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# *Healthy and unhealthy eating amongst stressed students: considering the influence of mindfulness on eating choices and consumption*

## BACKGROUND

Academic stress is associated with (a) increased food intake and (b) choosing calorie-dense food choices in higher education students. In this research, mindfulness was used to alleviate academic stress and, in effect, promote healthier eating behaviours and decision-making.

## PARTICIPANTS AND PROCEDURE

Ninety students were randomly allocated to either a mindfulness or a control condition. Both conditions exposed students to a stress-inducing task and levels of anxiety were recorded three times (i.e., prior to and after stress induction, and post-intervention) during the experiment. Chocolate and grapes were available to participants after the experiment as a token of appreciation.

## RESULTS

Intention-to-treat analyses revealed that mindfulness had a non-significant effect on increasing consumption

of healthy food, but assisted the decrease in consuming unhealthy food when compared to the control group. The main analyses revealed that when mindfulness alleviated stress (i.e., by using the anxiety measurements as a manipulation check), students consumed more healthy food and less unhealthy food.

## CONCLUSIONS

Mindfulness appears to enable better decision making as regards healthy and unhealthy foods when mindfulness meditation actually works. While the results appear positive, non-engagement with mindfulness meditation may necessitate the availability of other practices to reduce anxiety and stress. Clinical implications and the integration of health and wellbeing initiatives into universities are discussed.

## KEY WORDS

academic stress; anxiety; mindfulness; unhealthy eating; healthy eating

ORGANIZATION – Birmingham City University, Birmingham, United Kingdom

AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection

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## BACKGROUND

Obesity remains an unsolved crisis, with approximately 25% of adults in England being obese (Health and Social Care Information Centre, 2015). Obesity is associated with long-term distress and disabilities, increasing disease burdens and healthcare costs globally (Lean, 2018). Consequently overweight and obesity prevention is a worldwide concern (World Health Organization [WHO], 2004), with much research focusing on eating behaviours and weight regulation to inform current interventions. A special focus is currently placed on childhood obesity, which is an urgent public health challenge. Public Health England has recently implemented sugar reduction (i.e., in 2016), and are now implementing a reduction of calories (Selbie, 2018) in an attempt to reduce childhood obesity within the UK.

Whilst much attention is placed on childhood obesity, there has been a lack of research conducted amongst students within higher education. The first year of university is identified as an 'at risk' period for body weight gain (Brown, 2008; Sprake et al., 2017), with students commonly developing less healthy eating behaviours (Tanton, Dodd, Woodfield, & Mabhala, 2015). Transition to university creates a change in support networks and social norms (Tanton et al., 2015), with it often being the first time an individual has lived away from home, and has had the responsibility of preparing all their own meals. Barriers to healthy eating are access to unhealthy foods, the time taken to prepare healthy foods and a lack of motivation to cook healthy foods (Ashton, Hutchesson, Rollo, Morgan, & Collins, 2016; Escoto, Laska, Larson, Neumark-Sztainer, & Hannan, 2012; McMorrow, Ludbrook, Macdiarmid, & Olajide, 2017), with weight gain being particularly evident in students who live on campus (Tanton et al., 2015).

With transition to university creating a number of changes within an individual's life, it can be a stressful period, having the potential to have a negative impact on health-related behaviours (Quick & Byrd-Bredbenner, 2013). Stressed individuals within the general population often consume more food (Mouchacca, Abbott, & Ball, 2013; Tomiyama, Dallman, & Epel, 2011; Torres & Nowson, 2007). Research indicates that acute and chronic stress are associated with a higher caloric intake of sweet and high fat foods (Blyderveen et al., 2016; Tomiyama et al., 2012; Dallman, 2010; Tryon, Carter, Decant, & Laugero, 2013), as well as a higher intake of saturated fats (Roberts, Campbell, & Troop, 2014), with such eating behaviours contributing to weight dysregulation.

With stress having the potential to make students vulnerable to becoming external eaters (i.e., responding to external cues rather than internal cues such as hunger – Nolan & Geliebter, 2012), and by consid-

ering the barriers to healthy food choices amongst students (Beerman, Jennings, & Crawford, 1990), the need for interventions to increase students' awareness of eating has been highlighted (El Ansari, Suominen, & Samara, 2015). Students who are stressed and non-resilient display more problematic eating behaviours, where stress management tools could not only be used to relieve stress, but also decrease students' consumption of unhealthy foods (O'Connor, Armitage, & Ferguson, 2015). Research suggests that mindfulness alleviates stress and increases students' awareness of hunger and satiety cues (Tsenkova, Boylan, & Ryff, 2013).

Mindfulness-Based Stress Reduction (MBSR – Kabat-Zinn, 1982) is practised in the form of meditation where individuals learn to be aware of the present moment in a non-judgemental way, reducing stress and negative emotions such as impatience and frustration (e.g., Kabat-Zinn, 1982; Khoury, Sharma, Rush, & Fournier, 2015). Mindfulness has been used to reduce academic stress amongst students, where academic benefits and a positive impact on psychological wellbeing were observed (Hjeltnes, Binder, Moltu, & Dundas, 2015; Iranzobennett, Egan, Cook, & Mantzios, 2018). Therefore, stressors and stress are positively influenced through mindfulness practices.

In addition to tackling stress, mindfulness has also been used to increase awareness of eating and food, with such practices being referred to as mindful eating (Brunt, Berdal, & Stastny, 2013; Moor, Scott, & McIntosh, 2013). Mindful eating assists in the gradual change of external to internal eating, promoting healthier eating behaviours (Mantzios & Wilson, 2014, 2015a,b; Mantzios & Giannou, 2014), such as an increased intake of fruit and vegetables (Gilbert & Waltz, 2010), as well as a reduction in the consumption of high sugar and energy-dense foods (Mason et al., 2016). Research has found a negative association between mindful eating and fat and sugar consumption (Mantzios, Egan, Hussein, Keyte, & Bahia, 2018b), grazing (Mantzios, Egan, Bahia, Hussein, & Keyte, 2018a), motivations to eat palatable foods (Mantzios & Egan, 2018), as well as weight gain (Mantzios, Wilson, Linnell, & Morris, 2014). Alliro et al. (2018) recently reported that brief exposure to mindfulness meditation through a video format increased attention and resulted in better decisions regarding the consumption of healthier foods.

Despite previous literature stating that mindfulness may require regular practice to be effective (Mantzios & Giannou, 2018), this research focused on the immediate effect of mindfulness practice through experimental design with short interventions observed in other eating and/or mindfulness research (Jenkins & Tapper, 2014; Zeidan, Gordon, Merchant, & Goolkasian, 2010). The current study

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aimed to investigate the impact mindfulness has in the decision-making and consumption of healthy foods among higher education students. The primary aim was to investigate whether brief exposure to mindfulness meditation offers a solution in reducing unhealthy eating and increasing healthy eating in response to stress amongst university students, when healthy and unhealthy choices are available. We hypothesised that participants in the mindfulness condition would chose healthy (over unhealthy) snacks, and consume less food when compared to a control group.

## PARTICIPANTS AND PROCEDURE

### DESIGN

A between-subjects design was used to investigate the impact mindfulness had on students' eating choices and consumption levels in response to stress. Participants were randomly allocated to one of two groups consisting of a control condition and an experimental condition.

### PARTICIPANTS

Ninety students were recruited ( $M = 20.70$  years,  $SD = 2.17$ ) through opportunity sampling at a West Midlands University in the United Kingdom. Forty-five participants were randomly allocated to the control condition where they were provided with a nature audiobook file, whilst the remaining 45 participants joined the experimental condition where mindfulness meditation was used. Participants were excluded if they had a previous or current diagnosis of eating disorders. No prior exposure to mindfulness practice was required, with this not been controlled for within the analysis.

Sixteen participants (7 participants from the mindfulness condition, 9 participants from the control condition) were eliminated due to the stress-inducing task having no effect on their anxiety levels. After elimination, a total of 74 participants were used ( $M = 20.72$ ,  $SD = 2.32$ ).

### MATERIALS

*Stress-Inducing Task.* Ten unsolvable and ten solvable anagrams were used from the Aspinwall and Richter (1999) study as a stress-inducing task (Zellner et al., 2006). The anagrams were presented in the form of a PowerPoint presentation on a computer, with each slide presented at a 10-second interval. Participants recorded their answers on a response sheet. The researcher gave participants verbal instructions, recit-

ing *You will be taking part in a task that requires you to solve these anagrams. Most participants completed all the anagrams correctly, and very rarely one or two mistakes were spotted.*

*State Trait Anxiety Inventory (STAI) Short Form.* The STAI Short Form was given to participants on three separate occasions (1: before the stress-inducing task; 2: after the stress-inducing task; 3: after listening to the audio file) in the control and experimental conditions to measure how the individual felt at the present moment, recording their anxiety levels (Martean & Bekker, 1992). The STAI Short Form includes six items with a four-point scale ranging from 6 to 24 points. The questionnaire contains three items which are reverse-scored ("I feel calm", "I am relaxed" and "I feel content") and three items which are not reverse-scored ("I am tense", "I feel upset" and "I am worried"). The original scale has shown a Cronbach's  $\alpha$  of .95, with the current study displaying a Cronbach's  $\alpha$  of .78 before the stress task, .85 after the stress task and .83 after the audio file was employed.

*Audio files.* Participants from the control condition listened to a nature audiobook file which lasted for 12 minutes and 14 seconds as a control intervention as used in previous research (Zeidan, Johnson, Diamond, David, & Goolkasian, 2010; White, 1908). The experimental condition subjected listened to a guided-mindfulness meditation audio file, which lasted for 12 minutes and 16 seconds (Mantzios, 2016), allowing participants to practise mindfulness breathing meditation. This involved participants following through a series of breathing practices, with no information about food being recited.

*Food types.* Grapes and chocolates were presented on a plate. Twenty pieces of each food were provided. Portion sizes were kept consistent as inconsistency can influence the amount of food intake within individuals who are or not under the influence of mindfulness (Cavanagh, Vartanian, Herman, & Polivy, 2013). Grapes were selected as the healthy option, with research indicating that students consume less healthy foods when stressed (Unusan, 2006). Chocolate pieces of Galaxy Minstrels were chosen as the unhealthy option as research indicates that individuals snack on chocolate more when compared to crisps and biscuits (Wallis & Hetherington, 2009). Whilst grapes do contain high levels of natural sugars, compared to chocolates grapes contain less fat and more protein and are consequently considered to be more "healthy" than chocolates (Langlet, Fagerberg, Glossner, & Ioakimidis, 2017; Zellner et al., 2006). Both grapes and chocolates were chosen due to them being "sweet" foods, with research indicating that students consume more sweet foods when stressed, in comparison to other food types (Emond et al., 2016; Kim, Yang, Kim, & Lim, 2013).

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Table 1

Means, standard deviations and 95% confidence intervals of STAI scores for each condition

Condition	STAI scores	M	SD	Confidence interval	
				Lower bound	Upper bound
Mindfulness	Before stress	9.84	3.16	8.90	10.79
	After stress	15.00	4.59	13.62	16.38
	After Condition	9.47	3.81	8.32	10.61
Control	Before stress	10.09	3.27	9.11	11.07
	After stress	14.71	4.66	13.31	16.11
	After condition	10.24	3.59	9.17	11.32

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Table 2

Means and standard deviations of food consumption within each condition

Condition	Food	M	SD
Mindfulness	Grapes	3.13	4.78
	Chocolate	1.93	3.44
Control	Grapes	5.53	6.88
	Chocolate	5.07	6.37

## PROCEDURE

The experiment was conducted within a laboratory setting lasting 35 minutes. Participant information was given verbally and in a hard copy. On receiving informed consent, the STAI was administered through an online Google Forms application. Once completed, participants were required to complete the anagram stress task. Instructions were given to participants verbally and on the computer screen. The participants were provided with a response sheet to record their answers from the stress task. On completion of the stress task, participants were asked again to complete the STAI. Participants were then allocated to either the control or experimental condition to listen to the relevant audio file. Once participants had listened to either the mindfulness meditation or the nature audiobook file, they once again completed the STAI. On completion, participants were given grapes and chocolates for ten minutes without the presence of the researcher as a token of appreciation for their participation. The researcher then re-entered the room and debriefed the participant verbally and in writing. Since participants were blind to the aim of the study, a second consent form was provided to participants to approve their data being used regarding their food consumption and choice. All participation was voluntary and participants could withdraw from the study at any time during and after their participation. Ethical approval was obtained by the Ethics Committee in the Department of Psychology of the host institution.

## ANALYSIS

SPSS V23 was used to perform statistical analysis. Descriptive statistics (including the mean and standard deviation), Cronbach's  $\alpha$ , and two-way between-groups ANOVA were conducted.

## RESULTS

Parametric assumptions were met. Table 1 shows the means, standard deviations and the 95% confidence intervals for the STAI scores before the stress task, after the stress task and after the application of audio files for the mindfulness and control condition.

### INTERVENTION-TO-TREAT-ANALYSIS

A two-way between-groups ANOVA was conducted to explore the impact of mindfulness on grape consumption between mindfulness and control conditions. There was a non-significant main effect for mindfulness [ $F(1, 88) = 3.69, p = .058$ ].

A two-way between-groups ANOVA was conducted to explore the impact of mindfulness on chocolate consumption between mindfulness and control conditions. There was a statistically significant main effect for mindfulness [ $F(1, 88) = 8.43, p = .005$ ] with a large effect size (partial eta squared = .09). Table 2 displays the means and standard deviations of participants' food consumption. Participants within the mindfulness condition consumed fewer chocolates. Overall, participants consumed more food (grapes and chocolates) in the control condition.

### MAIN ANALYSIS

Further analyses were conducted when excluding participants who were not influenced by the mindfulness practice. We used anxiety reduction as a manipulation check and excluded participants who did not display a decline as observed in mindfulness

practices. A two-way between-groups ANOVA was conducted to explore the impact of mindfulness on grape consumption between mindfulness and control conditions. There was a statistically significant main effect for mindfulness [ $F(1, 72) = 4.56, p = .036$ ] with a medium effect size (partial eta squared = .06).

A two-way between-groups ANOVA was conducted to explore the impact of mindfulness on chocolate consumption between mindfulness and control conditions. There was a statistically significant main effect for mindfulness [ $F(1, 72) = 6.11, p = .016$ ] and the effect size was medium-large (partial eta squared = .09).

Table 3 displays the means and standard deviations of participants' food consumption after the elimination of participants. The results demonstrate that grapes were consumed more in the control condition than the mindfulness condition.

## DISCUSSION

The current study aimed to investigate the impact mindfulness has in the decision-making and consumption of healthy food choices within a stressful environment amongst students in higher education. The findings suggest that mindfulness meditation presented as an audio file has the potential to promote healthy eating behaviours amongst students, with participants consuming more grapes than chocolates within the mindfulness condition when stress reduction was successful.

These findings are consistent with the findings of Hjeltnes et al. (2015), who explored mindfulness as a method to alleviate the academic stress experienced by students. However, unlike Hjeltnes et al.'s (2015) research, the current study also investigated the impact that mindfulness has on the stress response (i.e., eating), with participants within the mindfulness condition consuming more healthy foods. The results of the current study were also consistent with previous research, which found that increasing an individual's awareness of how they eat (Ouwens, Schiffer, Visser, Raeijmaekers, & Nyklicek, 2015) increases their likelihood of consuming healthier foods (Tsenkova et al., 2013). Evidently, mindfulness has the potential to promote healthy snacking, as demonstrated in previous research (Mantzios & Egan, 2018; Mantzios et al., 2018a,b; Tanton et al., 2015).

Overall, this research provides insight into interventions that could be implemented into higher education to promote both physical and psychological wellbeing. Nonetheless, limitations of this research do need to be acknowledged. Firstly, no prior exposure to mindfulness practice was required to participate within this research, and exposure to mindfulness over longer durations and/or controlling for trait mindfulness would give more information to

Table 3

*Means and standard deviations of food consumption within each condition after elimination of participants*

Condition	Food	M	SD
Mindfulness	Grapes	3.08	5.09
	Chocolate	2.21	3.67
Control	Grapes	6.14	7.12
	Chocolate	5.33	6.82

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propose practices. It is suggested for future research that differences in exposure to mindfulness, longitudinal interventions and individual differences be explored to ensure the effectiveness of different groups, as it is plausible that those who score higher in trait mindfulness may have responded more positively to the mindfulness audio file.

Additionally, participants were required to complete the STAI on three occasions. This repeated exposure had the potential to result in participants rehearsing the items on the STAI, creating carry-over effects; which, in turn, could have led to fatigue and boredom (Bergh & Vrana, 1998). Furthermore, the current study only used sweet foods (grapes and chocolate), whereas students are exposed to a wide range of foods such as savoury snacks. As previous research has established that there is an increase in students' consumption of sweet food during academic stress (Emond et al., 2016), future research should expose students to a variety of healthy and unhealthy sweet and salty foods, to provide a more realistic view on students' consumption of foods within a stressful setting (Mikolajczyk, Ansari, & Maxwell, 2009). Lastly, the portion of food exposed within the current study was kept equal; however, students are exposed to snacks with different portion sizes, which influences their food intake. Future research should take into consideration the amount of food exposed to, as keeping a record of portion sizes may result in participants being prone to engage in external eating.

Overall, the current study supported the notion that eating in response to stress can be influenced by mindfulness (Hussein, Egan, & Mantzios, 2017; Jordan, Wang, Donatoni, & Meier, 2014; Marchiori & Papias, 2014). The findings suggest that universities should provide awareness on healthy eating by promoting mindfulness and mindful eating (Blotnick, Mann, & Joy, 2015; El Ansari et al., 2015; Mantzios & Giannou, 2014; Pool, Delplanque, Coppin, & Sander, 2015). However, when mindfulness meditation is not working for an individual in the capacity of an audio file, the ability to explore and enhance other practices, such as mindfulness colouring books, is vital in assisting the enhancement of physiological and psychological health (Mantzios & Giannou, 2018;

Krusche, Cyhlarova, King, & Williams, 2012). This research provides practical insight into the need for mindfulness-based interventions or attentive eating protocols to be integrated into universities to help students lead healthier lives during periods of stress during and after higher education.

*The study was approved by the Ethical Review Board of the university, and was in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Helsinki Declaration and its later amendments. Informed written consent was obtained prior to the experiment. This article does not concern any studies with animals.*

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