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The effect of a 5-minute body scan mindfulness intervention on healthier food choices

Kaylea B. Hopfer [1,*], Di Fang [2], Darya L. Zabelina [3], Yung Hung [4], Joshua D. Upshaw [3] and Rodolfo M. Nayga Jr. [5]

[1]Department of Agricultural Economics & Agribusiness, University of Arkansas, Fayetteville, AR, USA
[2]Department of Food and Resource Economics, University of Florida, Gainesville, FL, USA
[3]Department of Psychological Science, University of Arkansas, Fayetteville, AR, USA
[4]Department of Agricultural Economics, Ghent University, Ghent, Belgium
[5]Department of Agricultural Economics, Texas A&M University, College Station, TX, USA

*Corresponding author: 217 Agriculture Building, University of Arkansas, Fayetteville, AR 72701, USA. Tel: 405-535-5950; E-mail: kbhopfer@uark.edu

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Abstract

The effects of mindfulness interventions on food purchases and consumption are popular topics. Recent studies focus on mindfulness interventions that target overweight and obese populations. We measure the effects of a guided 5-minute body scan mindfulness intervention on 'healthier' food purchases in an online experiment. Specifically, we use a choice experiment approach with a between-subject design to evaluate participants' choices of unhealthy/healthier foods. Results revealed the mindfulness intervention effectively increased state mindfulness in the treatment group. The treatment had a positive and significant effect on the overweight subsample. Additionally, we found nutrition knowledge to have a positive and significant effect on 'healthier' food choices across three regression models and various subsamples. Our findings suggest that mindfulness interventions may be a useful, low-cost alternative to current weight loss strategies, especially for overweight and obese individuals. In addition, our findings point to the importance of nutrition knowledge in promoting 'healthier' food choices.

Keywords: Obesity, mindfulness intervention, food choice, healthy food choices, time preference, nutrition knowledge

JEL codes: I10, I12

1. Introduction

Existing some 2,500 years in Buddhist culture, the concept of mindfulness began with the historic Buddha teaching and practicing mindfulness himself (Shonin et al. 2015). Though many delineations of early mindfulness definitions exist, the concept can be summarized in stating, 'mindfulness entails being fully aware of what is unfolding in the here and now' (Shonin et al. 2015). While historically a Buddhist practice, no specific religious beliefs are required to practice the meditation form, which piqued the interest of Dr Jon Kabat-Zinn, a researcher in the health realm beginning in 1982 (Kabat-Zinn 1982). Dr Kabat-Zinn, widely

considered an expert in the mindfulness field, worked with chronic pain patients and eventually developed the meditation style Mindfulness-Based Stress Reduction (MBSR). He found MBSR to be an effective behavioral program for the chronic pain patients' self-regulation of pain (Kabat-Zinn 1982). MBSR is now the basis of numerous body-scan meditation methods, including the 5-minute body scan technique developed by Elisha Goldstein (Stahl and Goldstein 2019).

The long history between mindfulness and pain management has paved the way for MBSR's recent popularity as a tool utilized by researchers in food consumption, specifically with overweight and obese populations (Mantzios and Wilson 2015; Ruffault et al. 2017). Research indicates that mind-body use is more common among normal-weight individuals than among overweight and obese individuals (Camilleri et al. 2016). Further findings indicate that mindfulness training increases positive effects in weight loss trials in overweight and obese populations (Dalen et al. 2010; Ruffault et al. 2017). Among others, two main tools have risen to the top in assessing the impact of mindfulness: the Mindful Attention Awareness Scale (MAAS) (Brown and Ryan 2003) and the Toronto Mindfulness Scale (TMS; Lau et al. 2006). MAAS is used to measure an individual's trait mindfulness; how mindful they are dispositionally. TMS is used to measure an individual's state mindfulness, how mindful they are in the moment, especially as a reaction to stimuli. General understanding indicates that an individual has a fairly stable trait mindful disposition while state mindful levels are more easily altered (Mahmood et al. 2016); this holds even in an online setting (Cavanagh et al. 2013; Mahmood et al. 2016).

Previous research finds that individuals who are more mindful are better able to avoid automatic behaviors and evaluate the situation at hand (Pagnini and Phillips 2015), exhibit increased ethical behavior (Ruedy and Schweitzer 2010), and show greater levels of self-control under conditions of limited resources (Friese et al. 2012). When assessing dietary consumption, weight loss practice, and other health indicators these high levels of evaluative skills play an active role (Mantzios and Wilson 2015).

The effects of mindfulness on food purchases and food consumption are popular topics (Fischer et al. 2017; Stanszus et al. 2017). This is due, in part, to our society's on-going battle against obesity (Mantzios and Wilson 2015; Ruffault et al. 2017), which has been a prevalent public health issue (CDC 2012). Recent findings indicate that for adults who are overweight and obese, mindfulness practices are less commonly utilized, and crucially, mindfulness training has been shown to produce positive effects (i.e. reduced binge eating and weight loss) for these groups of people (Dalen et al. 2010; Camilleri et al. 2016; Ruffault et al. 2017). In addition, mindfulness interventions can enhance an individual's ability to eat intuitively based on bodily signals of hunger (Palascha et al. 2021).

Interventions that target obesity are costly (Deitz & Gortmaker 2016). This concern for cost positions mindfulness interventions to be more desirable, especially given the increasing popularity of digital health (Sallis 2012; Murray et al. 2016). Mindfulness interventions, when delivered online, are a feasible, low-cost alternative to current weight loss programs (O'Reilly et al. 2014; Mantzios and Wilson 2015).

While the effects of mindfulness have been extensively researched in the areas such as weight loss and food intake (Mantzios and Wilson 2015; Ruffault et al. 2017), the effects of mindfulness on healthier food purchases have not yet been explored.

The objective of the current study was to determine whether an online mindfulness intervention influences consumers' food purchases in a hypothetical food choice task. In particular, we employed a 5-minute body scan similar to Mahmood et al. (2016) and observed the number of 'healthier' food items chosen in a choice experiment. We hypothesized that participants who underwent the mindfulness body scan, compared to a control group, would choose 'healthier' food options more frequently.

Please choose the product you prefer
recall that each item is the **SAME PRICE**

Figure 1. 1 of 20 food choice sets presented to participants.

2. Methods

2.1 Study design

We implemented a food choice task, where a between-subject design (Charness et al. 2012) was employed to evaluate participants' choices of unhealthy/healthier foods (Vermeulen et al. 2008). This study was approved by the local Institutional Review Board at an American University. We followed Segovia et al. (2019) in their approach of presenting an image of food and a 'healthier' version of the same food; all food items chosen were shelf-stable and ready to eat. 'Healthier' in this study is defined as having improved nutrition values compared to the original version of the same food, for example, original versus sugar-free Jello. All food items are ready-to-eat items that were carefully chosen to be similar in terms of packaging, flavor, and price. The variety of snack items provided participants with a vast menu of options in order to appeal to a variety of food preferences. Slight price variation between each set of items exists in the market; however, no price variation exists between the two items in each binary set. A full list of choice set items is available in online appendix. Each of the 20 food choice sets was presented individually to the subjects. The order of items and position of items on the screen (i.e. right or left) were randomized across subjects. Instructions appeared at the top of the screen for each set of items, 'Please choose the product you prefer recall that each item is the **SAME PRICE**'. The task consisted of 20 binary choice sets; Fig. 1 shows an example of a choice set from the task.

Participants were randomly assigned to a control group or a mindfulness treatment group. Participants in the treatment group were presented with the body scan mindfulness intervention. Following the intervention, participants completed the food choice task. Participants in the control group were presented with neutral information, which was followed by the food choice task.

2.2 Setting

The setting of this study was online. Surveys were administered through Prolific.com between 24 July and 27 July 2020. Prolific pre-recruited a representative sample of the US population based on age, sex, and ethnicity. Participant samples were recruited through

social media (Facebook, Twitter, and blog posts), flyer campaigns at universities, and researcher referrals for survey purposes. When new surveys are posted on their platform, eligible participants are notified. Each participant received an incentive of $11.47/hour for completing the survey. Data collection was performed by Prolific and transferred to us for initial inspection of quality.

2.3 Data sources/measurement

The exposure/intervention was a body scan mindfulness intervention. In the treatment group, subjects were instructed to close their eyes and pay attention to specified parts of their bodies, moving from the feet up to the head. The intervention was pre-recorded with a male voice and lasted ~5 min. Subjects in the control group were presented with a 5-minute compilation of neutral information on glaciers (e.g. formation of glaciers and where they are located), recorded by the same voice. To ensure the exposure/intervention, subjects were unable to advance until after the 5-minute intervention completion time.

We assessed subjects' levels of mindfulness in two ways: trait mindfulness (i.e. MAAS) and state mindfulness (i.e. TMS). MAAS is a series of 15 questions answered on a six-point scale ranging from '*Always*' to '*Never*' (Brown and Ryan 2003). The answers are averaged to determine the participant's trait mindfulness score. TMS is a series of 13 questions answered on a five-point scale ranging from '*Not at all*' to '*Very much*' (Lau et al. 2006). The questions are divided into two subcategories: curiosity and decentering. The answers are averaged for each of the subcategories to determine the participant's state mindfulness score. State mindfulness was measured both before and after the intervention due to potential fluctuations in state mindful levels as mentioned above.

Time preference was measured using the consideration of future consequences (CFC; Strathman et al. 1994). CFC is a series of 14 questions answered on a seven-point scale ranging from 'Not at all like me' to 'Very much like me.' The answers were split into two categories and assigned a numeric value, which is then averaged to determine the participant's preference toward the future or present. Nutrition knowledge was measured based on familiarity with the nutrient content of foods regularly purchased, extent of knowledge of the nutrient content of foods regularly purchased, and belief in health claims on food products (i.e. 'low-fat', 'high fiber', etc.) (Drichoutis 2005).

Additional health measurements, trust in labels, and diet adherence questions were also inquired (Zaichkowsky 1985; Steptoe et al. 1995; Bjorner et al. 2013; Fang et al. 2019). General demographic information was also collected.

2.4 Bias

Bias could occur in hypothetical choice tasks (Brummett et al. 2007; Silva et al. 2011, 2012). Consequently, we included a cheap talk script to reduce potential hypothetical bias (Brummett et al. 2007; Silva et al. 2011, 2012). A cheap talk script was given at the beginning of the choice task to encourage participants to behave as they would in a retail store. Similarly, an oath was included at the beginning of the survey to commit participants to truthful answers (Carlsson et al. 2013; Jacquemet et al. 2013).

2.5 Study size

The study size was determined with a power analysis conducted using G*Power ©. The minimum required sample size to determine small effect (i.e. $d = 0.20$) at the commonly accepted power of 80 percent is 620. Therefore, we recruited 634 participants initially via Prolific.com.

2.6 Variables

The outcome variable was the total number of 'healthier' food items. It was measured by summing the number of 'healthier' items the participant chose out of the 20 total choices. Our exposure/intervention was the 5-minute body scan adapted from Stahl and Goldstein (2019). The intervention was found to increase participant's mindfulness (Mahmood et al. 2016).

We also measured and examined several potential confounds. De Marchi et al. (2016) found that consumers' time preferences have a significant influence on their valuation of health claims and calorie information present on packaging. For instance, consumers who are more future-oriented tend to make healthier purchase decisions because they envision the effects their consumption has on their 'future-self.' Another variable is nutrition knowledge. People who are more conscious about nutrition have been found to be more likely to purchase healthier foods (Drichoutis 2005; Fang et al. 2019).

2.7 Statistical methods

Three statistical methods were employed: ordinary least squares (OLS), Poisson, and negative binomial (NB) regressions (Wooldridge 2019). All statistical analyses were performed using R© version 4.0.2 (2020-06-22). OLS models allow for flexible specification, while Poisson and NB models can address the unique features of count data. There were no missing data in the sample.

As mentioned, the outcome variable was the total number of 'healthier' items chosen out of the 20 food choice task questions. The variable of interest was a dummy variable indicating the mindfulness intervention or treatment. Potential confounds were controlled with a list of covariates, including CFC, health importance, health interest, health perception, nutrition knowledge, special diet, age, gender, body mass index (BMI), education, race, and income. Specifically, all health indicators were continuous variables created by averaging numerical values, which correspond to question set answers. Special diet was a binary variable with 'Yes' being equal to 1. Gender was defined as male, female, and other. Age was a self-reported continuous variable, which we re-arranged to categorical with three groups: 39 and below, 40–59, and 60 and above. Education was a binary variable equal to 1 for individuals who have a bachelor's degree or higher. Race was defined as a binary variable, where White or Caucasian was equal to 1. Income was defined as a categorical variable with seven groups: $0–$14 999; $15,000–$29,999; $30,000–$44,999; $45,000–$59,999; $60,000–$74,999; $75,000–$89,999; $90,000 or more. Self-reported height and weight were used to calculate BMI scores, which were converted to a binary variable where a BMI of 25 or greater was equal to 1.

We also estimated models for the following subsamples: (1) overweight respondents; (2) normal and underweight respondents; (3) males; (4) females; (5) older respondents (age group 60+); (6) middle-aged respondents (age group 40–59); (7) younger respondents (age group 18–39); (8) respondents on a special diet; (9) respondents not on a special diet; (10) respondents with a bachelor's degree; (11) respondents without a bachelor's degree; (12) Caucasian respondents; and (13) non-Caucasian respondents.

3. Results

3.1 Participants

Our initial sample included 634 participants. We removed ten individuals due to failed oath commitment. After random assignment, the treatment group had 309 individuals, and the control group had 315 individuals. Only people who demonstrated an increase in state mindfulness were included in the analyses; therefore, we further removed 118 individuals

Table 1. Descriptive statistics.

	Treatment ($n = 191$)		Control ($n = 315$)	
Variable	Mean	SD	Mean	SD
Number 'Healthier' choices	7.995	4.551	7.825	4.807
TMS1 decentering	2.291	0.916	2.214	0.987
TMS1 curiosity	1.702	0.62	1.671	0.698
TMS2 decentering	2.661	0.906	1.734	1.126
TMS2 curiosity	2.485	0.693	1.741	0.872
Average response time	10.159	8.394	9.442	5.078
CFC score	4.89	0.903	4.806	0.928
MAAS score	3.872	0.912	3.83	0.857
Health importance	5.616	1.08	5.633	1.138
Health interest	5.337	1.225	5.396	1.222
Health perception	4.5	1.397	4.619	1.418
Nutrition knowledge	3.319	0.679	3.347	0.674
Following a special diet	0.157	0.365	0.216	0.412
Age	45.77	15.749	44.921	15.892
Female	0.513	0.501	0.495	0.501
Other	0.01	0.102	0.016	0.125
Male	0.476	0.501	0.489	0.501
White	0.717	0.452	0.721	0.449
Bachelor's degree or higher	0.576	0.496	0.533	0.5
Income	4.508	2.436	4.581	2.562
BMI	27.266	6.59	27.513	6.778
Overweight+	0.571	0.496	0.587	0.493

from the treatment group whose state mindfulness did not increase following the intervention. The analysis sample was composed of 506 participants: 191 in the treatment group and 315 in the control group.

3.2 Descriptive data

In Table 1, we provide descriptive statistics for the demographic and behavioral variables obtained from the survey separately for the control and treatment groups. For the entire sample, the average CFC score for the sample was 4.84 out of 7, and the average MAAS score was 3.85 out of 6, with the higher score indicating a greater degree of mindfulness. Participants' self-reported height and weight were used to calculate BMI and classified following the Centers for Disease Control and Prevention (CDC 2020)s recommendation: normal weight ($\leq$24.9), overweight (25–29.9), or obese ($\geq$30). The average BMI for our sample was 27.4, which falls within the overweight category. Over half of our sample (58 percent) was part of the overweight/obese category, which would explain the high average. Given this, we also examined the overweight and obese subsample separately. On average annual income of the sample was between $45,000 and 75,000, and the average age was 45.24 years old. Half of the participants were female (50 percent), 55 percent indicated having a bachelor's degree or higher, and 72 percent identified themselves as White. Answers to the three nutrition knowledge questions were averaged based on numeric assignment, and subject scores were determined on a five-point scale (five being the best and one being the worst). Of the 506 participants, 79.2 percent ($n = 401$) score a three or higher on this scale, which indicates a relatively high 'nutrition knowledge.' When asked how they would rate their knowledge of nutrient content of the foods they regularly buy, 75.3 percent ($n = 381$), indicate their knowledge to be either good or very good. And when asked for how many

Table 2. Balance test results.

Variable	Treatment group mean $n = 191$	Control group mean $n = 315$	*P*-value
Number of 'Healthier' choices	8.00	7.83	0.695
MAAS	3.87	3.83	0.597
CFC	4.89	4.81	0.316
TMS1 D	2.29	2.21	0.387
TMS1 C	1.70	1.67	0.616
TMS2 D	2.66	1.73	<0.001
TMS2 C	2.49	1.74	<0.001
Health importance	5.62	5.63	0.876
Health interest	5.34	5.40	0.599
Health perception	4.50	4.62	0.358
Nutrition knowledge	3.32	3.347	0.655
Special diet	0.16	0.22	0.105
Age	45.77	44.92	0.559
Gender—female	0.51	0.50	0.698
BMI	27.27	27.51	0.687
Education	4.30	4.26	0.739
White	0.72	0.72	0.935
Income	4.51	4.58	0.751

of their regularly purchased products they know the nutrient content well, 51.6 percent ($n = 261$) answered either most or all of them.

The 5-minute body scan effectively increased state mindfulness in the treatment group, as illustrated with the ANOVA test in Table 2. The *P*-value (<0.001) indicates the difference in TMS iteration 2 between the treatment and control groups were statistically significant. That is, the mindfulness intervention successfully increased the state mindfulness in the treatment group. On the other hand, there were no significant differences between the treatment and control groups based on socio demographics, CFC, health importance, or nutrition knowledge, reflecting the success of the randomization of subjects to control and treatment groups.

3.3 Main results

The main results are presented in Table 3. The OLS results indicated that mindfulness did not have a significant effect on 'healthier' food choices (0.16; 95 percent confidence interval (CI): −0.65 to 0.96). This effect was consistent in Poisson and NB regressions, 0.02 (95 percent CI: −0.05 to 0.08) and 0.03 (95 percent CI: −0.08 to 0.13) in Poisson and NB, respectively. This means that although our intervention was able to increase state mindfulness, it demonstrated no effect on 'healthier' food choices. On the other hand, nutrition knowledge was found to be significant in all models (1.47, 95 percent CI: 0.79–2.14 in OLS; 0.20, 95 percent CI: 0.14–0.26 in Poisson; and 0.21, 95 percent CI: 0.12–0.30 in NB). Furthermore, reporting of being on a special diet was positively and significantly associated with a greater number of 'healthier' food choices. CFC, health importance, health interest, and health perception were not significantly associated with healthier food choices.

Results from a full sample without excluding those who did not increase their mindfulness can be found in online appendix Tables A4–A7. The treatment effect was positive, but not significant in the OLS model (0.02, 95 percent CI: −0.67 to 0.71). We found similar results using Poisson and NB (0.01, 95 percent CI: −0.05 to 0.06 in Poisson; 0.01, 95 percent CI: −0.08 to 0.10 in NB).

Table 3. Main results.

	OLS	Poisson	NB
Dependent variable: total number of healthy choices			
Treatment	0.16	0.02	0.03
	(−0.65, 0.96)	(−0.05, 0.08)	(−0.08, 0.13)
CFC score (time preference)	−0.27	−0.03	−0.02
	(−0.75, 0.21)	(−0.07, 0.01)	(−0.08, 0.04)
Health importance	0.35	0.05	0.06
	(−0.25, 0.95)	(−0.01, 0.10)	(−0.03, 0.14)
Health interest	0.51	0.08**	0.08*
	(0.00, 1.03)	(0.03, 0.12)	(0.00, 0.15)
Health perception	−0.12	−0.02	−0.03
	(−0.49, 0.24)	(−0.05, 0.01)	(−0.08, 0.02)
Nutrition knowledge	1.47***	0.20***	0.21***
	(0.79, 2.14)	(0.14, 0.26)	(0.12, 0.30)
On a special diet	1.26*	0.13***	0.13*
	(0.14, 2.39)	(0.06, 0.21)	(0.00, 0.26)
Age			
40–59	0.1	0.01	0.01
	(−0.84, 1.04)	(−0.07, 0.09)	(−0.12, 0.13)
60+	1.07*	0.13**	0.13
	(0.04, 2.11)	(0.04, 0.21)	(0.00, 0.25)
Gender			
Female	0.17	0.02	0.04
	(−0.62, 0.96)	(−0.04, 0.09)	(−0.06, 0.14)
Other	0.04	−0.19	−0.18
	(−2.74, 2.81)	(−0.57, 0.20)	(−0.76, 0.40)
BMI > 25	0.00471	0.01	0.013**
	(−0.83, 0.84)	(−0.06, 0.08)	(−0.09, 0.12)
Education	1.31**	0.17***	0.18
	(0.45, 2.16)	(0.10, 0.24)	(0.07, 0.30)
White	−0.16	−0.02	−0.03
	(−1.05, 0.72)	(−0.09, 0.05)	(−0.15, 0.08)
Income			
$15,000–30,000	0	0.01	0.05
	(−1.56, 1.57)	(−0.12, 0.15)	(−0.16, 0.27)
$30,000–45,000	0.24	0.03	0.05
	(−1.32, 1.79)	(−0.10, 0.16)	(−0.16, 0.26)
$45,000–60,000	0.84	0.12	0.16
	(−0.60, 2.29)	(−0.002, 0.25)	(−0.03, 0.35)
$60,000–75,000	−0.29	−0.02	0.01
	(−1.98, 1.40)	(−0.17, 0.12)	(−0.23, 0.24)
$75,000–90,000	−0.48	−0.03	−0.02
	(−2.30, 1.34)	(−0.18, 0.12)	(−0.26, 0.22)
$90,000+	0.13	0.02	0.06
	(−1.35, 1.61)	(−0.10, 0.14)	(−0.14, 0.26)
Constant	−1.34	0.72***	0.60*
	(−4.33,1.66)	(0.44, 0.99)	(0.14, 1.05)
Observations	506	506	506
R^2	0.196	NA	NA
Adjusted R^2	0.163	NA	NA
Residual std. error	4.308 (df = 485)	NA	NA
F statistic	5.905*** (df = 20; 485)	NA	NA
Log likelihood	NA	−1553.31	−1,429.71
theta	NA	NA	5.150*** (0.579)
Akaike inf. crit.	NA	3148.61	2,901.43

Note: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; intercept: special diet: not on a special diet, age: 18–39, gender: male, BMI: <25, education: no bachelor's degree, race: non-white, income: <15 K.

3.4 Subsample analyses

Additional analyses were conducted based on subsamples mentioned in the statistical methods section. The results can be found in online appendix Tables A1–A3. Notably in the overweight and obese subsample, the treatment effect was positive and significant (1.24, 95 percent CI: 0.19–2.29 in OLS; 0.15, 95 percent CI: 0.06–0.24 in Poisson; 0.15, 95 percent CI: 0.01–0.29 in NB). We found a heterogeneous effect in the normal and underweight groups where the treatment variable was once again not statistically significant (−1.23, 95 percent CI: −2.49 to 0.04 in OLS; −0.15, 95 percent CI: −0.31 to 0.01 in NB). We did not find significant treatment effect in the subsamples based on gender, age, special diet, education, or race.

Overall, we found nutrition knowledge to be the covariate that had the most consistently significant effect on 'healthier' food choices, as mentioned above. Though knowledge and familiarity with nutrition content seems to be high, in the overall sample we find that 73.91 percent ($n = 374$) of subjects only believe half or fewer of the health claims on food products. The impact of the nutrition knowledge variable was not significant across all three models in the 40–59 age group. The significance of this variable was confirmed in 11 out of 13 subsamples assessed in OLS (12 out of 13 in Poisson; 12 out of 13 in NB).

4. Discussion and conclusions

4.1 Key results

We add to the growing literature on mindfulness and obesity (Zhang et al. 2021), by examining the effects of a short-term mindfulness intervention on 'healthier' food choices in an online setting. Our results show no effect of mindfulness intervention in a normal weight subsample, but a positive and significant effect in the overweight and obese subsample. Considering, according to the Centers for Disease Control and Prevention (CDC 2021) that obesity is an on-going public health crisis, this finding is of significant value.

Moreover, we find nutrition knowledge to drive 'healthier' food choices. This echoes the findings of Fang et al. (2019) on the importance of nutrition knowledge. Contrary to previous findings by De Marchi et al. (2016), time preference was not significantly associated with 'healthier' food choices. Similarly, we did not find evidence to support the differing effects of mindfulness based on gender (Gilbert and Waltz 2010).

Even though we did not find mindfulness to influence 'healthier' food choices among normal weight participants, we were able to validate that the 5-minute body scan was effective in an online setting. Therefore, this practice can be generalized as a cost-effective alternative to current weight loss training (O'Reilly et al. 2014; Mantzios and Wilson 2015). By using a nationally representative adult sample, we provide additional evidence given that most past research studies were conducted with student samples (Tapper 2017). These findings should appeal to academics in the space of mindfulness studies and practitioners who seek to validate the importance of nutrition knowledge.

A limitation in this study is in the hypothetical nature. Therefore, future studies should confirm these findings in a non-hypothetical setting. Another potential limitation is social desirability, which indicates individuals have a tendency to give answers that make them 'look good' (Martin & Nagao 1989). Moreover, future research could consider investigating the impacts of a long-term mindfulness intervention.

Supplementary material

Supplementary data are available at *Q Open* online.

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