Does better for the environment mean less tasty? Offering more climate-friendly meals is good for the environment and customer satisfaction

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**Abstract**

Food consumption comprises a significant portion of the total environmental impact of households. One way to reduce this impact may be to offer consumers more climate-friendly meal choices, such as when eating out. However, the environmental benefits of such an intervention will depend on not only consumers' liking of the climate-friendlier meals, but also on the perceived environmental impact. We therefore investigated the relationship between the global warming potential (GWP) of and consumers' liking of meals in two field studies in the same restaurant. Visitors to the restaurant were asked to rate the taste of the meal they had just consumed. These taste ratings were then related to the meals' GWP and number of purchases. In the second study, an intervention was tested consisting of a climate-friendly choice label and information posters. Contrary to expectations, it was found in both studies that the GWP of the meals was unrelated to the taste or the number of purchases. Offering more climate-friendly meals did not change consumer satisfaction. As expected, the introduction of the climate-friendly choice label increased the number of climate-friendly meal purchases. Therefore, offering more climate-friendly meals with a climate-friendly choice label can affect consumers' meal choices, but not their preferences or satisfaction, which is beneficial for the climate, consumers and gastronomic establishments.

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1. Introduction

It is estimated that food consumption accounts for 20–30% of the environmental impact of households in European countries (Tukker & Jansen, 2006). Improved diets and a decrease in food waste have been identified as essential measures for reducing greenhouse gas (GHG) emissions related to food production (Bajzelj et al., 2014). The environmental burden of food consumption in Europe could be reduced by 10% if consumers were to choose environmentally friendlier diets, which mainly implies a reduction in dairy and meat consumption (Jungbluth, Flury, & Doublet, 2013; Tukker et al., 2011; Westhoek et al., 2014).

Large proportions of consumers (between 41% and 63%) were reported in a Swiss study to have already adopted some so-called climate-friendly food choices, such as consuming only seasonal fruits and vegetables and avoiding foods transported by air (Tobler, Visschers, & Siegrist, 2011). Nevertheless, there is still considerable potential for more climate-friendly food choices. Currently, consumers cannot make such choices because they cannot directly assess the environmental impact during purchase, and information about the climate impact of food is scarcely provided. Consumers should thus be better informed. However, little is known about the effect of information provision on consumers’ green food choices and on their perceptions of climate-friendlier meals.

It is relatively easy to calculate how much carbon emissions could be reduced if consumers changed their behaviours (e.g. eating less meat) (e.g. Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009). However, it is more difficult to estimate what amount of a reduction is feasible, given consumers' actual decisions and behaviours. Therefore, understanding consumers' perceptions and behaviours related to climate-friendlier food choices is necessary. Food choices in restaurants and canteens are relevant to consider in this respect, as consumers’ expenditures on eating out have been increasing for years (e.g. Swiss Statistics, 2014; USDA ERS, 2014). If offering more climate-friendly meals in restaurants appeared to relate to lower customer satisfaction and could thus damage a restaurant’s reputation, such an offer would...
not be a sustainable option. Therefore, this paper investigated how the objective climate impact (i.e. global warming potential [GWP]) of meals relates to consumers’ preferences for and perceived environmental impact of meals, as well as their purchase behaviours in a gastronomic setting. Moreover, we examined whether informing consumers about climate-friendlier meals would affect their meal choices. In the following, several studies will be reviewed on consumers’ perceptions of foods and their environmental friendliness, as well as on providing information about the climate-friendliness of food, which resulted in four hypotheses.

1.1. Relation between environmental impact of and liking of food

Little is known about customer satisfaction in relation to environmentally friendly offers in restaurants. Consumers were found to have positive attitudes towards restaurants that serve local and organic products and that try to act green in other areas (Schubert, Kandampully, Solnet, & Kraj, 2010; Vierregge, Scanlon, & Huss, 2007). Restaurant visitors mostly do not receive detailed information on the climate friendliness of the offered meals. Hence, an important criterion in their meal choice is its sensory appeal (Scheibehenne, Miesler, & Todd, 2007; Steptoe, Pollard, & Wardle, 1995). Consumers have an innate preference for energy-dense food (i.e. rich in fat and sugars), such as dairy and meat (Drewnowski, 1997). The production of meat and dairy products has a high environmental impact (i.e. a high GWP, Tukker & Jansen, 2006) so that climate-friendlier meals are less likely to include these products. Most consumers associate meat with a high hedonic value (Graça, Oliveira, & Calheiros, 2015; Lea & Worsley, 2001). Moreover, consumers have been found to rate the attractiveness of meals in which meat has been substituted by alternative products as rather low (Schösler, Boer, & Boersema, 2012; Verbeke et al., 2015). Hence, we hypothesised that:

**Hypothesis 1.** A meal’s GWP is positively related to consumers’ liking of the meal and to the number of purchases, because GWP-rich ingredients are generally associated with a higher sensory appeal (tested in Studies 1 and 2).

After purchase, consumers experience the taste and some nutritious qualities of the meal (e.g. satiety), and they use this information to update their taste expectations and their general product evaluation before their next purchase (Grunert, Bredahl, & Knif, 2012). Because a meal’s environmental and health qualities cannot be based on direct experiences, consumers have to assess them using any available information, which may be their product experience or a health claim. Hence, if consumers have to estimate the environmental impact of their meal after consumption, they will rely on their taste experience. The latter will thus be generalised to the perceived environmental impact. In short, it was hypothesised that:

**Hypothesis 2.** Consumers’ perceived environmental impact of a meal is positively related to their liking of the meal (tested in Study 1).

Understanding the size and the direction of the associations between a meal’s objective climate friendliness, taste, sales numbers and perceived environmental impact is important to promoting the consumption of environmentally friendly meals. Should there be a negative association between the meals’ objective climate friendliness and the consumer’s taste experience, as well as between the objective climate friendliness and sales numbers, gastronomic establishments may be less inclined to offer such foods, as they will decrease customer satisfaction. On the other hand, if a meal’s objective climate friendliness relates positively with consumer’s experienced taste and sales numbers, as well as negatively with its perceived environmental impact, this information may be useful to food providers. This is because the careful development of a climate-friendly meal’s taste profile will improve consumer satisfaction in two ways: through a pleasant taste experience and through the perceived environmental friendliness of the food.

Most gastronomic establishments offer different meals with different GWP values so that the total GWP of a restaurant varies per day. The unit of interest is in this case all meals sold on a single day. Hence, we examined the relationship between customer satisfaction and the offered meals per day, as well as the total GWP of meals consumed on that day. Again, based on the phenomenon that people prefer energy-dense food (Drewnowski, 1997), which may be related with a higher GWP (Macdiarmid, 2013), we expected that:

**Hypothesis 3.** A higher GWP per day relates to higher customer satisfaction per day (examined in Studies 1 and 2).

1.2. Information about the climate-friendliness of foods

Climate-friendlier meals are often associated with organic and seasonal products. Seasonal fruits and vegetables are perceived to have a higher quality because of their freshness, taste and healthiness (Chambers, Lob, Butler, Harvey, & Bruce Trail, 2007), which have been found to be important determinants of purchasing seasonal fruits and vegetables (Tobler et al., 2011).

The organic production of food products must be communicated to consumers (e.g. by means of a label), as they are so-called credence characteristics and cannot be directly experienced before or after the purchase (Darby & Karni, 1973). Overall, consumers believe that organic-labelled products are healthier, more natural and tastier than conventional products (see e.g. Schleenebeker & Hamm, 2013; Yiridoe, Bonti-Ankomah, & Martin, 2005 for reviews). In other words, organic-labelled food products seem to cause so-called halo effects, meaning that the beneficial characteristic that is claimed (e.g. “100% organic”) is generalised to other positive evaluations of the product’s characteristics (e.g. its nutritious qualities), which may be unwarranted (Lee, Shimizu, Kniffin, & Wansink, 2013; Schultd & Hannahan, 2013; Thorndike, 1920).

For example, Lee et al. (2013) asked consumers to taste and evaluate pairs of the same food products, with or without an organic label, based on their taste, nutritious qualities and caloric content. Respondents rated the organic-labelled products to be lower in calories and to have better nutritious qualities than their conventional counterparts, thus revealing a halo effect of the organic label on nutritious qualities. In a detailed investigation by Bratanova et al. (2015), information that a food product has high sustainable qualities (i.e. regarding environmental friendliness, local production or fair trade) activated respondents’ moral satisfaction and their taste expectations of the offered food, which in turn influenced their taste experiences of this food. This occurred mostly among respondents with strong values that corresponded to the type of sustainability information.

Campbell-Arvai, Arvai, and Kalof (2014) found that their respondents were more likely to choose a climate-friendlier meal (i.e. a meatless meal) from a menu when such meals were the default options on the menu and when information was provided on the menu about the climate-friendliness of the meals, which was compared to a standard situation in which both meat-free and meat meals were presented on the same menu. Thus, it seems possible to induce climate-friendlier meal choices among consumers by increasing the offerings of such meals and by increasing their visibility in the restaurant. However, this study was conducted in a
laboratory setting without distractors, such as other guests, and real consumption behaviours were not measured.

A carbon label in a traffic light format was tested in an intervention study in a supermarket (Vanclay et al., 2011). During the eight-week intervention, the traffic light label resulted in more purchases of the ‘green’ climate-friendlier alternatives and fewer purchases of the ‘black’ climate-unfriendly alternatives than before the intervention. It therefore seemed worthwhile to investigate the effect of a climate-friendliness label in a gastronomic setting. Based on the halo effect (Bratanova et al., 2015; Lee et al., 2013) and on previous intervention studies (Campbell-Arvai et al., 2014; Vanclay et al., 2011), the following was hypothesised:

Hypothesis 4. Information about the climate-friendliness of a meal results in more purchases of the meal than if no such information is given (investigated in Study 2).

2. Study 1

2.1. Materials and methods

2.1.1. Setting, procedure and sample

The first study was a survey conducted in the university canteen of a large university in Switzerland. The canteen offers four hot meals for lunch, named ‘Menü 1’; ‘Spezial’, ‘Vegi’ and ‘Best of’, costing between 6.20 CHF (6.67 USD, ‘Menü 1’) and 13.50 CHF (14.53 USD, ‘Best of’) for students and between 12.70 CHF (13.67 USD, ‘Menü 1’) and 14.40 CHF (15.50 USD, ‘Best of’) for guests. The meals differ each day and week, but prices are the same each day. Besides the ‘Vegi’ meal, one of the other meals is often meatless.

The survey was conducted during the lunch hours of eight days over two regular semester weeks during the spring semester of 2014. We investigated 32 different meals in total (see Supplementary Information). The questionnaires were distributed among the canteen’s guests. They were approached after consumption of one of the four hot meals served that day and invited to complete a short questionnaire in return for a brownie. We aimed to distribute the questionnaires evenly over the four meal lines. This resulted in three to 17 completed questionnaires per meal (M = 7, Mdn = 6.5) for 32 different meals in total. In practice, it appeared rather difficult to distribute the questionnaires evenly, as some meals were less popular, so that consumers of these meals were rare in the cafeteria. After returning the completed questionnaire, respondents received their brownie.

In total, 225 guests of the canteen participated. Students (n = 204, 91%) were the main participants, in addition to some employees (n = 16, 7%) and external guests (n = 5, 2%). As the canteen belonged to a technical university, more men (n = 137, 61%) than women (n = 88, 39%) participated. The sample’s average age was 25 years (SD = 7), and 10 respondents (4%) indicated that they followed a strict vegetarian or vegan diet.

2.1.2. Measures

2.1.2.1. Questionnaire. In the two-page questionnaire, respondents were first asked to indicate their meal choice. This had to be one of the four hot meals served that day. Respondents were then asked to rate the taste of the consumed meal (‘How did it taste?’) on a 5-point Likert scale ranging from 1 (not at all good) to 5 (excellent). Similarly, respondents indicated the perceived environmental impact of the consumed meal: ‘To what extent did this meal have an impact on the environment (e.g. due to GHG emissions, land and water usage)?’ This item was also rated on a 5-point Likert scale ranging from 1 (very low) to 5 (very high). Finally, respondents were asked to complete some demographic questions, such as whether they were vegetarian or vegan, as well as their status in the canteen (student, employee or guest), their gender and their birth year.

2.1.2.2. Global warming potential calculations. For each hot meal offered during our study, the GWP was calculated in CO2 equivalents per kg of food (kg CO2-eq) using the Life Cycle Assessment (LCA) approach (Hellweg & I Canals, 2014). In an LCA, the environmental impacts of a product are calculated and added for different types of environmental extractions and pollution for each stage of a product’s life cycle: from production, processing, packaging and transportation to preparation. In this case, the LCA focused on the GWP of the meals by calculating the GHG emissions in the different stages (IPCC, 2007). This resulted in a single kg CO2-eq score per product (i.e. per meal).

On behalf of the catering service of the university canteen, ESU-services Ltd. (Zurich, Switzerland) had calculated the kg CO2-eq of the meals’ ingredients (Jungbluth, Doublet, & Flury, 2013). From the resulting database, the kg CO2-eq of each investigated meal was computed. Each meal included an overhead of 1.09 kg CO2-eq for food preparation and cleaning (e.g. cooking and disposal). We used the kg CO2-eq of the meals as a proxy for the meals’ climate friendliness, where a lower kg CO2-eq corresponded to a greater climate friendliness.

2.1.2.3. Number of sold meals. The catering service also provided the total number of customers per day and the number of purchases of each of the 32 investigated meals. The total number of customers in the canteen during the eight days of data collection ranged between 1,405 and 1,782 per day (Mdn = 1,671, including the four meal lines investigated in detail, as well as salad and soup).

2.1.2.4. Customer satisfaction and average kg CO2-eq per day. Two additional measures were calculated from the collected data. Customer satisfaction per day was computed by combining the taste ratings per meal with the number of purchases of each meal. This construct was based on the assumption that if more meals with higher taste ratings are purchased on a particular day, this will result in happier customers than if a large proportion of the customers on that day consume a poor-tasting meal. Additionally, the average kg CO2-eq per day was calculated to be able to evaluate the GHG emissions per day. Offering meals with a very high kg CO2-eq will only have a negative impact on the climate if they are consumed by a substantial number of people. The presence of other meals with relatively low kg CO2-eqs and that are more popular may overall result in an average kg CO2-eq per day. The calculation of both measures is explained in detail in the data analysis section below.

2.1.3. Data analysis

We aggregated the survey data per meal per day because the kg CO2-eq data were per meal. We then weighted the number of sold meals per meal per day because the total number of sold meals differed between days. The total number of sold meals over the eight days of the study (10,747 meals) was taken and divided by the number of days of this study (i.e. 8 days). The weighted number of sold meals per day was the average number of sold meals per day divided by the total number of sold meals that day, and this was again multiplied by the meal’s actual numbers sold that day.

With the aggregated data per meal, the correlations between the kg CO2-eq of the meal, the weighted number of sold meals, the respondents’ taste ratings and their perceived environmental impact of the meals were calculated. Nonparametric correlations (Kendall’s τ) were calculated, as the kg CO2-eq data did not have a normal distribution and the sample size of the meals was small (N = 32).

We related the average kg CO2-eq per day to the customer
satisfaction per day. The average kg CO₂-eq of all sold meals per customer per day was calculated as follows:

\[ \text{Average kg CO₂-eq} = \frac{\sum (\text{kg CO₂-eq}_i \times n_i)}{N} \]

whereby \( i \) denotes the number of meals per day. Additionally, the mean customer satisfaction per day was the sum of the aggregated taste ratings divided by the number of purchases of the four meals that day.

2.2. Results

2.2.1. Descriptives

On average, participants rated the taste of their meals as good compared to the midpoint of the scale (i.e. 3, \( M = 3.78, \ SD = .64 \)), \( t(223) = 18.22, p = .0001, r = .77 \). The mean perceived environmental impact of the meals was around the midpoint of the scale (i.e. 3, \( M = 2.94, \ SD = .88 \)), \( t(222) = -1.06, p = .29 \). The most climate-friendly meal had a kg CO₂-eq of 1.60 (vegetable schnitzel with mixed salad), and the least climate-friendly meal produced 3.95 kg CO₂-eq (Fleischkäse [a sort of meatloaf] with beer sauce, pasta and vegetables). The average kg CO₂-eq of all meals was 2.63 (SD = .59, Mdn = 2.54).

2.2.2. Relations among the meals’ kg CO₂-eq, taste ratings and number of purchases

We did not find a substantial or a significant correlation between the kg CO₂-eq of a meal and its mean taste ratings (see Table 1). This is illustrated by the almost horizontal line in Fig. 1, which shows that the taste of the meals was not significantly related to the kg CO₂-eq of the meals. Therefore, this required a rejection of Hypothesis 1: a higher kg CO₂-eq of the meals was not related to better taste experiences, nor to a higher weighted number of sold meals (Table 1). Moreover, taste did not significantly correlate with the weighted number of sold meals. This can also be seen in Fig. 1, as the sizes of the circles do not increase with a higher kg CO₂-eq per meal or with a higher taste rating.

We did not find a significant relation between taste rating and perceived environmental impact (see Table 1 for the correlation at the aggregated level; the correlation at the individual level: Spearman’s \( r = .08, \ p = .24, N = 222 \)). Respondents did not generalise their taste ratings to their environmental impact ratings so that Hypothesis 2 was also not confirmed. A higher kg CO₂-eq of a meal, however, was significantly related to a higher perceived environmental impact of the meal (Table 1). In other words, participants could to some extent estimate whether a meal had a higher or a lower environmental impact. The weighted number of sold meals correlated significantly with the perceived environmental impact of the meals (Table 1), meaning that respondents estimated the environmental impact of more popular meals to be higher than that of less popular meals.

We then calculated the average customer satisfaction per day and the average kg CO₂-eq of all sold meals per customer per day (see Section 2.1.3, data analysis). Customer satisfaction did not seem to vary much between the investigated days, whereas the average kg CO₂-eq of the sold meals seemed to vary over the eight days of our study (see Fig. 2). Customer satisfaction and average kg CO₂-eq per day were not significantly related (Kendall’s \( \tau = .00, \ p = 1.00 \)), which is confirmed by the observation that there is no linear relation visible between the two lines in Fig. 2. Thus, no support was found for Hypothesis 3, because a higher total climate impact of the food offered in the restaurant did not seem to increase overall customer satisfaction.

3. Study 2

3.1. Materials and methods

3.1.1. Setting, procedure and sample

The second study was conducted in the same canteen as the first study after the first study had finished (i.e. late spring 2014). The intervention study aimed to make the canteen’s visitors aware of the impact of food production and consumption on the climate and involved a pre-test and a post-test (see Fig. 3). However, the participants could not be randomly assigned to the pre- or post-tests. Therefore, the study had a quasi-experimental design.

### Table 1

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<td>3. Aggregated perceived environmental impact</td>
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*p < .05, **p < .01.
During the pre-test, no information and no label were presented to the canteen’s guests, and only the kg CO2-eq and the number of purchases were assessed for each of the four meal lines per day (Fig. 3). The pre-test took place during five consecutive days. The intervention started one week after the pre-test and lasted four weeks. It consisted of a ‘climate-friendly choice label’ (see Fig. 4) and information posters (see Supplementary Information). The post-test was conducted one week after the start of the intervention so that the canteen’s guests were already acquainted with the label and information (Fig. 3). The post-test took place on nine consecutive days during the last three weeks of the intervention (excl. three holidays, one bridge day between Ascension Day and the weekend).

During the intervention, the label was presented on the two climate-friendlier meals of the four hot meals offered each day. To facilitate the assignment of the label, the catering service aimed to offer two very climate-friendly meals (i.e. with a relatively low kg CO2-eq) and two very climate-unfriendly meals (i.e. with a relatively high kg CO2-eq) each day. No label was presented on the two climate-unfriendlier meals. The posters informed the guests about the relationship between food production and the consequences for the climate, such as the fact that the production of meat and dairy products results in much higher kg CO2-eq than vegetables and that products transported by air are associated with a much higher kg CO2-eq than products transported by car or boat. The facts were visually illustrated with a specific food example (see Supplementary information).

The number of sold meals and the GWP of the meals were assessed during the whole intervention. In addition, a survey was conducted among the guests on nine days during the intervention (i.e. the post-test, Fig. 3). Participants were approached in the same way as in the previous survey. However, this time, participants had to return the questionnaire to a box at the exit of the canteen. The experimenters visited the canteen at different times to avoid approaching the same customers repeatedly. After completing the questionnaire, respondents could participate in a lottery to win one of three vouchers for a vegetarian restaurant (CHF 100 each, about 107.64 USD) by putting a card with their e-mail address into a separate box. In total, 780 guests (response rate: 98%) completed our two-page questionnaire over nine days. As four hot meals are offered in the canteen each day, we had survey data for 36 different meals in total and there were between three and 43 completed questionnaires per meal (M = 19, Mdn = 16, see Supplementary Information).

Mainly students (n = 638, 82%) participated in our post-test survey, in addition to some employees (n = 107, 14%) and external guests (n = 18, 2%). In total, 17 respondents did not report their status in the canteen. Again, more men (n = 614, 78%) than women (n = 163, 21%) participated (including three respondents who did not report their gender). The sample’s average age was 25 years (SD = 6). About 5% of the respondents (n = 36) indicated that they followed a strict vegetarian or vegan diet.

3.1.2. Measures

3.1.2.1. Questionnaire. Two of the questions in the post-test survey are of interest here. Respondents were first asked to indicate their meal choice. This had to be one of the four hot meals served that day to be able to participate in this study. Additionally, respondents were asked to rate their satisfaction with the taste of the consumed meal (‘How satisfied are you with the taste of your meal?’) on a 5-point Likert scale ranging from 1 (not at all satisfied) to 5 (extremely satisfied). Finally, respondents were asked to answer some demographic questions, such as whether they were vegetarian or vegan, as well as their status in the canteen (student, employee or guest), their gender and their birth year.

3.1.2.2. Global warming potential calculations. The GWP values of the meals were calculated in the same way as in Study 1, using the same database, as well as including an overhead of 1.09 kg CO2-eq for food preparation and cleaning.

Fig. 3. Time plan of Study 2, incl. the types of collected data.

Fig. 4. The climate-friendly choice label presented during the intervention in Study 2 (designed by Bettina Veith).

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1 In practice, the attempt of the catering service to offer two very climate-friendly meals and two very climate-unfriendly meals did not result in a clear polarization of the offered meals. The average kg CO2-eq of the 36 meals was 2.63 (SD = .79, Mdn = 2.41, range: 1.61–5.49), which is not significantly different from the kg CO2-eq of the meals in Study 1 (M = 2.63, Mdn = 2.54, SD = .59, range: 1.60–3.95), Mann–Whitney U(66) = 523.00, Z = –.52, p = .52. In other words, the meals that the respondents evaluated in Study 2 were not that different from those in Study 1, which was done during a ‘normal’ week.
3.1.2.3. Number of sold meals. The catering service provided the total number of customers and the number of purchases per meal per day for the pre-test week and the whole intervention. Between 1,531 and 1,687 guests (Mdn = 1,651) visited the canteen per day during the pre-test, and between 817 and 2,005 guests (Mdn = 1,569) visited the canteen each day during the intervention. The number of visitors was lower on some days during the intervention than during the pre-test because holidays in the second period reduced the number of guests on the surrounding days (e.g. fewer guests the day after Easter Monday). Sales data and kg CO2-eq data for all meals purchased were gathered during the pre-test of five days and during the intervention (i.e. 17 days: four weeks minus three Holidays).

3.1.3. Data analysis

The same analyses were used as in Study 1 to test Hypotheses 1, 2 and 3 with the aggregated survey data, kg CO2-eq data and purchase data from the post-test (no survey was conducted during the pre-test). Additionally, an independent t-test was conducted to compare the mean taste ratings of meals with a climate-friendly choice label to those without a label to examine Hypothesis 1 in more detail.

To investigate Hypothesis 4, that is, the effect of the intervention on meal choices, we considered the purchase data of all days of the pre-test (five days) and of the intervention (i.e. 17 days, Fig. 3). We first categorised all meals offered during the pre-test and the intervention as climate friendlier or climate unfriendlier. Each day, the two meals with the lowest kg CO2-eq were classified as climate friendlier, so that the remaining two meals—with the highest kg CO2-eq on that day—were categorised as climate unfriendlier. However, the climate friendliness of the meals was only communicated to the guests during the intervention by means of a climate-friendly choice label. We then calculated the weighted number of purchases of climate-friendlier meals and of climate-unfriendlier meals. The same calculation was used as described in Study 1, only this time it was done separately for the climate-friendlier meals and the climate-unfriendlier meals. The weighted numbers of climate-friendlier meal purchases and of climate-unfriendlier purchases per day were then compared between the pre-test and intervention using a chi-square test. Additionally, we analysed whether the weighted number of climate-friendlier meal purchases increased during the intervention (i.e. 17 days, Fig. 3) by means of a linear curve estimation.

3.2. Results

3.2.1. Descriptives

During the post-test, respondents rated the taste of their meals as good compared to the midpoint of the scale (M = 3.70, SD = .88), t(778) = 22.26, p = .0001, r = .62. The average kg CO2-eq of the meals was 2.61 (SD = .79, Mdn = 2.41). The most climate-friendly meal had a kg CO2-eq of 1.61 (yellow curry with rice noodles, vegetables and mushrooms) and the least climate-friendly meal had a kg CO2-eq of 5.49 (red Thai curry with fried shrimps and basmati rice).

3.2.2. Relations among the meals’ kg CO2-eq, taste ratings and number of sold meals during the post-test

During the post-test (i.e. nine days during the intervention, Fig. 3), the correlation between the kg CO2-eq of the meals and their aggregated taste ratings was again not significant (see Table 2). This finding is supported by the almost horizontal line in Fig. 5. Moreover, the results of the independent t-test on the taste ratings showed that the taste ratings were not significantly different between climate-friendlier meals (i.e. with label,

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*p < .05, **p < .01.

3.2.3. Effect of the climate-friendly choice label on meal choices

At the pre-test, 46.2% of the purchased hot meals were climate-friendlier (n = 2,757) and 53.8% were climate-unfriendlier (n = 3,216). This changed to 55.9% climate-friendlier meals (n = 11,280) and 44.1% climate-unfriendlier meals (n = 8,916) during the intervention of 17 days. The chi-square test showed that this was a significant effect, $\chi^2(1) = 175.05$, p < .0001. Moreover, the number of climate-friendlier meal purchases seemed to increase during the intervention, as shown by the rising linear line in Fig. 7. The linear curve fitted well to the observed data, $R^2 = .47, F(1, 15) = 14.76, p = .002$. Hence, more climate-friendlier meals were purchased during the intervention when presented with a climate-friendly choice label compared to before the intervention. This number seemed to increase the longer the intervention lasted. The fourth hypothesis was thus confirmed.

Fig. 5. Mean taste rating and kg CO2-eq per meal in Study 2, incl. the weighted number of sold meals presented in the circles (i.e. the smallest circle corresponds to a weighted number of 114 sold meals that day, and the largest circle corresponds to a weighted number of 531 sold meals that day (i.e., 49%)).
4. General discussion

In two field studies, we showed that consumers’ liking of meals was not related to the meals’ GWP, thus refuting the first hypothesis. This was discovered among a small sample of guests during ‘normal’ operation of the canteen in the first study. In the second study, a larger sample of guests was investigated in the same canteen, and during an intervention that highlighted the climate-friendlier meals in a simple way to the guests.

The finding that consumers’ liking of meals was not related to the meals’ GWP may be seen as an encouragement to offer more climate-friendly meals in canteens and restaurants. It is possible to reduce GHG emissions associated with food consumption in a realistic setting without sacrificing the meals’ tastes. This finding is also in line with those from previous studies showing that consumers have positive attitudes towards the offering of green food in restaurants (Campbell-Arvai et al., 2014; Schubert et al., 2010). Moreover, even after highlighting climate-friendlier meals during the intervention, the meals’ GWP, consumers’ taste experiences and the number of purchases remained unrelated. The intervention with the climate-friendly choice label seemed to have several positive effects: it resulted in more purchases of climate-friendlier meals and did not reduce satisfaction among consumers. Previous research even showed that labelling environmentally friendly foods may increase consumers’ taste expectations and taste experiences, especially among people with strong biospheric values (Bratanova et al., 2015). Offering and labelling climate-friendly meals thus seems an effective and acceptable way of reducing GHG emissions in gastronomic establishments.

We did not investigate consumers’ taste experiences for the different components of the meals. It is therefore still unknown which components of the meals were the most important determinants of respondents’ liking of them. Overall, however, the absence of meat did not seem to have a negative impact on taste experience or customer satisfaction.

The hypothesised halo effect of liking on perceived environmental impact was not confirmed by our findings. Respondents did not generalise the sensory experience of their meal to their environmental impact ratings. Taste experiences may be too far removed from environmental impact for consumers to use the former to evaluate the latter. Additionally, the climate-friendly choice label did not seem to result in a halo effect, as respondents did not like the climate-friendly labelled meals more or less than the meals without a label. Lee et al. (2013) were also unable to clearly conclude that the taste ratings of foods presented with an organic label differed from those of the same products without such a label. However, a halo effect was found in studies in which respondents were asked to report their liking of organic foods compared to conventional foods without tasting them (Schuldt & Hannahan, 2013). This may imply that the actual product experience can eliminate overgeneralisations from certain product characteristics to others.

The findings of this study also attest those of Vanclay et al. (2011), who investigated the effect of a carbon traffic labelling system on several products in an Australian supermarket. They also found that labels could affect consumers’ purchase behaviours during the eight-week intervention. The long-term effect of a climate-friendly label is still unknown and this should be examined further.

In this intervention study, both a label and information about sustainable food consumption were provided to the canteen’s customers. As we did not investigate the effect of each of these two types of information separately, it cannot be concluded whether the acquisition of knowledge about sustainable food consumption increased among the canteen’s visitors, whether this caused the sales of the climate-friendlier meals to increase compared to before the intervention or whether this was caused by the climate-friendly choice label. As the findings of Study 1 showed that the canteen’s customers could, to some extent, estimate the environmental impact of meals, it seems that they had proficient knowledge about sustainable food consumption. It is therefore likely that the available information drew the customers out of their ‘consumer’ context in which hedonic values are decisive, and this put them in the higher-level context of being a good citizen whereby environmental protection is important (cf. Korzen & Lassen, 2010). The climate-friendly choice label mainly made this knowledge more easily accessible among the customers and ‘nudged’ them towards the climate-friendlier meals (Thaler & Sunstein, 2008).

The studies’ total sample of 68 meals (32 meals in Study 1 and 36 meals in Study 2) may seem too small to allow for a rejection of the existence of a correlation between taste rating and the GWP of meals. We aimed to identify at least a medium effect, as the environmental impact of the meal should have a notable impact on taste perception to be able to affect consumer behaviour in the real world. A correlation with a medium effect size (i.e. $r > .30$, see Cohen, 1988)—tested on one tail with $z = .05$—in a sample of 68 cases has a power of .81 (Paul, Erdfelder, Buchner, & Lang, 2013), which corresponds to a high probability of finding a significant
correlation. Hence, the number of meals investigated in the two studies was large enough for the analyses reported in this paper.

The two studies were conducted in a university canteen, which is usually not visited by representative samples of the population. Although we believe that taste ratings are not affected by education level, future research should investigate the relation between the environmental impact of food and taste experience in other populations and other settings. Further, the numbers of respondents per meal were rather low for some meals. This should not be a problem because we focused on aggregated data. Nevertheless, larger samples may be needed in future studies that test a larger variety of meals. Additional research should also examine which aspects of climate-friendlier meals mainly determine taste expectations and experiences, so that climate-friendlier meals can be made even to be more attractive to consumers.

In Study 2, not only the presence of the information and the label were added during the intervention, but also the meals were different compared to the pre-test. The purchase increase of the climate-friendlier meals during the intervention compared to the pre-test may therefore also be caused by more appealing climate-friendlier meals during the post-test than during the pre-test. As a control condition was not included in the intervention study (i.e. same meals but with GHG-providing information or a label), this explanation cannot be ruled out. A true control condition would however be difficult to establish in a field study because food choices—and thus sales numbers—depend not only on the offered meals and provided information, but also on other external cues, such as the canteen’s interior and personnel, weather conditions and lunch mates (e.g. Stroebele & De Castro, 2004). The control condition would still differ on one of these factors, because it would be planned at a different time in the same canteen, which may be accompanied by different weather conditions and lunch mates, or in a different canteen, which implies a different interior and different personnel.

Moreover, future research should investigate the extent to which a climate-friendly choice label can reduce the total GWP of a restaurant. This could not be examined in this study, as the caterer offered two very climate-friendly meals (i.e. with a relatively low kg CO2-eq) and two very climate-unfriendly meals (i.e. with a relatively high kg CO2-eq) each day to enlarge the difference in GWP correlation. Hence, the number of meals investigated in the two studies was large enough for the analyses reported in this paper.

The studies reported in this paper were part of the ETH Sustainable Gastronomy project, an interdisciplinary project initiated by the ETH Gastronomy Committee, the World Food System Center, Seed Sustainability and the SV Group. We would like to thank Sandro Hodel, Michael Bürgi, Bastian Fluri and Bettina Veith for developing and designing the intervention materials in Study 2; Diana Hornung, Sandro Hodel and David Preradovic for collecting the survey data; Sandro Orvati for facilitating data collection and the set-up of the intervention in the canteen and the SV Group and ESU-services for providing us the sales data and the kg CO2-eq data of the meals.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.appet.2015.08.013.

References


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