction from Arch et al. [9]: *"While you are eating the chocolate, focus your attention on the sensory experience of tasting the chocolate...focus on the various sensations you experience such as the colour, texture, scent, and flavour while tasting and fill your head with the details of these sensations..."* In effect, help to provide your clients with tools to better respond to the effect of stress on eating behaviour.

References

1. Cohen S, Gianaros PJ, Manuck SB. A Stage Model of Stress and Disease. Perspect Psychol Sci. 2016 Jul 29;11(4):456–63.
2. Sominsky L, Spencer SJ. Eating behavior and stress: a pathway to obesity. Front Psychol. 2014 May 13;5.
3. Adam TC, Epel ES. Stress, eating and the reward system. Physiol Behav. 2007 Jul;91(4):449–58.
4. Warne JP. Shaping the stress response: Interplay of palatable food choices, glucocorticoids, insulin and abdominal obesity. Mol Cell Endocrinol. 2009 Mar;300(1–2):137–46.
5. Gibson EL. The psychobiology of comfort eating. Behav Pharmacol. 2012 Sep;23(5 and 6):442–60.
6. Schvey NA, Puhl RM, Brownell KD. The Stress of Stigma. Psychosom Med. 2014 Feb;76(2):156–62.
7. Leigh Gibson E. Emotional influences on food choice: Sensory, physiological and psychological pathways. Physiol Behav. 2006 Aug;89(1):53–61.
8. Dickerson SS, Gruenewald TL, Kemeny ME. When the Social Self Is Threatened: Shame, Physiology, and Health. J Pers. 2004 Dec;72(6):1191–216.
9. Arch JJ, Brown KW, Goodman RJ, della Porta MD, Kiken LG, Tillman S. Enjoying food without caloric cost: The impact of brief mindfulness on laboratory eating outcomes. Behaviour Research and Therapy. 2016 Apr;79:23–34.