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# Healthy eating and sustainable nutrition through mindfulness? Mixed method results of a controlled intervention study

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ABSTRACT

Mindless eating is at the core of many ecological and social problems associated with modern nutritional behavior. Mindfulness training has been proven to be an efficient means for improving healthy nutrition. First, it enables reconnection with internal hunger and satiety cues, instead of external cues. Second, it supports making deliberate choices against unconscious eating patterns. It is less clear whether training in mindfulness can be similarly effective for sustainable nutritional habits, defined here as socially and ecologically responsible consumption behaviors over the whole consumption cycle. A controlled mixed method intervention study employed an adapted mindfulness-based intervention (MBI) to investigate such potential effects in a healthy, adult student population (n = 76/n = 11). Results from both qualitative and quantitative data indicate that the MBI exerts strong effects on mindful eating, whereas effects on sustainable nutritional behaviors are limited and only appear in the qualitative data as content concerning pre-behavioral stages of consumption, such as attitudes and intentions. First follow-up results suggest a slower process for changing nutritional behaviors toward more sustainable food choices. Based on the integrated mixed method results, we conclude that MBIs are an effective way to change unhealthy, mindless eating habits. To obtain stronger effects on sustainable nutritional behaviors, we suggest MBIs with a specific focus on sustainable nutritional behaviors and openly advertising the aim of the intervention in order to create a common intention in target groups who are looking for ways to put their altruistic intentions into practice, e.g. in sustainable consumption education programs.

## 1. Introduction

It is widely known that contemporary nutritional is related to multiple societal and environmental problems. These health problems of virtually epidemic proportion, such as obesity, are mainly found in the western hemisphere, and are rooted in the ongoing development of the global food system. The focus of production on processed, low-priced and highly marketed food (Swinburn et al., 2011) and changes in diet composition – for example, a shift towards higher intake of animal products – are key factors for associated problems (Tilman & Clark, 2014).

At the same time, modern developments in production and consumption of food have been singled out as a major cause of climate change (Steinfeld et al, 2006). According to leading international organizations and researchers, the food production sector causes, among other detriments, more greenhouse gas emissions relevant to climate change than any other industry (ibid.). Apart from environmentally-friendly food production, public health and social justice are both essential parts of the United Nations' Agenda for sustainable development (United Nations, 2017). Contemporary Western diets are a serious threat to this agenda, making the establishment of sustainable food production and consumption one of the main tasks for supporting sustainable development. Because the food industry is highly dependent on demand, consumers are especially responsible for contributing to the accomplishment of this task.

Many consumers in western countries seem to be inclined to eat more sustainably. For example, they express their intentions to consume less animal products and see this as one aspect of becoming healthier and protecting both the environment and animal welfare (Lee & Simpson, 2014; Radnitz, Beezhold, & DiMatteo, 2015). In Germany, for example, a willingness to reduce consumption of animal products is affirmed by two thirds of the population (Scholl, Gossen, Holzhauer, & Schipperges, 2016). Despite a recent slight decrease in meat consumption in western countries, overall consumption remains much higher than what is ecologically sustainable (Lee & Simpson, 2014). Pre-behavioral stages of consumption such as attitudes and intentions,

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which are deemed important predictors of sustainable behavior (Bamberg & Moeser, 2007), thus do not seem to translate into immediate behavioral change. Apart from extensive research concerning the attitude-behavior-gap (Kleinhückelkotten, Neitzke & Moser, 2016), there are many other explanatory approaches to this phenomenon (Dewaele et al., 2018). Frank (2017), for example, argues that people lack cognitive awareness about the realities of food production, consumption and the corresponding consequences for health, environment and animal welfare and that this lack of awareness is due to widespread dissociation between food production and consumption at both the societal and individual levels.

One approach that appears promising for tackling these challenges is the practice of mindfulness in the context of nutritional behavior. The general concept of mindfulness stems from Buddhist philosophy and psychology, where mindfulness is seen as an important means by which human tendencies toward greediness, aversion and delusional thinking can be counteracted, and ethical attitudes and behaviors cultivated that are oriented toward benevolent relations to the animate and inanimate world (Grossman, 2015). To cultivate mindfulness, a variety of practices can be used to systematically train awareness and emotional (non-) reactivity as well as enhance awareness of internal processes such as thoughts, emotions and bodily sensations (Chiesa & Malinowski, 2011). In particular, current research suggests that mindfulness practice can help individuals cultivate conscious and healthy eating behaviors (Beshara, Hutchinson, & Wilson, 2013; Kristeller, Wolever, & Sheets, 2014). Another strand of research suggests that mindfulness carries the potential to foster sustainable consumer behaviors (e.g. Rosenberg, 2004; Armstrong & Jackson, 2015; Ericson, Kjønstad, & Barstad, 2014; Fischer et al., 2017). However, empirical studies about the practice's potential to stimulate eating behaviors oriented toward the ecological and social dimension of sustainability remain absent.

This paper will contribute to closing this gap by investigating the effects of a consumption-specific mindfulness-based intervention (MBI) on mindful eating *and* sustainable nutritional behavior in a mixed method approach employing both qualitative and quantitative data. It is based on a larger research project called "BiNKA",[1] where the focus was to pioneer explorations into the general effects of a consumption-specific MBI.

After outlining the study's theoretical background, the research procedure is explained and findings are presented. The last part of the paper comprises a discussion of results, followed by a consideration of research limitations, and concluding remarks.

## 2. Mindfulness and nutritional behavior

Eating has been deemed an "overlearned behavior" (Mantzios & Wilson, 2015) that is carried out absent-mindedly, or "mindlessly" (Kristeller & Epel, 2014). Unconsciousness about our nutritional behavior extends from the origin of our daily meals, to "*what*" we eat, "*how much*", "*how*", and "*why*" we eat. This entails varying degrees of automaticity alongside strongly habitualized consumption patterns (van't Riet et al., 2011). As a consequence, eating is often initiated according to external, instead of internal, cues (e.g. mealtimes or other social pressures, instead of physical hunger). In fact, food-related behaviors are always embedded in socio-cultural and structural contexts, reducing consumers' reflexivity concerning personal intentions and attitudes, as well as their knowledge about the origins of food.

Furthermore, as Mantzios and Wilson (2015) point out, eating is often a reaction to impulses or it is an emotional coping strategy for avoiding or suppressing negative thoughts and emotions, instead of being primarily based on physical needs or rational argument. Thus, despite general willingness among consumers to eat in a healthy and more sustainable manner and an increasing awareness for this, strong habits and automaticity, impulsivity related to external triggers, and using food as a coping mechanism often restrict the control that people have over their food purchases and consumption (Bahl, Milne, Ross, & Chan, 2013).

More recently, scholars have suggested that the cultivation of *mindful nutritional behavior* could address these challenges (Bahl et al., 2013; Dutton, 2008; Marchiori & Papies, 2014). Using the definition of mindfulness *"as the unbiased awareness that emerges through intentionally and continuously paying attention to subjective momentary experience with an open, accepting, benevolent, and compassionate attitude"* (Boehme, Geiger, Grossman, Stanszus, & Schrader, 2016, p. 6), mindful nutritional behavior can be understood as nutritional behavior accompanied by an unbiased awareness of physical and emotional sensations, feelings and thoughts. This behavior includes shopping for food, eating, being otherwise exposed to food, as well as discarding food. To count as being mindful, all these ways of relating to food must be grounded in an open, accepting, benevolent, and compassionate attitude (see also Framson et al., 2009).

In fact, the practice of mindfulness has been successfully applied to reconnect people with healthy, mindful eating behavior (Bahl et al., 2013; Dutton, 2008; Marchiori & Papies, 2014). It has been particularly successful in supporting therapies for eating disorders, mainly binge eating and obesity (Alberts, Mulkens, Smeets, & Thewissen, 2010; Bahl et al., 2013; Godfrey, Gallo, & Afari, 2015; Kristeller et al., 2014; Miller, Kristeller, Headings, & Nagaraja, 2014; Warren, Smith, & Ashwell, 2017; Pinto-Gouveia et al., 2017). More specifically, it has been shown that combining mindfulness training with the intention to change eating behavior has an effect on the aforementioned psychological mechanisms of mindless eating. Reduced overall automaticity in eating and shopping for specific goods and increased non-reactivity to externally initialized cravings were shown by Jacobs, Cardaciotto, Block-Lerner, and McMahon (2013), Mantzios and Wilson (2015) and most recently by Tapper, Seguias, and Pathmanathan (2018). A rise in general awareness about eating behavior, reported in all studies, was often accompanied by increased responsiveness to internal, physical cues instead of impulsive or emotional triggers. The growth in awareness often extended to specifics such as *how* we eat (slow, fast, with distractions such as watching tv, reading, or day-dreaming) and *what* we eat, and resulted in a documented weakening of habitual patterns (Kristeller et al., 2014; Miller et al., 2014; Warren et al., 2017). This development also supported more deliberate and healthier choices (Bahl et al., 2013; Keesman, Aarts, Häfner, & Papies, 2018; Kristeller & Lieberstein, 2016; Warren et al., 2017). Further detailing which aspect of mindfulness supports these effects, Keesman, Aarts, Häfner, and Papies (2017) describe the facet "decentering". This facet of mindfulness describes the practice of distancing oneself from immediate sensations and focusing on the impermanence of one's state of mind, e.g. thoughts and bodily stimulations or cravings. According to the authors, decentering targets the underlying process of automatic food cue reactions in the body, consequently enabling a more deliberate, de-automatized choice of what and when to eat.

These various effects are interrelated and interdependent. However, it should be apparent that this seeming increase in general awareness allows for changes in habitual response patterns rooted in emotions and impulses. The ability to take a decentered perspective allows one to respond to inner satiety cues and in consequence leads to more deliberate and healthy choices. The evidence presented here suggests that mindfulness training enables people to understand and de-automatize their previous seemingly remote-controlled behavior and to increase their general health and well-being.

[1] The BiNKA-study, named after a German acronym for "Education for Sustainable Consumption through Mindfulness Training", hereinafter referred to as MBI or intervention, as this paper focusses only on a specific part of the bigger study. For further details about the background and the project see Stanszus et al. (2017).

## 3. Mindfulness and sustainable consumption

For similar reasons, multiple scholars have argued that mindfulness training may also have the potential to promote sustainable nutritional behavior. Such behavior is defined here according to the cube model of sustainable consumption behaviors (Geiger, Fischer, & Schrader, 2017) as individual acts for acquiring, using and disposing of food that do not compromise the ecological and socio-economic living conditions of any other people, currently living or in the future, in such a way that they can't satisfy their needs.

The literature suggests different mechanisms through which mindfulness can be cultivated, leading to increased sustainable consumption (for a more detailed discussion see Fischer, Stanszus, Geiger, Grossman, & Schrader, 2017; Geiger, Grossman, & Schrader, 2019):

1. *Disruption of routines*: as previously discussed regarding mindless eating, unconscious consumption routines can also entail unsustainable ones. By enhancing introspective capacities, mindfulness practice leads to an increased awareness of the inner states and processes that usually prompt habitual behaviors (Bahl et al., 2016; Rosenberg, 2004) and thus supports deliberate consumption choices. Concerning sustainable food consumption, Hunecke and Richter (2018) looked at the relationship between different facets of mindfulness and self-reported sustainable food consumption behavior. They found that one facet "acting with awareness", had a direct, positive relationship with sustainable food consumption behavior, supporting the argument for the first potential mechanism.
2. *Physical and psychological well-being*: as mentioned above, there is ample evidence that mindfulness practice is instrumental for physical and psychological health and well-being (Eberth & Sedlmeier, 2012; Grossman, Niemann, Schmidt, & Walach, 2004). Psychological well-being has been discussed both as a consequence of and a precondition for sustainable behavior (Corral Verdugo, 2012; Kasser, 2017), and physical health behavior was shown to correlate positively with ecological conservation behavior (Geiger, Otto, Schrader, 2017).
3. *Values*: Mindfulness practice may be conducive to the clarification of values and to supporting the role of intrinsic and socially oriented values in people's lives (Ericson et al., 2014; Kasser et al., 2014) and decreasing the importance of material values (Burroughs & Rindfleisch, 2002).
4. *Pro-sociality and compassion*: pro-social behaviors are explicitly increased through meditation practices (Leiberg, Klimecki, & Singer, 2011; Lim, Condon, & DeSteno, 2015). This process is seen to be initiated through the development of compassion (Condon, Desbordes, Miller, & DeSteno, 2013). Compassion and altruistic values in turn are positively linked to pro-environment intentions and behavior (deGroot & Steg, 2008; Geiger & Keller, 2017; Pfattheicher, Sassenrath, & Schindler, 2015).
5. *Congruence*: Self-perceived inattention to everyday experiences was found to be associated with a widening of the attitude-behavior gap (Chatzisarantis & Hagger, 2007; Ruffault, Bernier, Juge, & Fournier, 2016). As mindfulness implies the inverse of inattentiveness, i.e. enhanced awareness of immediate daily experiences, mindfulness may be associated with closure of the attitude-behavior gap. In the field of sustainable behaviors this would imply an enhancement of behaviors, as sustainability-related attitudes and intentions are usually rather high (Eurobarometer, 2014).

Expanding this topic specifically to nutritional behavior, Thích-Nhất-Hạnh and Cheung (2012) suggest that mindfulness practice could create a heightened awareness for the inter-connectedness of individual food consumption with broader consumption and production spheres. Rosenberg (2004) defends this assertion, suggesting that mindfulness training re-instills a sense of interrelatedness between people, supporting non-consumerist satisfiers for people's needs.

In conclusion, the aforementioned studies provide evidence for a relationship between mindful behavior and sustainable nutritional behaviors. However, individual mindful eating is not *per se* sustainable, as food production, use and disposal of foods might create social and environmental problems that undermine the agenda of sustainable development (Kjæ;rgård, Land, & Bransholm Pedersen, 2014). In this sense, the positive *self-oriented* aspects of mindful eating need to be accompanied by altruistic, or "*other-oriented" aspects* (environment, society) in order to become a promising practice for fostering sustainable consumption. No empirical inquiry has so far undertaken to find out whether the development of *mindful eating patterns* comes along with *sustainable consumption behaviors* reflecting such an orientation towards others.

This paper will contribute to closing this gap by exploring the following research questions:

1. Does the adapted MBI have effects on mindful eating, confirming previous positive research findings?
2. Does the MBI have effects on pre-behavioral stages of consumption such as intentions and attitudes, as predictors for sustainable eating behavior?[2]
3. Does the MBI have effects on participants' actual nutritional consumption behavior that is related to aspects of sustainability?

## 4. Methods & measures

### 4.1. Study design

For this intervention study, a fully integrated mixed method model design was used (Foscht, Angerer, & Swoboda, 2007). The design accounts A) for the pioneering, explorative character of the research and the lack of precise data about which facets of mindfulness are trained through which practices, as well as B) for the difficulties that have been reported by many other studies to measure mindfulness with quantitative self-report measures alone (see van Dam et al., 2018; Chiesa, 2013; Grossman, 2011) (See Fig. 1).

Mindfulness is a complex and multifaceted concept and, more importantly, a highly individual and subjective experience (Grossman, 2010). To be able to cover participants' experiences and the potential effects of the MBIs as holistically as possible and thus to answer criticism regarding measuring effects of mindfulness with a too narrow methodological approach, a quantitative pre-/post-/follow-up study was combined with in-depth, semi-structured interviews (with a representative sub-sample of participants post-intervention) for a joint analysis (Flick, 2014; Kuckartz, 2016). Equal importance was ascribed to the two databases. The research design can be described as a fully integrated method model (Foscht et al., 2007), because it allowed the integration of hypothesis testing and hypothesis generation in a single study as well as parallel data collection with a theoretical sampling and an integrative analysis strategy. As presented in Fig. 1, the design spanned all levels of the research process. Integrated research questions and, on the sample level, connecting quantitative and qualitative study through partly sub-sampling the interviewees according to quantitative results of the pre- and post-studies (sequential data collection) formed the basis of the design. On the data level, the qualitative interview guideline and the structuring of transcripts via the deductive codes

[2] We included pre-behavioral phases of consumption, such as attitudes and intentions (Bamberg & Moeser, 2007), for two reasons: First, they are thought to be relevant predictors for explaining actual behavior, especially in the area of nutritional behavior (e.g. Berndsen & van der Pligt, 2004). Second, the integration of different stages of the consumption process allowed for an inquiry into the relation between mindfulness and sustainable nutritional behavior on a larger scale. This accounts for the novelty of the research area and its explorative character.

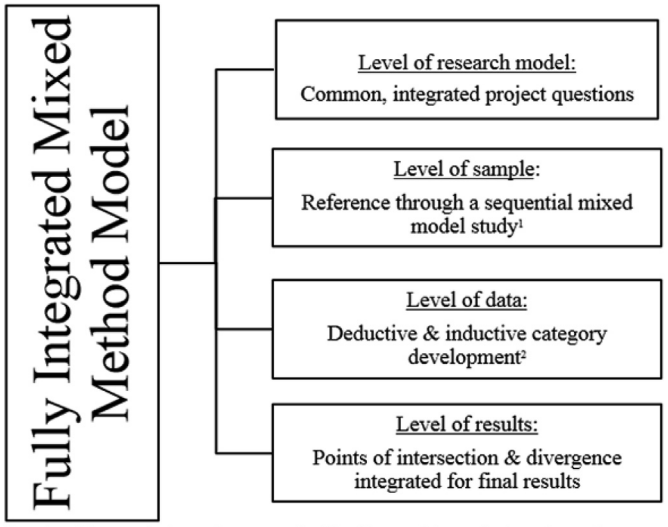


**Fig. 1.** Integrated mixed method model.

were based on the quantitative hypotheses and the corresponding variables. However, inductive categories were generated as well. The results were compared and interpreted together to create sound and synthesized results.

### 4.2. Procedure

The MBI was advertised to university students in Berlin[3] by means of an inter-university website connected to the sports program; announcements offered a stress-reduction program without disclosing the study's focus on consumption (the program was also conceived to enhance the well-being of attendees). In a pre-study meeting it was explained that students were expected to complete a series of questionnaires at different points in time in exchange for cost-free participation. Additionally, some students were asked to participate in a post-intervention interview. In accordance with ethical guidelines of the German Psychology Association, participation was completely voluntary, students were reimbursed in the form of a remitted course fee, and personal data at different measurement times were tracked via an anonymous personal code, so that individual persons could not be identified. Psychopathological conditions (e.g. clinical depression) were ruled out before the first session through a short screening executed by the mindfulness trainer. As no clinical population was involved and all participants were of legal age, a written statement was deemed unnecessary by the Ethical Committee of the Technische Universität Berlin.

Enrollees were randomly assigned to either the intervention group (IG), who received the mindfulness-based intervention (MBI) right away, or a wait-control group (CG) who received the MBI after the IG had finished. Three courses were run for each group, with group size varying between 12 and 13 participants, mirroring normal group sizes for MBSR-trainings.

Quantitative data on mindful and sustainable eating was gathered twice: within a week before the training started (pre) and within a week after the training was completed (post). In a follow-up measurement conducted seven months later, mindful eating was not assessed. Only the main variables of the general study on mindfulness and sustainable consumption were collected. Assessments were completed online. An invitation and two reminder emails were sent for each assessment.

The qualitative data was gathered through semi-structured interviews conducted post-intervention. Interviews were carried out by three main investigators from the project who were not involved in the teaching activities for the intervention. The interviews lasted between 35 and 70 min. All interviews were audiotaped and transcribed verbatim. Course participants also wrote diaries reporting their experiences of daily mindfulness practice. This was additionally included in the analysis.

### 4.3. Participants

We aimed at recruiting a minimum of 72 (12 × 6) participants, to mirror usual group size for MBSR courses, while ensuring $n > 30$ in the intervention and control group for minimum statistical robustness and allowing for potential dropouts. Slightly overbooking each course, we initially recruited $n = 79$ students to participate in the study. $n = 40$ were assigned to the intervention group (IG) and $n = 39$ to the wait group (CG), with a random shuffle function applied to the running subject number.

Three students dropped out of the intervention group before the training started, leaving a starting student sample of $n = 76$ ($n_{IG} = 37$/ $n_{CG} = 39$) with a mean age of $M = 31$ years, 73.4% were women. Nine women and two men (80% women, mean age $M = 30$ years) were selected for the semi-structured in-depth interviews. Five were selected on a random basis. The other 6 were selected because their quantitative results indicated extreme pre-post differences in either mindfulness or sustainable consumption measures. For various reasons some participants were unavailable. However, the final sample of interviewees represents a typical subsample of the entire cohort and is not a sample that tends toward the extreme ends of the quantitative data. The subsample thus does not differ from the whole sample in terms of age, gender, previous experience with mindfulness as well as results on mindfulness, mindful eating and sustainable consumption measures. Attendance of interviewees during the course was somewhat higher, as compared to the whole sample (see Table 1).

### 4.4. Intervention

The MBI included different exercises from sustainable consumption education programs put into the format of the well-established Mindfulness-based-stress-reduction (MBSR) program developed by Jon Kabat-Zinn (1991, c1990). Similar to the MBSR training, the consumption-specific MBI comprised eight weekly group sessions (of 90 min each), one additional half-day session after week six ("day of mindfulness", 4 h) and individual daily practice (20 min). The training included different meditation techniques (body scan, breathing meditation and loving-kindness or "metta" practice), as well as different educational formats such as group discussions, inquiry and guided reflections. Simple movement or yoga exercises were included, too. The first four weeks of the MBI were focused directly on cultivating mindfulness, on introducing the general concept of mindfulness, on obstacles and challenges in meditation and on the notions of dissatisfaction and emotional intelligence. Weeks five to eight subtly introduced the topic of consumption into the mindfulness framework and themes were addressed, such as needs and desires, compassion and kindness, mindful consumption and a world characterized by mindful awareness. The topic of nutrition was addressed with the standard MBSR raisin exercise (ibid.) daily homework (mindful intake of food and mindful grocery

[3] The issue concerning the market coverage of sustainable food alternatives and their availability is deemed an important driver for broader adoption of sustainable nutritional behaviors (Di Giulio et al., 2014). Individuals' food environment is highly relevant for food choices and can even influence social norms toward specific products (Frank, 2017). In this paper, however, the focus remains on individual behavior in the given context of the city of Berlin, Germany. Organic, vegetarian and even vegan food is abundant and available in all conventional supermarkets and a widespread network of organic supermarkets. The active and control groups (of the quantitative sample; there was no control group for the qualitative sample) were exposed to the same conditions for food choices, thus accounting for context effects.

**Table 1**
Demographic data of interview participants.

| No. | ID | Group | Frequency of participation | Age | Gender |
|---|---|---|---|---|---|
| 1 | IG1STU10 | IG | 9 | 30 | female |
| 2 | IG3STU12 | IG | 9 | 35 | female |
| 3 | IG3STU4 | IG | 9 | 41 | female |
| 4 | KG3STU9 | CG | 8 | 27 | male |
| 5 | IGSTUX* | IG | – | – | – |
| 6 | IG1STU2 | IG | 8 | 36 | female |
| 7 | IG2STU8 | IG | 8 | 30 | female |
| 8 | KG3STU2 | CG | 9 | 25 | female |
| 9 | KG3STU3 | CG | 8 | 29 | male |
| 10 | KG2STU17 | CG | 9 | 23 | female |
| 11 | KG2STU9 | CG | 7 | 30 | female |

*Note*: CG = (waiting list) control group. IG = Intervention group. 1–5 were chosen randomly *Values got lost.

shopping as informal exercises) and mindful eating exercises in the course (eating in silence as a group exercise during the day of mindfulness). For further details on how the training was developed and what it entails, see Stanszus et al., 2017.

## 5. Measures

### 5.1. Quantitative study

#### 5.1.1. General mindfulness

The *C*ompre*h*ensive *I*nventory of *M*indful *E*xperiences (CHIME) by Bergomi, Tschacher, and Kupper (2014) comprises 37 items to measure eight different facets: *acceptance (*e.g. "I see my mistakes and difficulties without judging myself"), *acting consciously* (e.g. "It is easy for me to stay focused on what I am doing"*), inner awareness* (e.g. "When I am sitting or lying, I perceive the sensations in my body"), *outer awareness* (e.g. "I perceive colors and shapes in nature clearly and consciously"), *decentering* (e.g. "In difficult situations, I can pause for a moment without reacting immediately"), *openness (*e.g. "I try to stay busy to keep specific thoughts or feelings from coming to my mind"), *relativity* (e.g. "In everyday life, I am aware that my view on things is subjective and does not necessarily correspond to facts") and *loving insight* (e.g. "When I have needlessly given myself a hard time, I can see it with a bit of humor"). All items were assessed on a 7-point frequency scale where only the two extremes were labelled, with "almost never" (0) and "almost always" (6). Analyses were based on the overall scale mean (Cronbach's $\alpha = .88$).

#### 5.1.2. Mindful eating

To assess mindful eating, a short version of the Mindful Eating Questionnaire by Framson et al. (2009) was constructed. Two items for each factor *disinhibition* ("I stop eating when I'm full, even when eating something I love"), a*wareness* ("Before I eat I take a moment to appreciate the colors and smells of my food"), *distraction* ("My thoughts tend to wander while I am eating") and *emotional response* ("When I'm sad I eat to feel better") were retained. Only one item for *external cues* ("I recognize when food advertisements make me want to eat") was retained because the second item showed negative loadings in a pre-test ("I recognize when I'm eating and not hungry."). As for the CHIME scale, all items were assessed on a 7-point frequency scale where only the two extremes were labelled, with "almost never" (0) and "almost always" (6), (Cronbach's $\alpha = .62$). For a full list of items, see supplementary material A.

#### 5.1.3. Attitudes towards sustainable food consumption

An attitudinal scale was constructed following the recommendations for measurements of attitudes by Ajzen (1991). The 8-item scale on attitudes for sustainable consumption behavior (A-$SCB_{NUTRITION}$: $\alpha = .65$) reflected the main aspects of the SCB-scale (e.g. "Fair prices for small scale farmers are important"). Items were assessed on a 7-point Likert scale with every second option labelled "completely disagree" (0), "rather disagree" (2), "rather agree" (4) and "completely agree" (6). For a full list of items, see supplementary material A.

#### 5.1.4. Sustainable food consumption

Sustainable food consumption was measured with the Sustainable Consumption Behavior- Nutrition ($SCB_{NUTRITION}$) scale by Geiger, Fischer, et al. (2017) and Geiger, Otto, et al. (2017). The 17-item scale ($\alpha = .73$) spans all three consumption phases and both dimensions of sustainability, ecological and socio-economic impacts (e.g. "I buy organically grown/fair trade products", "I cook in an energy-saving way" or "I buy snacks and drinks in one-way packaging"- which was reverse coded). Items were assessed on a 7-point scale with every second option labelled with "never" (0), "sometimes" (2), "often" (4) and "always" (6). Answers for daily behaviors (e.g. preferred main courses) were labelled with "never" (0), "once a week" (3) and "daily" (6). For a full list of items, see supplementary material A.

### 5.2. Qualitative study

#### 5.2.1. Interviews

Before the start of each interview, participants were asked for consent to audiotape the interview and were reminded of their voluntary attendance as well as their right to not answers or to stop the interview. After the official procedure, participants were invited to complete a 1-min breathing meditation to settle into the interviewing space and set the focus for the dialogue. To account for both the explorative character of the study and to gather data on the specific research questions, the interview guideline was developed in two parts. The first part of the interview invited open-ended responses about participants' general experiences in the MBI and practices at home that they deemed important to elaborate upon ("What did you experience in the training and with your practice at home?"). They were encouraged by the interviewer through follow-up questions to deviate toward whatever they considered important to describe. In the second part, questions with more detail guided the interview, such as questions for eliciting a general description of their eating and food shopping routines and possible changes to those behaviors over the last weeks ("Would you elaborate on your general nutrition behavior please?", "Did you experience any changes in relation to your general nutrition behavior in the past weeks?") or their understanding of consumption and sustainable consumption ("What exactly is consumption to you?", "How would you describe sustainable consumption?"). Interviewees were further asked whether and how they perceived themselves to be more mindful, according to their understanding of the concept ("In your opinion, did you develop more "mindfulness?", "How would you know that/how do you experience that?"). In the end, they were encouraged to ask any open questions and were also informed about the state of the study and the next steps of analysis.

#### 5.2.2. Data analysis

A qualitative content analysis (CA) based on Kuckartz (2014; 2016) provided the basis for data analysis. A deductive coding scheme was developed to reconstruct the subjective experience of participating in the MBI. As suggested by Kuckartz (ibid.) and Ramsenthaler (2013), the quantitative hypotheses and the interview guideline were used as a grid for developing a first version of the deductive code system, which was tested against the material. Inductive categories were developed alongside the coding process, accounting for the likely appearance of unanticipated effects. Subcategories were subsequently elaborated within an iterative coding and refining process until 25% of the data was unambiguously and completely categorized in accordance with the scheme. Two student assistants coded the remaining data material. Based on the codings, the first and second author wrote individual case summaries (Kuckartz, 2014), synthesizing and abstracting the central

effects of the intervention and its influence on participants' consumer behaviors.

## 6. Results

Results of the qualitative study will be directly compared and complemented with results from the quantitative survey, creating an integrated view on the effects of the consumption specific MBI.

### 6.1. General mindfulness

To establish the effectiveness of the MBI with regard to general mindfulness experienced by the participants as a prerequisite for further mindfulness-based effects, results on that measure will be presented first.

In the interviews, a perceived increase in general or specific areas of mindfulness was articulated by all participants. They usually associate mindfulness with higher attentiveness to ongoing experience, a more relaxed state of being and the development of ethical qualities, such as empathy, compassion and equanimity. Four statements help exemplify the effects:

*"[…] I am in any case more mindful than before. Definitely."* IG2STU8.

*INTERVIEWER: "Ok, so you mean you became more mindful [through the MBI]? I: Definitely."* KG3STU3.

*„In a clearer awareness, different perception of people: more emphatic, more mindful."* KG2STU17 (Excerpt from training diary).

*"I had the feeling that [through the practice] a lot of things did not bother me as much anymore, I could stay connected with myself and better observe what is REALLY happening."* IG1STU2.

In the quantitative study, the changes in the CHIME measure over the course of the MBI were compared between the IG and CG. A 2 × 2 ANOVA with *experimental group* (IG-CG) and *measurement point in time* (pre-post) as factors revealed a significant interaction effect F (1,62) = 33.9, p = .001, $\eta_p^2$ = .354), a significant main effect for *measurement point in time* F (1,62) = 26.8, p = .001, $\eta_p^2$ = .302) and no main effect for experimental group F (1,62) < 1). Post-hoc t-tests indicated substantial changes in the CHIME measure for the IG only (t (27) = 5.61, p < .001; $d_{KORR}$ = 1.32, see Fig. 2, KG: t (35) = −0.73, p = .473).

Table 2 gives a more detailed overview over the intervention's effect

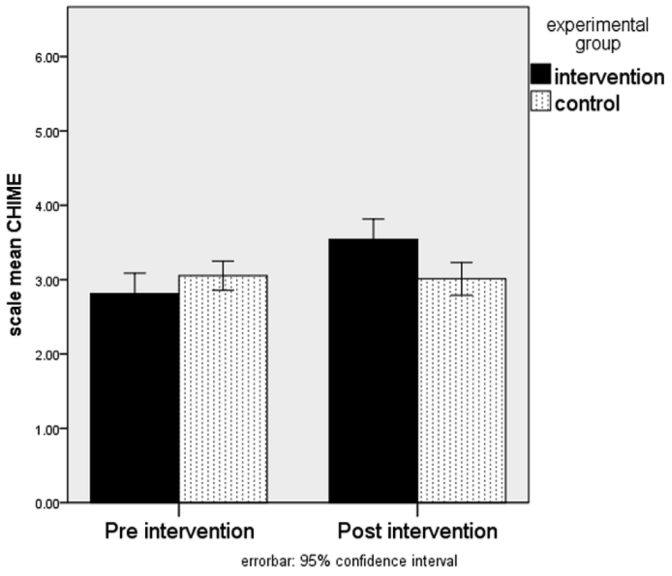


**Fig. 2.** Effects of the MBI on CHIME measure.

**Table 2**
Summarizing overview of effects.

| Effect categories: Interviewees: | I. Effects on mindful eating | II. Effects on sustainability-related pre-consumption phases | III. Effects on sustainability-related consumption behavior |
|---|---|---|---|
| IG1STU2 | X | X | |
| IG1STU10 | X | X | |
| IG2STU8 | X | X | |
| IG3STU4 | X | | |
| IG3STU12 | X | | |
| IGXSTUX | X | X | X |
| KG2STU9 | X | X | |
| KG2STU17 | X | | |
| KG3STU2 | X | X | |
| KG3STU3 | X | X | X |
| KG3STU9 | X | X | X |
| **Total qualitative** | **11** | **9** | **3** |
| | **100%** | **82%** | **27%** |
| **Total quantitative effect size** | $\eta_p^2$ = **.131** | $\eta_p^2$ = **.002** | $\eta_p^2$ = **.000** |

Note: Total quantitative results are based on the whole sample (n = 64). The effect sizes reflect a strong effect of the training on mindful eating and no effects on pre-behavioral consumption phases and behavior itself.

**Table 3**
Effects of 2 × 2 ANOVA repeated measurements for all facets of mindfulness.

| dV: mindful experiences and its facets: | Interaction effects: experimental condition x sample | | |
|---|---|---|---|
| | *F* | *p* | $\eta_p^2$ |
| CHIME | **33.9** | < **.001** | **.354** |
| 1. Acceptance | **29.4** | < **.001** | **.322** |
| 2. Decentering | **21.4** | < **.001** | **.257** |
| 3. Acting consciously | **15.9** | < **.001** | **.204** |
| 4. Inner awareness | **10.5** | = **.002** | **.144** |
| 5. Outer awareness | 3.3 | = .075 | .050 |
| 6. Openness | **8.6** | = **.005** | **.122** |
| 7. Relativity | **8.3** | = **.005** | **.118** |
| 8. Insight | **8.3** | = **.006** | **.118** |

on the different mindfulness facets. As can be seen, participants increased their mindful experiences significantly in all facets except the outer awareness facet, with strongest effects on acceptance and decentering. Acting consciously, capturing an antidote to automaticity, also increased in the intervention group. Weaker effects were observed in the three attitudinal facets of openness, relativity and insight (see Table 3).

### 6.2. Mindful eating

Consistent with the results for general mindfulness, the analysis of the qualitative data also showed effects on mindful eating for all participants. The following section will describe the observed effects. Furthermore, selected quotations from participants will be presented to convey the essence of the theme, as well as to indicate how interwoven and interdependent the effects on the three aspects of mindless eating are.

A rise of general awareness and reflection concerning eating behavior was reported by interviewees. This resulted in a greater awareness of one's level of physical hunger or satiety, alongside the capability to better respond to those internal cues, instead of e.g., habitually finishing one's plate. The following quotes are examples:

*"The slower and more aware I eat [compared to fast and timely restraint meals before the training], the better my stomach feels and the earlier and easier I notice when I am full."* IG3STU4.

*"And through that practice [of mindful eating] I realized that I notice when I am full much faster. I found that quite astonishing and actually do pay more attention to that now in my day-to-day life. That doesn't mean that I can always stop the eating impulse, but I do realize, puh, I am full. I had previously pushed that away or went straight over it."* IG1STU2.

Heightened and intensified pleasure while eating due to this rise in awareness or a more nuanced experience of different tastes was also a common development counteracting automaticity:

"*It is fascinating what you can notice in the mouth if only you pay attention to it. The sweetness of grapes I perceived as much more extreme than I expected, to let a piece of banana melt on my tongue is an interesting experience, as is the neutralizing effect of coffee afterwards."* IG3STU12.

A recurring topic mentioned by participants concerned realizations about routinely and automatically eating while doing other things at the same time, such as watching TV, checking social media or listening to music, as the following quotation illustrates:

*"That I do take the time to sit down and shut out other factors, meaning not necessarily having the phone next to me, going 'oh I am eating right now, why don't I figure out at the same time when I have to leave tomorrow'. Things like that, to combine the eating with some other activity, because for that, I invest too much work in the food."* KG3STU2.

Some interviewees also spoke about an accompanying growth in reflection regarding the production process (including their own efforts in preparation) or the origin of the food they consume. These reflections seem to help curb impulsivity and allow for de-automatized responses, as well as helping to not use food as a coping mechanism. Moreover, they pave the way for more sustainable food consumption, as the following example details:

*"I do not want to think so much when eating. […] But I noticed now, I do consider - alongside my desire - a little bit more; Do I really need this right now? […] The appetite quasi automatically decreases then. [ …] When I crave sausages for example and then I look: What ingredients do they have? I think about it for some moments and it is more likely that I don't eat it then, instead of following my first impulsive appetite."* KG2STU9.

However, these results were not explicitly linked to a perceived increase in ethical qualities, such as compassion, which were clearly present in the first effect category, general mindfulness.

These results were confirmed in the quantitative study, even though some effects found, on impulsivity, were not measured quantitatively (see measures section). As with general mindfulness, a 2 × 2 ANOVA with *experimental group* (IG-CG) and *measurement point in time* (pre-post) as factors for mindful eating were run. The ANOVA revealed a significant interaction effect F (1,62) = 9.34, p = .001, $\eta_p^2$ = .131), a significant main effect for *measurement point in time* F (1,62) = 9.16, p = .003, $\eta_p^2$ = .129) and no main effect for *experimental group* F (1,62) < 1). Post-hoc t-tests indicated more mindful eating habits only after participation in the MBI, see Fig. 3 (IG: t (27) = 3.87, p < .001; $d_{KORR}$ = .71, see Fig. 2, CG: t (35) = -.03, p = .980).

### 6.3. Sustainable food consumption: effects on pre-consumption phases

Participants exhibited a multitude of effects on the pre-behavioral phases of consumption, behavior, attitude and intention, in the qualitative study while no explicit mention was made concerning a change in values. The aforementioned growth in awareness about the production of food products was complemented in this effect category by a simultaneous rise in appreciation for the products and their availability. In some cases, this led to a change in consumption attitudes e.g.:

*„When I thought about it [the food product] or thought about where it came from and what it's made of, it seemed to be less important what I was choosing. Because then I saw value in each product, even in something as "boring" as a cheese sandwich or something. That's why my choice got more equanimous. Just a little more relaxed."* IG2STU8.

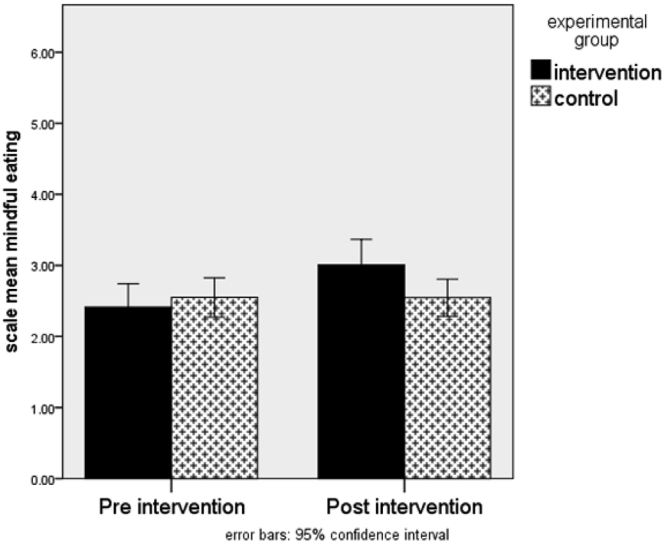


**Fig. 3.** Effects of the MBI on mindful eating.

Alongside this change in attitude, the intention to consume more sustainably arose or was strengthened:

*"With mindful eating, I experience the taste of every single bite with more awareness and greater appreciation, because I reflect on the origin of the products. When I then shop mindfully, I pay more heed to sustainable, organic, fair trade products."* IG1STU10.

*"I am definitely open, more open to the topic and realized that it is good and right and spreads to many other areas […]. Be it being mindful with what I eat, what I buy or don't buy or how I move or how I leave my environment [..]."* IG3STU4.

*"Buying organic stuff was something I wanted to do before as well, this kind of reflecting, concerning myself, how meat is produced and milk and how the animals are living and one thinks: No, that cannot be* supported, *even if it's more expensive […] That was there before, but got reinforced. Through the training, yes, it got strengthened."* IG3STU12.

Especially the last quotation also displays an increase in compassion oriented towards others. However, the explicit effects on pro-sociality in regard to nutritional behavior remain very scarce.

The last positive effect to be described is the decrease in cravings for meat in participants who already had the intention to eat less meat for sustainability reasons before the training (e.g. animal welfare, CO2-footprint of meat):

*„Because especially in the beginning I noticed that I eat with more awareness. […]. That my need for meat somehow actually decreased more." KG3STU9.*

*„My boyfriend had a pizza with ham or something. I realized that I felt disgust. I had that numerous times, this feeling of aversion towards meat. […]" IGSTUX.*

In one case, the effect of increased awareness about one's own behavior and the accepting and neutralizing quality of mindfulness led to a decrease in bad consciousness about consuming *unsustainably*, creating a potential rebound effect:

*"Because I tend to have a bad consciousness when I become aware of the fact that I can't fulfill my own [sustainability] criteria at the moment. The training […] helps me to accept this fact better and to say: ok, it is what it is, maybe because I don't have enough money right now to buy*

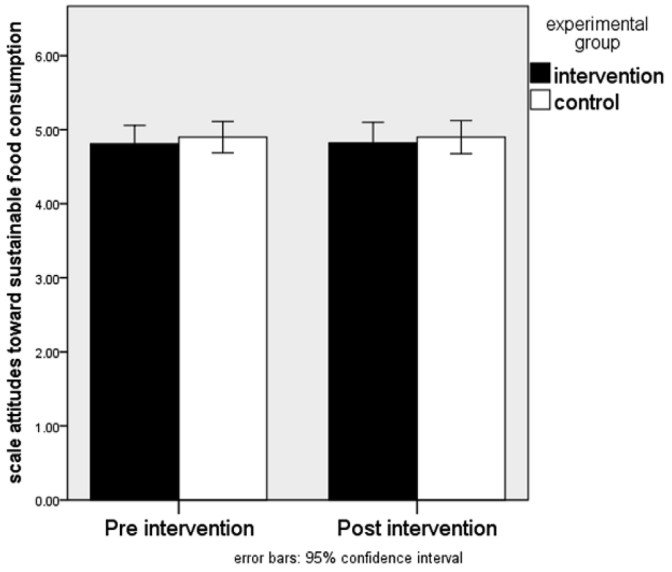


**Fig. 4.** Effects of the MBI on attitudes towards sustainable food consumption.

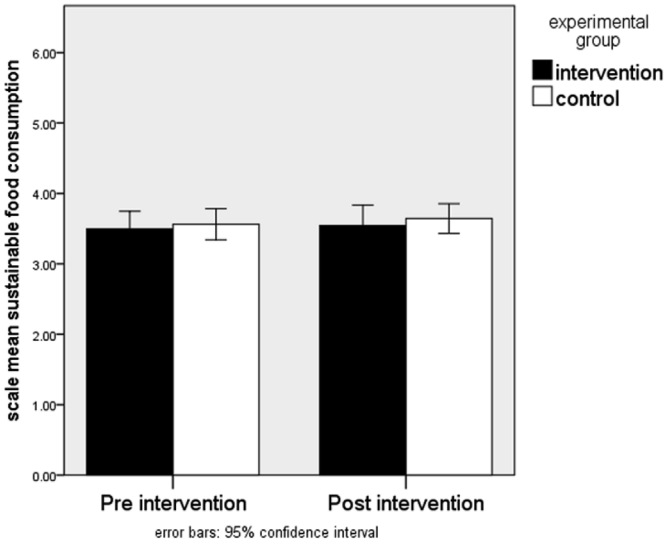


**Fig. 5.** Effects of the MBI on sustainable food consumption.

*organic [food] only."* IG1STU2.

As the focus of the larger, quantitative BiNKA study was on the closure of the attitude– behavior gap, behavioral intentions were not measured in the quantitative study. For attitudes, a 2 × 2 ANOVA with *experimental group* (IG-CG) and *measurement point in time* (pre-post) as factors for the A-$SCB_{NUTRITION}$ measure revealed no significant effects whatsoever, including the interaction between group and measurement point in time ($F(1,62) < 1$). This means there were no changes as a consequence of the MBI in the already strongly positive attitudes (mean = 4.9 out of 6 point scale) towards sustainable food consumption (see Fig. 4).

### 6.4. Sustainable food consumption: effects on behavior

Those changes in intentions and attitudes experienced by most of the participants during and after the training did not, however, lead to a similar account of changes in actual consumption *behavior*. Only two specific effects in a minority of interviewees were found in the data concerning changes in actual food consumption behavior. One participant reported increased consumption of organic products after overcoming his previous preconceptions about the difference to conventional produce:

*"I didn't think much of organic products beforehand […] I am a vegan, but hmm, I thought it was a rip-off, because it is always much more expensive and basically, it's the same ingredients etc." "But, hmm, lately, I have been thinking, ok, I will spend the 30 cents extra and buy the organic product instead."* KG3STU3.

The second effect – decreased meat consumption – is explained by two participants as being due to their heightened bodily awareness and a resulting curbed appetite for meat. This stands in contrast to their previous attempts to avoid meat consumption through discipline or other, cognitively-based strategies alone.

*"With food, well (pfffffff), my meat consumption, I believe, went down some more, since the beginning of the training". INTERVIEWER: "And you believe that's due to the training?" "Hm, yes, I believe that […]."* KG3STU9.

„Its more of a mind thing, that I actually do like to eat meat, that I think it's tasty, but I am often forbidding myself to eat it. Especially non-sustainably sourced meat. And in the [pizza with meat] situation, I realized, I don't WANT that. I had this feeling of disgust." IGSTUX.

These single effects reported by three participants could not be corroborated for the whole sample in the quantitative results. The 2 × 2 ANOVA with *experimental group* (IG-CG) and *measurement point in time* (pre-post) as factors for the $SCB_{NUTRITION}$ measure revealed no significant effects, including the interaction ($F(1,62) < 1$). Fig. 5 illustrates that there were no changes in sustainable food consumption as a consequence of the MBI.

### 6.5. Summarizing overview of effects

In summary, the study revealed a multitude of effects. As can be seen in Table 2, for category one both approaches revealed the same results, namely a strong effect of the MBI on mindful eating behavior in all participants. For the second effect category, the quantitative study only tested effects on attitudes and did not find any. However, the qualitative study inductively revealed various themes in the data and shows a more differentiated picture of attitudes and stronger, more behavioral oriented intentions. Results differ considerably in the third category, from solid effects found in the interviews to no effects for the survey data. Effects on actual consumption in terms of more sustainable behaviors were found to be sparse. Three of the interviewees reported changes in the qualitative study. However, the effect was not matched by the quantitative results.

## 7. Discussion

*"Your intentions set the stage for what is possible. They remind you from.*

*moment to moment of why you are practicing in the first place" (Kabat-Zinn, 1991, p. 32).*

This study set out to empirically explore conjoint effects of a mindfulness training on mindful and sustainable nutritional behavior. The presented mixed methods analysis revealed strong positive effects for mindful eating (research question 1), mixed effects for pre-behavioral stages of sustainable consumption (research question 2) and only sparse evidence for changes in actual sustainable consumption behaviors (research question 3). While quantitatively the effects on the different outcomes strongly dissociate, the qualitative interviews show small, but solid evidence that mindful eating practice can in fact help pave the way to more sustainable food consumption.

In what follows, an interpretation of our results is provided according to the three effect categories of (1) mindful eating, (2) sustainability-related pre-consumption phases and (3) sustainability-

related consumption behavior.

1) Concerning the first category, both qualitative and quantitative results are in line with previous studies that showed how mindfulness practice supports conscious choices and counteracts impulsivity regarding food consumption. The overall results are also in line concerning the use of food as a coping mechanism. Especially the mindfulness facets of decentering and acceptance (of the current experience) showed strong increases, as has been shown by author studies (e.g. Keesman et al., 2017). Those findings reinforce the idea concerning the strong potential of mindfulness practice to cultivate more healthy eating habits, (as taking more time to eat and focusing exclusively on food intake), even in this healthy cohort that does not suffer from the psychological strain to change eating behavior for health reasons. Furthermore, mindful eating entailed an increased awareness of the production process and the origins of food as well as personal attitudes, intentions and eating habits. Such problem awareness and reflexivity are deemed to be preconditions for making sustainable consumption choices (Klöckner & Matthies, 2004), even though they are not directly related to actual consumer behavior. However, the facet of outer awareness did not increase, which should be taken into consideration for future designs, as especially this facet may be necessary to engage people in sustainable nutritional behavior beyond their own plates. Finally, the training may also stimulate the development of general ethical qualities considered important for acting sustainably, such as empathy and compassion. In conclusion, the intervention both promoted healthier food choices (a self-centered effect) through increased mindfulness while extending participants' awareness for other-oriented sustainability aspects and equipping them with the emotional competencies to act accordingly.
2) Regarding the effects on *sustainable pre-consumption phases regarding food*, qualitative interviews revealed strong effects on attitudes and intentions. Most of the participants spoke about how their pre-existing attitudes to consume sustainable foods were either strengthened through the MBI or the general rise in awareness they experienced led them to expand their sustainability attitudes towards food as well. It seems as if even though the attitude was present cognitively among participants prior to the training, the MBI gave it a different quality or reinforcement through experience, disabling their auto-pilot. The highly positive pre-intervention attitudes evidenced in the questionnaire study support this interpretation of qualitative change instead of a quantitative rise. The interviews also revealed a rise in awareness of previously unconscious eating patterns, supporting Rosenberg's (2004) hypothesis that increased mindfulness goes alongside more deliberate and potentially sustainable consumption choices. Such attitude affirmation can also be construed in the sense of interconnectedness, as suggested by Thích-Nhất-Hạnh and Cheung (2012). Participants realize how their food consumption is inextricably interrelated and therefore effects the economical, ecological and social environment in which they are embedded (see for example p. 14, quote IG2STU8).
3) When regarding changes in actual consumption behavior, three out of the 11 interview participants reported effects in the qualitative study. This finding is paralleled by an absence of effects in the quantitative results. The few effects reported in the interviews, namely an increased consumption of organic food and a decrease in meat eating, were all based on *pre-existing* intentions to change behavior to more sustainable food choices. In the case of growth in organic food consumption, the participant reports that his intention to consume more sustainably had been dormant for a couple of years and was reactivated through the MBI. The two participants who state a decrease in meat consumption track these changes directly to their development of mindfulness, namely their heightened sense of awareness and perception of inner cues, instead of being guided by impulses that go against their intentions to reduce meat consumption. The rise in mindfulness and accompanying effects consequently seemed to support individuals in acting on their intentions deliberately, without exerting disciplinary effort.

Despite the decreasing effects from mindful eating, to pre-behavioral, to actual food consumption behavior, they turn out to be noteworthy when considering that the BiNKA training was not explicitly tailored to food consumption. As mentioned before, the intervention was not advertised as a training to support sustainable consumption behaviors nor health behaviors, but as a stress-reduction program. The findings suggest that directedness and intentions play a determining role with regards to the actual effects of an MBI. Participants related to their *pre-existing* attitudes on sustainable consumption when they spoke about their becoming more pronounced or expanding to different fields. As Kabat-Zinn (1991) highlights in the introductory quote, Shapiro et al (2006; 1992) also elaborates on the important role intentions play concerning the effectiveness of mindfulness training. He points out that the intention of meditators influences the outcomes of their practice. If one practices mindfulness to reduce stress, one will more likely reduce stress than change (food) consumption behavior – and vice versa. The current study's aim was not revealed to the participants in order to avoid self-fulfilling response bias. Each participant brought their own individual intention to his or her practice, instead of there being one common "vision" necessary to unfold the full potential outcome of the practice (Kabat-Zinn, 1991, c1990). Individual intentions were collected in the data from the interviewees. They were mainly based on self-focused interests, such as stress reduction, connecting to oneself or plain curiosity about mindfulness training. They did not entail a specific wish to increase sustainable consumption through the practice, which was most likely also the case in the larger questionnaire study sample. Nevertheless, the training affected people's eating behaviors, strengthened intentions for more sustainable nutritional behaviors and occasionally led to more sustainable food choices. Against the backdrop of the deep habitualization of eating (Köster, 2009), the various structural, social and emotional difficulties in changing one's eating patterns (Frank, 2017) and the short amount of time people invested in the training, these are noticeable findings.

Some of the differences between qualitative and quantitative findings can be explained. First, measuring changes in attitudes towards sustainable food consumption behavior pointed to a ceiling effect. This means participants already exhibited strong positive attitudes before the beginning of the intervention and it was thus unlikely to see further increases. Second, qualitatively observed effects on the behavioral level represent single case situations that have not yet turned into new eating patterns. For this reason, general effects might not have shown up in the survey data, even though they clearly represent a promising initial step toward more sustainable food consumption behavior. Third, participants reported that the training helped them to shed light on previously unconscious aspects of their food consumption. This increase in awareness may have caused a more accurate – and slightly more negative – estimation of their eating behaviors, instead of the more positively biased responses prior to the training. In fact, such biases are particularly likely regarding potentially unethical consumption (Gregory-Smith; Smith & Winklhofer, 2013). Moreover, it is well documented within the quantitative mindfulness research that increased awareness can lead to a more accurate self-estimation (compare for example Grossman, 2008), conferring further plausibility to this explanation.

Notwithstanding this rather positive perspective on the study's results, the results also show that promoting sustainable nutritional behavior through mindfulness training is by no means an automatic success. Even though the potential mechanisms identified in the literature were partly found in the empirical data as well, especially with regards to decreased automaticity and awareness of ethical aspects, both study sources reveal a declining strength of effects, indicating strongest and most prevalent changes in mindful eating, while less

participants reported effects on sustainability-related attitudes or intentions. Also, changes in actual sustainable or unsustainable eating behavior were individual, isolated effects and undetectable in an overall, quantitative measure.

For target groups that are looking for ways to put their other-oriented intentions into practice, or as part of sustainable consumption education programs, however, mindfulness training seems to be an auspicious catalyzer.

### 7.1. Limitations

It's important to explicate several limitations for the understanding of the results. For one thing, the current study was part of the larger BiNKA-project which was intended to exploratively research the potential of mindfulness for education in sustainable consumption. It was thus not specifically tailored to explore effects on nutritional behavior. For both the quantitative and qualitative studies, a more comprehensive and nuanced set of measurements investigating mindful and sustainable food consumption is recommended for future research into this specific field. For example, the short version of the mindful eating scale and the newly constructed scale to assess attitudes towards sustainable nutrition showed a rather low Cronbach's Alpha ($\alpha$ = .62/ .65) pointing towards the multifaceted nature of both constructs which are not sufficiently captured in the short scales applied here. Moreover, a more differentiated model and consequently more detailed analysis of which specific practice evokes which corresponding effect in participants will be highly valuable for more nuanced research in the future.

The quantitative measurement of mindful eating suffers from the same limitations as measuring general mindfulness, so additional rigorous research is needed to improve psychometric properties and construct validity to create valid and reliable instruments in this area. Furthermore, mixed method approaches examining changes in observable (eating) behavior through mindfulness practice, e.g. by observations or assessment of family and partners (van Dam et al., 2018) as well as experience sampling, are highly recommended for most holistic designs. Another relevant limitation, as discussed before, is the fact that participants were not fully aware of the aim of the study, which might have prevented intentions from unfolding their full potential. However, some participants showing effects reported that they would not have taken part in the MBI, had they known its “true” aim. The attendance rate of participants that were interviewed was slightly higher than average, resulting in a possibly positive motivation bias in the qualitative sample. To extend future research beyond student populations is also recommended, to allow for greater generalizability of findings. Finally, the researchers analyzing the qualitative data are all practitioners of mindfulness themselves. Although considered an essential precondition to researching mindfulness (Grossman, 2008), there is the potential for a positive bias in data interpretation.

## 8. Conclusion

The current study set out to explore the effects of an adapted MBI on both mindful and sustainable nutritional behavior and pre-behavioral stages of consumption with a mixed method controlled intervention study. In conclusion, it can be said that notwithstanding the rather positive perspective on the study's results, it is clear that promoting sustainable nutritional behavior through mindfulness training is by no means an automatic success. Both qualitative and quantitative data sources reveal a declining strength of effects, indicating strongest and most prevalent changes in mindful eating, while less participants reported effects on sustainability-related attitudes or intentions. Changes in actual sustainable or unsustainable eating behavior were individual, isolated effects and undetectable in the overall, quantitative measure. It is also important to point out again that participants relate to their *pre-existing* attitudes on sustainable consumption when they speak about their becoming more pronounced or expanding to different fields. In no case did participants reported a complete change of attitudes. Given the alleged importance of intentions concerning the outcome of mindfulness practice, it is questionable whether the practice can really serve to promote sustainable consumption beyond self-focused health aspects on a large scale. Future research is required to further and differentiate understanding of those first findings. For target groups that are looking for ways to put their other-oriented intentions into practice, or as part of sustainable consumption education, however, mindfulness training seems to be an auspicious catalyzer and should be considered a useful and supportive addition to existing and future programs.

## Conflicts of interest

All authors declare no conflicts of interest in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2019.104325.

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