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Development and validation of the Food Disgust Picture Scale

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The present set of studies developed and tested the Food Disgust Picture Scale (FDPS). This is a tool for the assessment of food disgust sensitivity that will measure disgust and predict possible reactions. This eight-picture tool can be used in complement to or as a replacement for currently available text-based measures. In an exploratory Study 1 (N = 57), we constructed a scale consisting of eight pictures. Most of them were taken from validated picture databases. They proved powerful in the assessment of food disgust sensitivity. Study 2 built on these results and refined the scale by substituting pictures from Study 1 with freely available images displaying similar content. The basic structure of the FDPS was then replicated in a bigger sample of Swiss adults (N = 538). Correlational analyses using the eight-item Food Disgust Scale (FDS short), the revised version of the Disgust Scale (DS-R), and the food neophobia scale (FNS) supported the convergent validity of the FDPS. In Study 3 (N = 226), we used a test-retest design to demonstrate the short-term stability of the FDPS. As a result of these studies, the present work provides a short and comprehensive measure of food disgust sensitivity. This novel approach of using pictures to induce a disgust response independently of language significantly facilitates intercultural research on disgust. The FDPS will further contribute to the understanding of food-related disgust and its impact on our food choices.

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1. Introduction

Disgust is more than the feeling of nausea when a pungent smell hits our noses (Miller, 1997). It is one of our basic human emotions and was already recognised and described as such by Charles Darwin (1872). It has been reasoned that disgust originated from the rejection mechanism governed by taste perception, known as distaste, which protects the body by discouraging ingestion of bitter tastes often associated with the presence of toxins (Chapman & Anderson, 2012; Rozin & Fallon, 1987). From this early definition of disgust as disease-avoidance emotion, the understanding of disgust has evolved and is now seen as mechanism that helps to regulate behaviour in social and interpersonal situations (Tybur, Lieberman, & Griskevicius, 2009). The emotion is also triggered by culturally and morally unacceptable behaviour and thereby affects social attitudes (Davey, 2011; Haidt, McCauley, & Rozin, 1994). This multifaceted nature of disgust makes it a difficult construct to capture as a whole. The aim of the present work was to develop a short and comprehensive eight-picture tool for the assessment of food-specific disgust. The scale was developed in three steps. First, items were developed based on currently available theories of disgust (e.g., Hartmann & Siegrist, 2018; Olatunji et al., 2007; Rozin & Fallon, 1987). Second, these items were analysed for their suitability and performance, and the scale was shortened and refined. In a third and final step, the newly developed scale was tested for construct validity including test-retest reliability.

Disgust, in its most basic form, is seen primarily as a food rejection mechanism (Chapman & Anderson, 2012). Thus, it is not surprising that it plays a role in our eating behaviour. Disgust was found to be closely related to food neophobia, a food behaviour where food items are rejected mainly due to their unfamiliar nature (Fessler, Arguello, Mekdara, & Macias, 2003; Hartmann & Siegrist, 2018). Furthermore, research suggests that even non-spoiled food can provoke a disgust reaction (Eickmeier, Hoffmann, & Banse, 2017) and that the emotion of disgust influences the way we handle and consume food (Hartmann & Siegrist, 2018; Pellegrino, Crandall, & Seo, 2015). These findings give us a glimpse of the impact that food disgust might have on our everyday lives. It is likely that a better understanding of the mechanisms underlying food disgust will not only pave the way for a better understanding of food avoidance behaviour but also help predict people’s food...
choices and encourage acceptance of newly developed products.

The first specific measure of food disgust sensitivity was only introduced recently. The Food Disgust Scale (FDS, Hartmann & Siegrist, 2018) uses text-based items to assess an individual’s food disgust sensitivity. Unlike other scales that include exotic foods such as monkey meat (Olatunji et al., 2007; Schienle, Walter, Stark, & Vaitl, 2002), the FDS focuses on food-related items associated with spoilage, hygiene, or contamination. It contains 32 items that describe food-related situations or products across eight subscales. These subscales include animal flesh, poor hygiene, human contamination, mould, decaying fruit, fish, decaying vegetables, and living contaminants. Specifically, these include ageing foods such as an apple slice that has turned brown or brown-coloured avocado pulp and potentially harmful foods, for example bread from which mould has been cut off, a steak that is still bloody inside, or raw fish, such as sushi. Items also cover human contamination (a friend bites into my bread) and poor hygiene (another person’s hair in my soup) (Hartmann & Siegrist, 2018).

The use of text to elicit disgust has advantages and disadvantages in comparison to pictures. First of all, it has to be noted that the integrated model of text and picture comprehension (Schnorr & Bannert, 2003) suggests that comprehension of text requires a different cognitive processes than the comprehension of pictures. According to this model, text comprehension is a descriptive process including text processing, construction of a text surface representation, production of several propositional representations of the text content, and the formation of a mental model. In comparison, picture comprehension is a depictive process including the perception of an external picture, creation of a visual image thereof, and construction of the picture’s propositional representation and mental model. The two processes have in common that they both require the reader to encode the information that is provided (Jian & Ko, 2017). Second, the use of text allows for a detailed description of an object’s past and present. It is therefore possible to describe in detail how a food item was produced or handled. If, however, a participant looks at a picture of a food item, the object’s past remains a subject to the participant’s interpretation. Third, the use of textual information across various countries requires translation. Schienle et al. (2002) demonstrated that simply translating the English version of the questionnaire by Haidt et al. (1994) into German turns the scale into an unreliable measure for the emotion of disgust. We therefore believe that the combination of both a text-based and a picture-based measure allows for a more comprehensive assessment of people’s disgust sensitivity.

In the present set of studies, we developed a food-specific disgust scale that uses images to induce disgust. Through the use of pictures, we aim to circumvent the limitations of text-based tools and to provide a measure that complements a text-based scale or that can be used as an alternative. In the following, three studies are presented that provide a comprehensive assessment of the Food Disgust Picture Scale (FDPS) and its factor structure. For these studies, we used independent Swiss adult samples. In the first study, we used an exploratory approach to collect pictures suitable for the assessment of food disgust sensitivity. In the second study, the knowledge we gained in Study 1 was used to refine the tool. Convergent validity of the FDPS was then assessed by comparing it to previously established measures of food disgust sensitivity, general disgust sensitivity, and food neophobia. In the third study, the short-term stability of the FDPS was determined in a test-retest design.

2. Study 1: scale construction

The first aim of this study was the selection of food-related pictures that possessed the ability to evoke disgust. The second, overarching aim of this first study was the development of a short and one-dimensional picture scale that measures participants’ disgust sensitivity.

2.1. Method

2.1.1. Participants

Data for this exploratory study were collected in 2016 in Switzerland. The link to an online survey was sent to a convenience sample via e-mail. This sample included people across different age groups that were known to the authors but had no connection to the research project. Four participants were excluded due to incomplete data. The final sample contained 57 people (35 female, 22 male) with an age range from 19 to 80 (M = 31.89, SD = 12.53). The minimum survey duration was more than half the median of the total survey duration. Therefore, none of the participants were excluded due to answering the questions too quickly (e.g., Hartmann, Keller, & Siegrist, 2016).

2.1.2. Food Disgust Picture Scale

Pictures were collected from various sources, including online services providing open-source images (pixabay.com), online services selling pictures (istock.com), and validated picture databases (Blechert, Meule, Busch, & Ohla, 2014; Foroni, Pergola, Aragiris, & Rumiati, 2013). Following a review of the existing literature (Blechert et al., 2014; Foroni et al., 2013; Hartmann & Siegrist, 2018), a pool of 36 food pictures covering a wide range of disgust-eliciting cues was gathered. These cues included hints of decay (rotting food), contamination (handling raw meat with bare hands, painted nails, and wearing rings), mould, or animal reminder (prawns with head and tail, whole chicken). For control purposes, we included four non-disgusting pictures (a slice of a watermelon, a strawberry, spinach leaves, and raisins, picture references NF_006, NF_037, NF_094, and NF_096, Foroni et al., 2013). We chose unprocessed natural food items to make sure that there were no hygiene concerns. The final selection then comprised 40 food pictures. Participants were asked to rate each of these pictures on a scale from 0 (not disgusting at all) to 100 (extremely disgusting). The introductory text to each picture was “Closely look at this picture. Imagine, you were asked to consume this food item. Please indicate how disgusting you perceive this item to be. Please answer intuitively, there are no right or wrong answers.” Participants gave their answers on an interactive slider as depicted in Fig. 1. The instructions to each question read “Click on the slider to give your answer. Subsequently, a cursor will appear. You can move this cursor along the slider.”

2.1.3. Food Disgust Scale

The short version of the Food Disgust Scale (FDS short, Hartmann & Siegrist, 2018) measures sensitivity to potential disgust eliciting food-related stimuli (animal flesh, poor hygiene, human contamination, mould, decaying fruit and vegetables, fish, and living contaminants) and can be used as a measure of food-specific disgust sensitivity. The short version of the scale consists of eight items describing scenarios which the participant is asked to rate on a scale from 1 (not disgusting at all) to 6 (extremely disgusting).

2.1.4. Procedure

The survey was conducted using the online survey tool Unipark (Management Questback GmbH, Germany) and its total duration was around ten minutes. First, participants were asked to answer socio-demographic questions. Second, participants had to fill in the FDS short. Third, participants were presented with the 40 selected food pictures. Picture order was randomised to prevent order
effects. However, we decided against randomising the order of the three parts of the survey (demographic questions, FDS short, FDPS) for two reasons. First, we assumed that we might confuse participants by asking them to rate disgust scenarios, followed by asking them for demographic information before presenting disgusting pictures again. Second, we presented the FDS short before presenting the FDPS to make sure that there were no cross-over effects from the FDPS pictures when assessing food disgust sensitivity with the FDS short.

2.1.5. Scale construction and data analysis

The rationale behind the scale construction took into account our three aims. First, we wanted to create a short tool, so we needed to reduce the number of items of the scale. Second, we aimed to create a tool that covered a wide range of disgust elicitors from the food domain. Third, we aspired to create a reliable scale that contained the most suitable items for the assessment of food disgust sensitivity. In pursuit of these goals, we dropped 32 of the 40 items based on several factors. To ensure that the pictures we used covered a broad range of food items and disgust elicitors, we excluded four non-disgusting pictures and items with content overlap (e.g., several items that showed mould). Furthermore, we avoided pictures bound to certain food cultures (e.g., zampone, an Italian delicacy). Finally, we dropped all pictures that were rated as either not disgusting or slightly disgusting as we wanted to use pictures that were able to induce a disgust reaction. A final selection of eight pictures remained (see Table 1 for details). For this scale, reliability analysis (Cronbach’s alpha) was conducted. IBM SPSS Statistics software package version 23 was used for all statistical analyses.

2.2. Results

Alpha reliability for the eight remaining pictures was good ($\alpha = .83$). The correlation between this picture scale and the FDS short was high with $r = .82$, $p < .001$. As Table 1 shows, the picture with a mouldy tomato was associated with higher mean disgust scores than images that depict other disgust elicitors. The mouldy tomato is followed by items related to meat and hygiene, which received slightly lower disgust scores. In comparison, participants evaluated pictures that show fish (including sea food) and vegetables as less disgusting.
Table 1
Characteristics of the eight selected pictures including disgust scores and picture sources (data from Study 1, N = 57).

<table>
<thead>
<tr>
<th>Description</th>
<th>Source</th>
<th>Disgust Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato with mould</td>
<td>a</td>
<td>71.28 26.85</td>
</tr>
<tr>
<td>Zampone (stuffed pig's trotter)</td>
<td>a</td>
<td>58.53 36.39</td>
</tr>
<tr>
<td>Woman's hands, wearing rings, handling meat</td>
<td>b</td>
<td>46.47 37.71</td>
</tr>
<tr>
<td>Whole chicken</td>
<td>b</td>
<td>43.86 34.10</td>
</tr>
<tr>
<td>Snail on strawberry</td>
<td>b</td>
<td>42.96 31.91</td>
</tr>
<tr>
<td>Spaghetti with mussels</td>
<td>a</td>
<td>29.88 36.74</td>
</tr>
<tr>
<td>Prawns with heads</td>
<td>b</td>
<td>28.40 34.35</td>
</tr>
<tr>
<td>Old tomatoes</td>
<td>c</td>
<td>21.91 21.11</td>
</tr>
</tbody>
</table>


2.3. Discussion

In this first study, we developed a new scale that measures food-specific disgust using pictures of food items that individuals are likely to be confronted with in everyday life. The eight selected pictures proved powerful in the measurement of food disgust sensitivity as indicated by the high correlation with the FDS short. However, the picture scale developed in this study required further refinement and validation. The items used in Study 1 did not include sweets. In order to cover a broader range of food groups, we decided to include these items in Study 2. Furthermore, as many of the pictures were taken from research databases commonly used for emotional research they cannot be used freely, modified, and distributed. Rights for their usage are restricted to ensure their quality as research stimuli by avoiding uncontrolled exposure. However, we aimed to construct a tool that is easy to use and freely available.

3. Study 2: scale refinement and validity testing

The second study tested whether the results found in Study 1 could be replicated when using a bigger sample of Swiss adults. Furthermore, while Study 1 aimed to explore the basic characteristics of the picture scale, Study 2 used this knowledge to improve the scale and its usability by substituting pictures that were not freely available by similar pictures which are free to use, modify, and distribute.

We assessed convergent validity of the FDPS through comparison with overall disgust sensitivity (DS-R, Olatunji et al., 2007), food disgust sensitivity (FDS short, Hartmann & Siegrist, 2018), and food neophobia (FNS, Pliner & Hobden, 1992). Food neophobia describes an individual’s tendency to avoid or reject a food due to its unfamiliar nature, and it has been shown to influence people’s food choices (Siegrist, Hartmann, & Keller, 2013).

3.1. Method

3.1.1. Participants

Data for the second study were collected in 2017. Participants were recruited from an internet panel provided by a commercial, ISO-certified panel provider (Respondi AG). Participants who did not finish the questionnaire were excluded. Furthermore, all participants that needed less than half the median of the total survey duration to complete the questionnaire were excluded (e.g., Hartmann et al., 2016), as it was assumed that these participants did not answer all questions reliably (n = 19). Quotas were applied to the variables of gender and age. The final sample consisted of 538 participants with an age range from 18 to 86 years (see Table 2 for details).

3.1.2. Scale refinement

Building on the results of Study 1, pictures bound by limited usage rights were replaced with pictures containing similar content that were free to use. Additionally, content was extended to include pictures showing a maize salad with a caterpillar in it, marmalade with mould on top, and chocolate with chocolate bloom (a white coating that is sometimes mistaken for mould). In total, 13 pictures were tested for their ability to measure food disgust sensitivity.

3.1.3. Measures

Food-specific disgust sensitivity was measured with the eight-item Food Disgust Scale (FDS short). Furthermore, the Disgust Scale–Revised (DS-R, Olatunji et al., 2007) was used as a measure of disgust sensitivity. This scale consists of 25 items which can be grouped into three domains (core disgust, animal reminder disgust, and contamination-based disgust). As a measure of food neophobia, the validated German version (Siegrist et al., 2013) of the Food Neophobia Scale (FNS) by Pliner and Hobden (1992) was used.

3.1.4. Procedure

The online survey tool Unipark (Management Questback GmbH, Germany) was used to conduct the survey. Its total duration was around ten minutes. In the first step, participants were asked to provide socio-demographic information. In the second step, the questionnaires as described earlier were presented. In the third and last step, participants were presented with 13 food pictures which they were asked to rate on a scale from 0 (not disgusting at all) to 100 (extremely disgusting) as depicted in Fig. 1. To prevent order effects, the presentation of pictures was randomised.

3.1.5. Data analysis

Mean scores and Cronbach’s alpha were calculated for the scales used. Correlational analyses were used to assess associations between age, gender, and disgust sensitivity. The final model was assessed through the use of confirmatory factor analysis (CFA) using maximum-likelihood estimation. Its model fit was estimated with the chi-square statistic, the root mean square error of approximation (RMSEA < .05), the comparative fit index (CFI > .90), and the normed fit index (NFI > .90). Modification indices (co-variances with MI values > 80 and regression weights with MI values > 50) were checked to identify misspecifications within the model (Shek & Yu, 2014). For salient loading, the criterion of .40 was used. The data were analysed with IBM SPSS Statistics software package version 23 and the extension SPSS AMOS version 23.0.0.

3.2. Results

3.2.1. Model refinement

To reduce the number of items included in the scale, we selected the best items from the categories of insect disgust, mould disgust,
and meat disgust based on inter-item correlations and Cronbach's alpha. Additionally, we removed fish-related items as they turned out to be problematic for two reasons. First, their usability for the FDPS was questionable due to the fact that they depicted very specific items (e.g., prawns and mussels). Second, fish and sea food are a minor source of protein in the Swiss diet (Keller et al., 2012). Thus, these items were removed from the scale. In total, we dropped five pictures. The list of dropped items and the possible difficulties connected to them are summarised in Table 3. This scale refinement then resulted in an eight-factor-model.

The remaining eight pictures illustrate various disgust elicitors (see Table 4 for an overview): animal flesh, human contamination, mould, decaying fruit or vegetables (three items), living contaminants, and chocolate bloom. However, the model fit of the resulting eight-item solution was insufficient. As a consequence, we allowed the error terms of the items 2001_chicken (depicting a whole chicken) and 2003_hands (showing hands that handle raw meat) to be correlated based on the fact that both items depict meat. The resulting model fit was acceptable with χ² (19) = 46.83, p < .001, CFI = .98, RMSEA = .05, NFI = .97. Standardised factor loadings ranged between .41 and .80 (see Fig. 2).

3.2.2. Internal consistency
Cronbach’s α for the eight-item FDPS was high with .83. The FDS short had an acceptable internal consistency for a short scale (eight items, α = .70). Similarly, the DS-R and FNS showed good internal reliabilities (DS-R: 25 items, α = .82; FNS: 10 items, α = .82).

3.2.3. Gender and age differences
Women (n = 271) reported significantly higher disgust sensitivity than men (n = 267) for all three measures of disgust (see Table 5). Furthermore, a positive association with age was found for FDPS scores (r = .16, p < .001) and food neophobia (r = .10, p < .05).

3.2.4. Convergent validity
We examined convergent validity of the FDPS scores in relation to measures of food disgust sensitivity (FDS short) and disgust sensitivity (DS-R) using correlational analyses. As shown in Table 6, significant and substantial correlations were found between the FDPS and both measures of disgust (FDS short and DS-R). The correlation between the FDPS and the short version of FDS (r = .64, p < .001) was stronger than between the FDPS and the DS-R (r = .55, p < .001) and its subscales core disgust (r = .53, p < .001), animal-reminder disgust r = .35, p < .001, and contamination-based disgust (r = .45, p < .001). A weaker but statistically significant correlation was found between the FDPS and food neophobia (r = .28, p < .001).

3.3. Discussion
Convergent validity of the newly developed scale was supported by the pattern of correlations that emerged between FDPS scores and disgust measures. As expected, strong correlations were found between the FDPS and the FDS short, which both assess food disgust sensitivity. Furthermore, the FDPS was significantly correlated with the DS-R and its subscales. The highest correlations were found between the FDPS and the core subscale of the DS-R, which is a mix of items including the consumption of culturally inappropriate foods (e.g., vanilla ice cream with ketchup), contamination through animals (e.g., cockroach), consumption of spoiled food (e.g., spoiled milk), and hygiene (e.g., the smell of urine). Slightly smaller correlations emerged for the contamination-based subscale of the DS-R, which includes hygiene (e.g., restaurant where the cook has a cold) and inappropriate foods (e.g., chocolate shaped like dog faeces). As expected, the lowest correlations were found for the animal reminder subscale, which does not contain any food-related items. Construct validity of the FDPS was further assessed through its relation to food neophobia. Previous studies (Al-Shawaf, Lewis, Alley, & Buss, 2015; Hartmann & Siegrist, 2018) showed that food disgust and food neophobia are related but distinctly different psychological constructs. The main difference between the two is that neophobia deals with novel foods while the FDPS focuses on familiar foods. To minimise content overlap between neophobia
Table 3

List of dropped items, their disgust scores, and reasons for their exclusion (data from Study 2).

<table>
<thead>
<tr>
<th>Picture</th>
<th>Description</th>
<th>Domain</th>
<th>Possible Difficulties</th>
<th>Disgust Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Marmalade with mould" /></td>
<td>Marmalade with mould&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Mould</td>
<td>Redundancy due to content overlap (potato with mould)</td>
<td>M: 76.45, SD: 25.72</td>
</tr>
<tr>
<td><img src="image" alt="Snail on cucumber" /></td>
<td>Snail on cucumber&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Living contaminants</td>
<td>Unclear whether the snail is to be considered as food</td>
<td>M: 62.63, SD: 30.54</td>
</tr>
<tr>
<td><img src="image" alt="Zampone (Italian dish), pork" /></td>
<td>Zampone (Italian dish), pork&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Animal flesh</td>
<td>Strongly depends on cultural background and religion</td>
<td>M: 59.82, SD: 33.00</td>
</tr>
</tbody>
</table>
and disgust, care was taken to include only items expected to be familiar to most Western people when selecting pictures for the FDPS. Still, a positive association between the two emerged, adding further support to the notion that the constructs are related.

4. Study 3: test-retest reliability

In the third study, we aimed to assess the short-term stability of the Food Disgust Picture Scale. For this purpose, a two-week test-retest design was used.

4.1. Method

4.1.1. Participants

For this study, participants were recruited in 2017 from an internet panel of the consumer behaviour research group at ETH Zurich in Switzerland. This panel consists of people from the general population who have agreed to participate in online studies. Participants were asked to fill in the FDPS twice at an interval of two weeks. The first survey was completed by 269 participants. In the second survey, 264 participants took part. Data from both surveys were matched using an anonymised, personalised code that participants were required to provide during both surveys. Participants were excluded from the analysis if they did not provide a matching code during both surveys or if they could not be matched using demographic characteristics. Similarly, participants who needed less than half of the median time to complete the first survey \( (n = 4) \) were excluded due to concerns regarding data quality (e.g., Hartmann, et al., 2016). The final sample contained 226 matching pairs (148 male, 78 female). Participants’ age ranged from 21 to 85 \( (M = 62.22, SD = 12.40) \).

4.1.2. Data analysis

Cronbach’s alpha was calculated for the scale in the first survey. Furthermore, Pearson’s correlations were computed for single items and total scores in both surveys. All analyses were run using IBM SPSS Statistics software package version 23.

4.2. Results and discussion

As in Study 2, women \( (M_1 = 66.62, SD_1 = 15.89; M_2 = 63.27, SD_2 = 18.11) \) scored higher on the FDPS than men \( (M_1 = 62.41, SD_1 = 18.01; M_2 = 61.78, SD_2 = 17.65) \). However, the effect did not reach statistical significance \( (t_1(224) = 1.74, p = .08; t_2(224) = 0.60, p = .55) \). Furthermore, a positive association between age and FDPS scores was found \( (r_1 = .14, p < .05; r_2 = .15, p < .05) \).
Table 4
Final version of the eight-item food disgust picture scale (data from Study 2, N = 538).

<table>
<thead>
<tr>
<th>Picture</th>
<th>Description</th>
<th>Source</th>
<th>Disgust Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>2911_maize</td>
<td>Maize salad with a caterpillar in it</td>
<td>b</td>
<td>80.01 23.72</td>
</tr>
<tr>
<td>2905_potato</td>
<td>Potato with mould</td>
<td>a</td>
<td>79.17 24.61</td>
</tr>
<tr>
<td>2906_melon</td>
<td>Decaying melon</td>
<td>a</td>
<td>69.05 26.20</td>
</tr>
<tr>
<td>Picture</td>
<td>Description</td>
<td>Source</td>
<td>Disgust Scores</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td>2912_tomatoes</td>
<td>Wrinkled tomatoes</td>
<td>b</td>
<td>57.34 29.25</td>
</tr>
<tr>
<td>2902_avocado</td>
<td>Avocado with brown spots</td>
<td>b</td>
<td>55.68 30.13</td>
</tr>
<tr>
<td>2903_chocolate</td>
<td>Chocolate with chocolate bloom</td>
<td>b</td>
<td>52.00 32.21</td>
</tr>
</tbody>
</table>

(continued on next page)
Internal consistency of the FDPS was sufficient for a short scale ($\alpha_1 = .76$, $\alpha_2 = .82$). These values are similar to the value obtained in Study 2, indicating that the FDPS measures food disgust reliably across different study samples. This finding is of particular interest considering that due to the quotas we applied, participants in Study 2 were clearly younger and the sample contained more women than the sample used for Study 3. Additionally, the mean disgust scores and ranges of scores obtained for single pictures in Study 3 were comparable to the values from Study 2 (see Table 7).

The results of the test-retest reliability analysis depend on the time span between the first and the second data collection (Bühner, 2004). With this information in mind, we adapted the study design of previous food disgust research (Hartmann & Siegrist, 2018), thereby making our results comparable. Hartmann and Siegrist (2018) reported a test-retest correlation of .86 for the FDS short. Test-retest correlation for the FDPS reached an acceptable level of similar magnitude ($r = .74$, $p < .001$). These results suggest that participants’ disgust sensitivity remains stable over a period of two weeks.

5. General discussion

The aim of the present article was to develop and test the Food Disgust Picture Scale (FDPS), which is a new short measure for food disgust. It consists of eight pictures depicting various food-related disgust elicitors (e.g., mould, meat, hygiene, decay, and insect contamination). To assess its psychometric properties, three studies were conducted. Our results suggested that the FDPS is a valid and reliable short measure of food specific disgust that may facilitate food-related disgust research.

Though a considerable amount of research has revealed that women are more disgust sensitive than men (e.g., Druschel & Sherman, 1999; Haidt et al., 1994; Oaten, Stevenson, & Case, 2009; Olatunji et al., 2007) the reasons for and the exact nature of these gender differences in disgust sensitivity are still not completely understood. The fact that sexually mature individuals were found to be more disgust sensitive than sexually immature individuals (Prokop & Jančovicová, 2013) may indicate a connection between the gender differences in disgust sensitivity and sexuality or reproduction. In line with this, other studies have provided

<table>
<thead>
<tr>
<th>Picture</th>
<th>Description</th>
<th>Source</th>
<th>Disgust Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001_chicken</td>
<td>Whole chicken</td>
<td>a</td>
<td>48.98</td>
</tr>
<tr>
<td>2003_hands</td>
<td>Hands handling meat, rings, painted nails</td>
<td>a</td>
<td>43.03</td>
</tr>
</tbody>
</table>

Note: Disgust scores ranged from 0 to 100 for all eight pictures.
Picture sources: a – pixabay.com, b – produced by the authors.
evidence for a connection between sex hormones and disgust sensitivity in women. Specifically, Fessler and Navarrete (2003) found a positive correlation between disgust sensitivity in the sex domain and the likelihood of conception based on participants’ self-reported menstrual cycles. In addition to this, Fessler, Eng, and Navarrete (2005) reported heightened disgust sensitivity in women during the first trimester of pregnancy. They reasoned that with embryos being the most vulnerable during the first trimester of pregnancy, increased disgust sensitivity could be seen as a protective mechanism for the unborn child. In the light of these results, the gender difference we found in Study 2, in which women scored higher on the FDPS, can be interpreted as a possible defence mechanism, especially because in the prospect of bearing or caring for children, pathogen contact involves more risks for women than for men. However, no significant gender difference was found in Study 3. This could be due to the smaller sample in Study 3, which

![Fig. 2. The final model for the Food Disgust Picture Scale (FDPS, data from Study 2, N = 538). The eight-item model (χ²(19) = 46.83, p < .001, CFI = .98, RMSEA = .05, NFI = .97) consists of eight pictures depicting various disgust elicitors.](image)

Table 5

<table>
<thead>
<tr>
<th></th>
<th>All (N = 538)</th>
<th>Women (n = 271)</th>
<th>Men (n = 267)</th>
<th>t-test for gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>FDPS</td>
<td>60.66</td>
<td>20.10</td>
<td>61.94</td>
<td>19.40</td>
</tr>
<tr>
<td>FDS short</td>
<td>3.38</td>
<td>0.87</td>
<td>3.54</td>
<td>0.83</td>
</tr>
<tr>
<td>DS-R</td>
<td>12.93</td>
<td>4.51</td>
<td>14.37</td>
<td>4.11</td>
</tr>
<tr>
<td>FNS</td>
<td>2.93</td>
<td>0.98</td>
<td>2.85</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Note: FDS short = eight-item version of the Food Disgust Scale (Hartmann & Siegrist, 2018); DS-R = Disgust Scale-revised (Olatunji et al., 2007); FNS = Food Neophobia Scale (Pliner & Hobden, 1992).

***p < .001.

Table 6

Pearson correlations between the Food Disgust Picture Scale and measures of validity (data from Study 2, N = 538).

<table>
<thead>
<tr>
<th>Picture</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>2001_chicken</td>
<td>51.77</td>
<td>34.64</td>
</tr>
<tr>
<td>2003_hands</td>
<td>42.24</td>
<td>33.23</td>
</tr>
<tr>
<td>2905_potato</td>
<td>81.40</td>
<td>20.34</td>
</tr>
<tr>
<td>2902_avocado</td>
<td>60.85</td>
<td>29.34</td>
</tr>
<tr>
<td>2911_maize</td>
<td>82.56</td>
<td>23.46</td>
</tr>
<tr>
<td>2912_tomatoes</td>
<td>58.44</td>
<td>28.22</td>
</tr>
<tr>
<td>2903_chocolate</td>
<td>61.13</td>
<td>30.23</td>
</tr>
</tbody>
</table>

Note: FDS short = eight-item version of the Food Disgust Scale (Hartmann & Siegrist, 2018); DS-R = Disgust Scale-revised (Olatunji et al., 2007); DS-R subscales: Core – Core Disgust, Animal – Animal Reminder Disgust, Contamination – Contamination-based Disgust; FNS = Food Neophobia Scale (Pliner & Hobden, 1992).

*p < .05, **p < .01, ***p < .001.
in turn led to less statistical power. Even though the variation was not significant, women scored higher than men on the FDPS in Study 3.

Previous research has reported a negative association between age and disgust (Eickmeier et al., 2017; Fessler & Navarrete, 2003). It has been argued that the decrease in disgust sensitivity with age could be because a long and extensive history of disgust experiences make an individual less susceptible to disgust cues (Oaten et al., 2009). Contrary to this reasoning, Studies 2 and 3 revealed a positive association between FDPS scores and participants’ age. As age comes with an increasing risk of and vulnerability to illness, we reason that people from older age groups benefit from an increase in food disgust sensitivity that protects them from food-borne illnesses (Oaten et al., 2009).

In the questionnaires, care was taken to ensure that participants answered the FDS short first before moving on to the FDPS. In doing so, we aimed to prevent cross-over effects from the FDS pictures on the assessment of participants’ disgust sensitivity with the FDS short. However, this procedure raised the question of whether the FDS short might have influenced responses on the FDPS. In Study 2, the FDPS followed the FDS short. For Study 3, however, participants answered the FDPS only. As the FDPS scores were comparable between the two studies, it is reasonable to assume that there was no carry-over effect from the FDS short.

Using different panels for each of the three studies presented here, it is not surprising that the mean age differed across the studies. This effect was reinforced by the fact that we set quotas for age and gender for panellists who took part in Study 2, but not for Studies 1 and 3. Using a different panel for each of the three studies meant we were able to demonstrate the scale’s applicability to the general public. Additionally, our findings supported the notion that the FDPS is a measure that can be used across adult samples.

Some of our findings were unexpected. For example, we chose to include in the scale the item 2003_hands, which depicts a woman’s hands handling raw meat, as we assumed that participants would see it as an unhygienic way of handling food. Therefore, we suspected that the picture would fall into the hygiene subdomain of disgust. Surprisingly, our results suggested that the fact that the depicted food was meat was more important for participants’ disgust assessment than any hygiene concerns. Evidence that the two items 2003_hands and 2001_chicken belonged to a similar group of disgust elicitors was supported by previous research (Tylburg, Laaksaoso, Ruff, & Klauke, 2016). This research suggested that the consumption of fruit and vegetables poses different risks than the consumption of meat and that meat-related threats are often harder to identify than plant-related threats.

Correlation patterns between the FDPS and the FDS short, both measuring participants’ food disgust sensitivity, indicated a strong relation between the two measures. However, they differed in the kind of disgust elicitor they used, which showed that the tools offer complementary measures of individual food disgust sensitivity. We found that some of the written scenarios implied a certain behaviour (e.g., “To eat the mould-free part of a mouldy tomato.”) (Hartmann & Siegrist, 2018) or describe what has happened to a food item (e.g., “If people blow their nose before they serve my meal.”) (Hartmann & Siegrist, 2018), whereas the FDPS confronts people with a potentially disgusting food item without providing further information. We therefore assumed that the FDPS complements the FDS short in the assessment of food disgust by using pictures as disgust elicitors instead of words without one measure necessarily being superior to the other. It remains an interesting question for future research to identify the most suitable area of application for both measures.

This study was not without limitations. First, as most of the disgust scales available so far (e.g., Hartmann & Siegrist, 2018; Olatunji et al., 2007), the FDPS does not contain control items. However, the scale’s application to child populations might benefit from the inclusion of control items. Second, though care was taken to select food items that were familiar to most Western people, the FDPS was developed and tested on a Swiss sample. Therefore, the scale’s usability across countries remains an exciting topic for future research.

We believe that the short and comprehensive nature of the FDPS will help facilitate food disgust research with children and people with lower literacy levels as the disgust elicitor works independently of language. Hence, we are confident that the FDPS might help overcome the dearth of measures that are comparable across age groups and countries.

6. Conclusion

As demonstrated by three studies, the FDPS is a valid and reliable measure for food disgust. As it is a short scale consisting of eight items only, it is economical and can therefore be used in addition to or in complement to other scales. The FDPS has several strengths. First, all pictures are free to use, modify, and distribute which allows their use in various test designs where modifications might be advantageous (e.g., eye tracking studies). Second, participants do not have to imagine or understand a written scenario. This facilitates research involving children or people with lower literacy levels. Third, this scale uses pictures to induce disgust. Problems stemming from ambiguity of language or insufficient translation are therefore largely circumvented when using this scale. For these reasons, this tool could significantly facilitate intercultural research on food disgust.

Acknowledgements

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.appet.2018.02.020.

References


