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Short Communication

Effects of labeling a product eco-friendly and genetically modified: A cross-cultural comparison for estimates of taste, willingness to pay and health consequences

Patrik Sörqvist [a,*], John E. Marsh [a,b], Mattias Holmgren [a], Rebecca Hulme [b], Andreas Haga [a], Paul B. Seager [b]

[a] Department of Building, Energy and Environmental Engineering, University of Gävle, Gävle, Sweden
[b] School of Psychology, University of Central Lancashire, Preston, UK

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ABSTRACT

As the demand for eco-friendly food—produced without pesticides and environmentally harmful chemicals—increases, the need to develop genetically modified (GM) organisms that are more resistant to parasites and other environmental crop threats may increase. Because of this, products labeled both "eco-friendly" and "genetically modified" could become commonly available on the market. In this paper, we explore—in a Swedish and a UK sample—the consequences of combining eco-labeling and GM-labeling to judgments of taste, health consequences and willingness to pay for raisins. Participants tasted and evaluated four categories of raisins (eco-labeled and GM-labeled; eco-labeled; GM-labeled; and neither eco-labeled nor GM-labeled). The results suggest that there is a cost associated with adding a GM-label to an eco-labeled product: The GM-label removes the psychological benefits of the eco-label. This negative effect of the GM-label was larger among Swedish participants in comparison with UK participants, because the magnitude of the positive effect of the eco-label was larger in the Swedish sample and, hence, the negative effects of the GM-label became more pronounced (especially for health estimates). The roles of individual differences in attitudes, environmental concern and socially desirable responding in relation to the label effects are discussed.

1. Introduction

Consumer demand for environmentally friendly (eco-friendly) products is high (Rousseau, 2015) while the general consumer is skeptical towards genetically modified (GM) produce (Costa-Font, Gil, & Traill, 2008; Montuori, Triassi, & Sarnacchiaro, 2012). Eco-friendly food is produced in ways that are ecological (i.e., less harmful to the natural environment) and beneficial to the health of the farmers, as its production involves less pesticides and harmful chemicals than conventional produce involves. GM food, in turn, is produce that has been altered through biotechnology to enhance its growth potential and resistance to parasites (Murrell, 2014). One reason why consumers refrain from purchasing and consuming GM products appears to be out of environmental concern (Montuori et al., 2012). However, while the term "organic" is sometimes used to denote a food product that is not GM, GM produce and eco-friendly food are not mutually exclusive. In a not so distant future, demands for eco-friendly food—produced without environmentally harmful chemicals—may require extended development of products resulting from biotechnology as GM food is capable of resisting parasites with less use of pesticide. In the present paper, we explore—in two different cultures—the consequences of combining an eco-label with a GM-label to judgments of taste, health consequences and willingness to pay.

The year 2013 witnessed a 100 factor increase in the use of land cultivated by GM products since their first introduction in 1996 (ISAAA, 2013). Moreover, GM crops were planted on an estimated 10% of the world's croplands in 2010 (James, 2011). Among the scientific community, GM crops are widely considered to pose no greater risk to human health than conventional food (Ronald, 2011). For example, Ronald (2011) reports that there are no adverse environmental or health effects from commercialization of genetically engineered crops. Moreover, Ronald (2011) cites an array of reports which conclude that the body of knowledge addressing the issue of food safety in relation to genetically engineered crops is comprehensive. Such reports deem that there are similar consequences to human health and the environment associated with genetic engineering as there are with those associated

* Corresponding author at: Department of Building, Energy and Environmental Engineering, University of Gävle, SE-801 76 Gävle, Sweden.
E-mail address: patrik.sorqvist@hig.se (P. Sörqvist).

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with conventional breeding. That is, there is a similar risk of unintended consequences from new variety of plants (and therefore crops) developed via genetic engineering as there is produced via conventional approaches. However, the probability with which any unintended consequences can be detected is much greater for genetically-engineered crop varieties since there are currently three governmental agencies regulating and assessing newly developed GM crops, whereas the same agencies do not regulate crops developed through conventional breeding – approaches for which compounds with harmful effects on humans and animals have been documented (Ronald, 2011).

The discrepancy of views regarding the safety of GM food between expert scientists and the general public has been highlighted in a recent poll by the Pew Research Center (2015). Among the key data of this survey are that 57% of the general US public agree that GM foods are generally unsafe to eat while 88% of scientists from America's largest science body (American Association for the Advancement of Sciences [AAAS]) state that GM foods are generally safe. This represented the largest opinion difference between the public and scientists within the survey (cf. Hilbeck et al., 2015). Moreover, the public's perceptions of GM food differ substantially from that of conventional and organic food (Anderson, Wachenheim, & Lesch, 2006), and there is a further difference in preference for these methods of food production across cultures (Pirani & Secondi, 2011).

In view of these public opinions on food with different origins and production systems, an increasingly large number of products on the market have labels attached to them, such as 'fair trade' and 'organically produced'. These labels serve as a marketing device to inform concerned consumers, but the labels also tend to have other psychological consequences. Specifically, labels tend to enhance subjective evaluations of products when the labels appeal to the person making the evaluations (Piqueras-Fiszman & Spence, 2015). For example, individuals prefer the taste of chocolate claimed to be "Fair Trade" over identical chocolate claimed to be "conventional" (Lotz, Christandl, & Fetchenhauer, 2013). Similarly, products tend to receive more favorable perceptual evaluations (e.g., they are perceived to: taste better, be more comfortable) when they are labeled "eco-friendly" (Lee, Shimizu, Kniffin, & Wansink, 2013; Sörqvist et al., 2013; Sörqvist, Haga, Holmgren, & Hansla, 2015; Sörqvist, Haga, Langeborg, et al., 2015). These "halo effects" seem to reflect actual changes to the perceptual input—a perceptual distortion—as a consequence of the participants' associations with the label rather than biased self-reports in the participants' responses (Litt & Shiv, 2012), and result in different neural processing of the taste experience (Enax, Krapp, Piehl, & Weber, 2015), at least in the context of the effects of labeling on taste perception. Moreover, the effects seem to arise because people expect the labeled products to be superior to their non-labeled/conventional counterparts, or because people wish that the labeled products would be better than their counterparts (Sörqvist, Haga, Langeborg, et al., 2015). On this view, the psychological effects of labeling depend on people's beliefs and attitudes toward the labeled products and, because of this, the effects could be positive or negative and vary in magnitude as a function of cultural differences.

Scandinavians (people from Sweden, Norway and Denmark) are highly concerned with environmental issues. In a study by Pirani and Secondi (2011), nearly 100% of the Swedish respondents viewed environment-protective actions as 'fairly important' or 'very important' while 90% of the UK sample said the same thing. Moreover, 90% of the Swedish sample said they were willing to pay a premium for eco-friendly food while approximately 80% of the UK respondents claimed they were willing to pay more money for eco-friendly products. In light of these, albeit small cultural differences, the eco-label effect (i.e., the preference bias for eco-labeled over conventional-labeled products) should be larger in a Swedish sample as compared with a UK sample.

In contrast, around 20% of the Swedish population states that they are willing to purchase genetically modified food while the complementary 80% is more skeptical (Lehrman & Johnson, 2008). Individuals from the UK also generally have a negative view of genetically modified food (Poortinga & Pidgeon, 2006), but when results from studies with Swedish and British participants are compared (Lehrman & Johnson, 2008; Spence & Townsend, 2006), Swedish people come out as somewhat more concerned with the potentially negative effects of genetically modified food. Taken together with the finding that label effects depend on expectation processes (Piqueras-Fiszman & Spence, 2015) and attitudes such as environmental concern (Sörqvist, Haga, Holmgren, et al., 2015), it is predicted that GM-labels should lead to less favorable evaluations of a product, both in a Swedish and a UK sample, but that the magnitude of this negative effect might be larger in a Swedish sample.

In the present paper, we used an experimental protocol to explore the psychological consequences of combining a positive eco-friendly label with a (presumably) negative GM-label. The participants were asked to rate the consumables on three judgmental dimensions: sensory-related (taste), value-related (willingness to pay) and health-related (health consequences of eating the food product). Taste and willingness to pay are important factors to study because they stand out as strong determinants of consumer choice (e.g., Kikulwe, Wesseler, & Falck-Zepeda, 2011) and taste is theoretically interesting because taste judgments are based on a sensory experience whereas value- and health-related estimates are not. The reason why health-related estimates are interesting to study in the context of combined eco-friendly and GM labels is because people tend to avoid GM food due to concerns with health consequences (Montuori et al., 2012), while they are attracted to eco-friendly food because they think it is beneficial to their health (Williams & Hammitt, 2001). The study of the effects of combining eco-friendly and GM labels will reveal how people deal with these incompatible attitudes. Moreover, we measured individual differences in environmental concern (worries for future environment-related consequences), tendencies toward socially desirable responding (the tendency to respond in ways that would appeal to others rather than to respond in a more truthful manner) and general attitudes toward GM and eco-friendly food in a Swedish and a UK sample, to test whether the magnitude of the label effects vary with the psychological characteristics of the participants. This control of individual differences in attitudes is particularly important in view of the fact that "eco-friendly" and "GM" can have different meanings in the two cultures depending on their experience with these two labels.

2. Methods

2.1. Participants

Forty-four Swedish (64% women, mean age = 25 years, range 19–49 years) and forty-four English (61% women, mean age = 33 years, range 19–58 years) individuals participated in the study and were recruited from two University campuses.

2.2. Materials

2.2.1. Raisins

Thompson sultana raisins from California that are available in both the UK and Sweden were used. Conventional raisins were used, which were neither eco-friendly nor genetically modified.

2.2.2. Questionnaire

The taste and health estimates were made following the same relative-estimates procedure as in Experiment 1 of the study by Sörqvist, Haga, Langeborg, et al. (2015). The participants tasted four raisins (one from each category; eco-labeled and GM-labeled, eco-labeled but not GM-labeled, GM-labeled but not eco-labeled, and neither eco- nor GM-labeled). They rated the taste of each raisin, respectively, immediately after tasting. The estimates were made on a scale ranging from 1 (not at all good) to 11 (very good), but the first raisin was assigned a "6" on this taste scale, and the participants were told to use this value as a comparison point when making taste estimates for the next three raisins. The purpose of this method was to reduce error variance and to ensure that all participants followed the same procedure (i.e., comparing the raisins) while tasting. The order of the four label categories was counterbalanced between participants, so that all label categories acted as the reference point the same number of times. After making the taste estimates, the participants were asked to make a judgement regarding how healthy they believed that the raisins were to eat. These estimates were made the same way, on the same scale, as the taste estimates. The participants then wrote down how much they were willing to pay (WTP) for each of the four raisin types, respectively. The Swedish participants were told that they should report how much they were WTP for 500 g and the UK participants how much they were WTP for 1 pound (lb) of raisins.

Next, the participants were asked to answer the questions "*What do you think of genetically modified food products?*" across four judgmental dimensions (unpleasant – pleasant, bad – good, unfavorable – favorable, negative – positive). Judgments were made in response to each of the four dimensions on a scale from 1 to 5. The participants also answered the question "*What do you think of eco-friendly food?*" by responding to another set of the same four judgmental dimensions. Responses were used to calculate an overall index of the participants' attitude towards genetically modified food products and eco-friendly food products, respectively, by averaging the responses across the four dimensions.

Individual differences in egoistic, altruistic, and biospheric environmental concerns were also measured. The following questions were used (Schultz, 2001; Swedish version adopted from Sörqvist, Haga, Langeborg, et al., 2015): "How concerned are you that today's environmental problems will affect...?". The participants responded to each of 12 consequences on a seven-point scale ranging from 1 (not concerned) to 7 (very concerned). Measures of concern for egoistic consequences of environmental problems were obtained by averaging questions concerning "myself", "my lifestyle", "my health" "my future"; measures of altruistic consequences were obtained by averaging questions concerning "all human beings", "people close to me", "future generations", and "my children"; and measures of biospheric consequences were obtained by averaging questions concerning "all living things", "plants", "animals", and "life at sea". The general average across all 12 questions was used to obtain an index of individual differences in environmental concern.

On the final page of the questionnaire, a short version of the BIDR 6 scale (Bobbio & Manganelli, 2011), was presented to assess socially desirable responding. The scale comprised 16 statements (e.g., "I have some pretty awful habits"; "I never regret my decisions"). The participants were asked to rate each statement on a scale ranging from 1 (not true) to 7 (very true). The average across all 16 statements was used to obtain an index of individual differences in socially desirable responding.

2.3. Design and procedure

The experiment took place in both the UK and in Sweden. In both countries, participants were recruited on a university campus and were invited to a laboratory where they could taste the raisins and respond to the questionnaires in isolation. In the laboratory, there was a table displaying 4 paper plates. One (and only one) raisin was placed on each plate respectively. There were notes beside the paper plates that told the participant whether the raisin was "genetically-modified and eco-friendly", "eco-friendly", "genetically-modified" or "conventional". The text of the notes was presented in 36 point Times New Roman font. The order by which the label categories were displayed (across the table, left to right) was counterbalanced between participants as was the order of tasting (the participants were told to taste the left-most raisin first, and so on. They did not cleanse their palates between tasting raisins).

3. Results

3.1. Sample characteristics

The Swedish participants had a more positive attitude to eco-friendly food ($M = 4.42$, $SE = 0.07$) compared to the UK participants ($M = 4.08$, $SE = 0.10$), $t(86) = 2.77$, $p = .007$, Cohen's $d = 0.60$, and the Swedish participants had a more negative attitude towards genetically modified food ($M = 2.43$, $SE = 0.12$) in comparison with the UK sample ($M = 2.98$, $SE = 0.12$), $t(86) = 3.19$, $p = .002$, Cohen's $d = 0.69$. The difference between the countries was relatively small but suggests that the positive eco-label effect may be more pronounced in the Swedish sample and the negative GM-label effect may also be more pronounced in the Swedish sample. Moreover, the degree of environmental concern did not differ between the Swedish ($M = 5.50$, $SE = 0.15$) and the UK sample ($M = 5.25$, $SE = 0.14$), $t(86) = 1.23$, $p = .223$, Cohen's $d = 0.26$, but the UK sample ($M = 4.28$, $SE = 0.10$) was slightly higher in socially desirable responding than the Swedish sample ($M = 3.96$, $SE = 0.10$), $t(86) = 2.25$, $p = .027$, Cohen's $d = 0.48$.

3.2. Taste estimates

As can be seen in Fig. 1, the magnitude of the eco-label effect (i.e., a preference for eco-labeled products) on taste estimates was greater in the Swedish sample than in the UK sample. Moreover, the negative effect due to labeling the product genetically modified was pronounced but did not vary with sample origin. This was confirmed by a 2(GM-label: yes vs. no) × 2(eco-label: yes vs. no) × 2(sample origin: Sweden vs. UK) mixed analysis of variance (ANOVA) with taste as the dependent variable, GM-label and eco-label as within-participant variables and sample origin as the between-participant variable. The analysis revealed a close to significant effect of eco-label, $F(1, 86) = 3.54$, $MSE = 1.77$, $p = .063$, $\eta^2_p = .04$, but a significant interaction between eco-label and sample origin, $F(1, 86) = 4.17$, $MSE = 1.77$, $p = .044$, $\eta^2_p = .05$. In the Swedish sample, products with an eco-label received more favorable evaluations, $F(1, 43) = 5.84$, $MSE = 2.39$, $p = .020$, $\eta^2_p = .12$, whereas there was no such eco-label effect in the UK sample, $F(1, 43) = 2.02$, $MSE = 1.82$, $p = .162$, $\eta^2_p = .05$. The GM-label main effect was also significant, $F(1, 85) = 9.51$, $MSE = 2.66$, $p = .003$, $\eta^2_p = .10$, but GM-label did not interact with sample origin, $F(1, 85) = 0.34$, $MSE = 2.66$, $p = .721$, $\eta^2_p = .002$, nor with eco-label, $F(1, 85) = 0.42$, $MSE = 1.77$, $p = .521$, $\eta^2_p = .005$. Moreover, there was no three-way interaction between the factors, $F(1, 85) = 0.53$, $MSE = 1.77$, $p = .469$, $\eta^2_p = .006$. Hence, the positive eco-label effect arose only in the Swedish sample and the negative GM-label effect arose in both samples to a similar magnitude. Because the Swedish and the UK samples differed on socially desirable responding, a 2 (GM-label: yes vs. no) × 2(eco-label: yes vs. no) × 2(sample origin: Sweden vs. UK) control analysis, with socially desirable responding

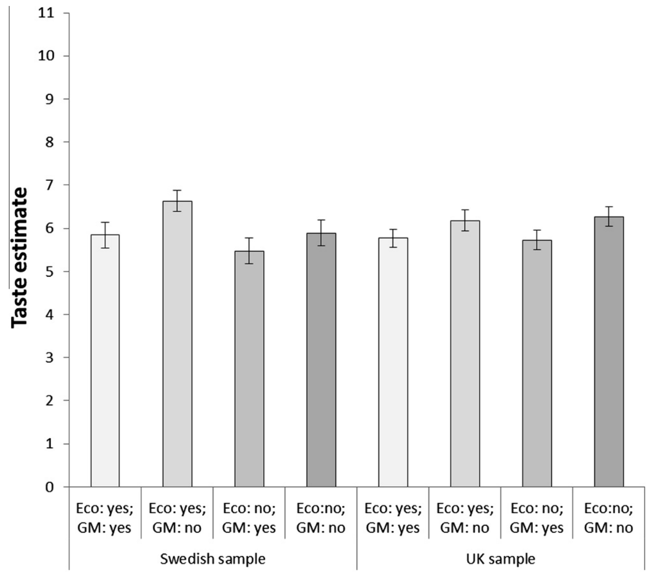

Fig. 1. Swedish and UK participants' taste estimates of raisins labeled both eco-friendly and genetically modified (GM), only eco-friendly, only GM, or neither eco-friendly nor GM. Error bars represent standard error of means.

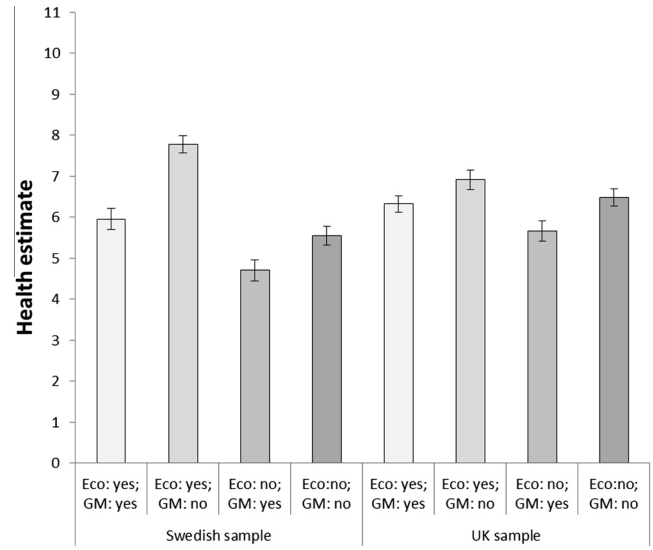

Fig. 2. Swedish and UK participants' estimates of how healthy it is to eat raisins labeled both eco-friendly and genetically modified (GM), only eco-friendly, only GM, or neither eco-friendly nor GM. Error bars represent standard error of means.

as a covariate, was undertaken. This analysis revealed results consistent with the original analysis. Socially desirable responding interacted with the GM-label effect, $F(1, 85) = 6.51$, $MSE = 2.47$, $p = .013$, $\eta^2_p = .07$, because higher socially desirable responding was associated with a greater self-reported preference for the product without the GM label, $r(86) = .25$, $p = .019$, but socially desirable responding did not interact with any other variable. The interaction between eco-label and sample origin was still significant, $p = .045$, as was the main effect of GM-label, $p = .048$. Hence, the main effect of GM-label and the interaction between eco-label and sample origin was still present when socially desirable responding was statistically controlled.

3.3. Health estimates

Fig. 2 reports the health estimates for eco-labeled and GM-labeled raisins across participants from the two countries. As seen below, the interaction between eco-label and GM-label was stronger in the Swedish sample than in the UK sample. That is, the positive effects of adding an eco-label was larger in the Swedish sample compared to the UK sample, and the negative effects of adding a GM-label was somewhat more pronounced in the Swedish sample because of the Swedish participants' strong preference for the eco-labeled raisin (i.e., the strong preference made the "drop" in the subjective evaluation of the GM-labeled product larger). A 2(GM-label: yes vs. no) × 2(eco-label: yes vs. no) × 2(sample origin: Sweden vs. UK) mixed ANOVA with health estimates as the dependent variable, GM-label and eco-label as within-participants variables and sample origin as the between-participant variable, revealed a significant effect of GM-label, $F(1, 86) = 34.93$, $MSE = 2.61$, $p < .001$, $\eta^2_p = .29$, and a significant effect of eco-label, $F(1, 86) = 74.97$, $MSE = 1.53$, $p < .001$, $\eta^2_p = .47$, but no effect of sample origin, $F(1, 86) = 2.64$, $MSE = 4.00$, $p = .108$, $\eta^2_p = .03$. The interaction between sample origin and GM-label did not reach significance, $F(1, 86) = 3.30$, $MSE = 2.61$, $p = .073$, $\eta^2_p = .04$, but there was a highly significant interaction between sample origin and eco-label, $F(1, 86) = 20.46$, $MSE = 1.53$, $p < .001$, $\eta^2_p = .47$. GM-label and eco-label did not interact, $F(1, 86) = 2.15$, $MSE = 1.44$, $p = .146$, $\eta^2_p = .02$, but there was a significant three-way interaction between all factors, $F(1, 86) = 5.55$, $MSE = 1.44$, $p = .021$, $\eta^2_p = .06$. The three-way interaction emerged because the interaction between GM-label and eco-label was significantly stronger in the Swedish sample, $F(1, 86) = 7.38$, $MSE = 1.42$, $p < .001$, $\eta^2_p = .15$, than in the UK sample, $F(1, 86) = 0.39$, $MSE = 1.45$, $p = .535$, $\eta^2_p < .01$. In the context of health estimates, socially desirable responding was unrelated to the GM-label effect, $r(86) = .05$, $p = .638$.

3.4. Stated willingness to pay

As can be seen in Fig. 3, both Swedish and UK participants were willing to pay a higher price for eco-labeled raisins in comparison with a non-labeled alternative, but this difference was larger in the Swedish sample. In other respects, the two samples behaved in similar ways. This was confirmed by a 2(GM-label: yes vs. no) × 2(eco-label: yes vs. no) × 2(sample origin: Sweden vs. UK) mixed ANOVA with willingness to pay estimates as the dependent variable, GM-label and eco-label as within-participants variables and sample origin as between-participant variable. There were significant main effects of eco-label, $F(1, 86) = 91.42$, $MSE = 21.98$, $p < .001$, $\eta^2_p = .52$, and GM-label, $F(1, 86) = 19.58$, $MSE = 64.89$, $p < .001$, $\eta^2_p = .19$, but not of sample origin, $F(1, 86) = 1.62$, $MSE = 497.48$, $p = .207$, $\eta^2_p = .02$. The interaction between eco-label and GM-label was significant, $F(1, 86) = 5.01$, $MSE = 19.72$, $p = .028$, $\eta^2_p = .06$, as was the interaction between eco-label and sample origin, $F(1, 86) = 14.15$, $MSE = 21.98$, $p < .001$, $\eta^2_p = .14$. However, the interaction between GM-label and sample origin was not significant, $F(1, 86) = 0.37$, $MSE = 64.89$, $p = .548$, $\eta^2_p = .004$, and there was no interaction between all three factors, $F(1, 86) = 1.86$, $MSE = 19.73$, $p = .176$, $\eta^2_p = .02$. In the context of willingness to pay estimates, socially desirable responding was unrelated to the GM-label effect, $r(86) = -.12$, $p = .262$.

4. Discussion

As can been seen in the left hand side of Figs. 1–3, the eco-labeled (non-GM-labeled) alternative is favorably evaluated, while the eco- and GM-labeled alternative is almost level with the non-labeled alternative. These findings suggest that there is a cost associated with adding a GM-label to an eco-labeled product: The GM-label removes the psychological benefits of the eco-label. This neg-

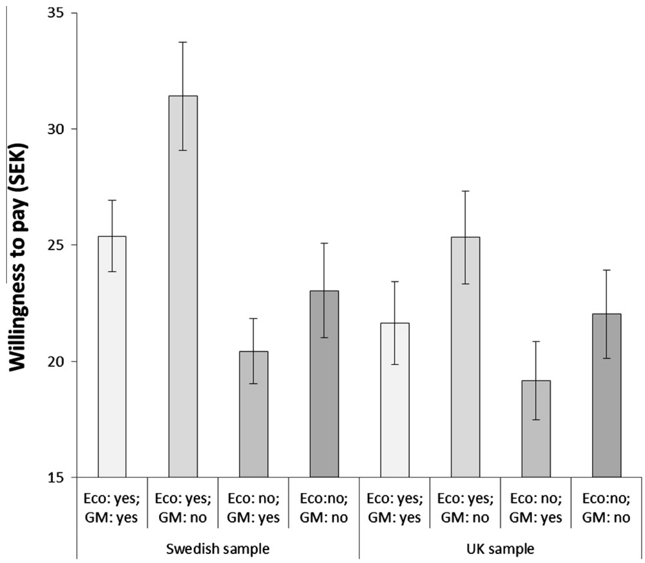

Fig. 3. Swedish and UK participants' willingness-to-pay estimates of raisins labeled both eco-friendly and genetically modified (GM), only eco-friendly, only GM, or neither eco-friendly nor GM. Data is shown in the Swedish currency Krona (SEK), but the UK participants made their estimates in Great Britain Pounds (1 GBP ≈ 13 Krona). Error bars represent standard error of means.

ative effect of the GM-label was larger among Swedish participants compared to UK participants, because the magnitude of the positive effect of an eco-label was larger in the Swedish sample and, hence, the negative effects of the GM-label became more pronounced (especially for health estimates). The cultural differences varied somewhat depending on judgmental dimension. There was no eco-label effect on taste estimates in the UK sample but there was an effect in a positive direction for the Swedish sample, while participants from both countries viewed the eco-labeled raisins as more healthy.

A comment on the methods of the current study is warranted. The participants were asked to use the first raisin tasted as a comparison point for the subsequent estimates (similar to Experiment 1 in Sörqvist, Haga, Langeborg, et al., 2015). One advantage with this approach is that the meaning of the values on the scale and the strategies used to execute the task should be similar between participants, a procedure that makes the difference between the experimental conditions more easily detected because the measurement error is reduced. A potential disadvantage with the procedure is that the differences between conditions can be exaggerated. Furthermore, the reader must be careful not to assign any weight to the absolute values of the estimates as it is only the relative differences between conditions that are informative. Another point that should be pointed out is that the current study only used raisins as the to-be-evaluated product because the same variety of raisins, from the same producers, is found in both Swedish and UK stores. This choice limits the generalizability of the results, but it should be noted that the eco-label effect appears to be quite similar in magnitude across different types of products and judgmental dimensions (Sörqvist, Haga, Langeborg, et al., 2015). A third point that should be addressed is the relatively small sample size. This is important because the multi-factorial analyses of variance reported are associated with a relatively high probability of making at least one Type I error (reporting a statistically significant effect which is false). The positive effect of eco-labeling has been replicated many times, vouching for the reliability and validity of this effect. Similarly, replication will determine the validity of the other effects reported here. The small sample size also means that the results reported here can only be considered exploratory rather than representative for the Swedish and UK populations. It is not possible to say with certainty that Swedish and UK individuals differ systematically, and generally, in the way depicted here, because the individual differences in the crucial variables—which co-vary with the magnitude of the label effects—may have different distributions within subgroups of these two populations. The point to be made here is that attitudinal differences between individuals, which may also differ between cultures, influence susceptibility to the psychological effects of eco- and GM-labeling. Interestingly, the Swedish and the UK samples did not differ in overall environmental concern and still the magnitude of the eco-label effect was (much) more substantial in the Swedish sample. This pattern suggests that environmental concern, *per se*, is not the mechanism underpinning the label effect. Rather, the positive effects of an eco-label appear to be underpinned by positive attitudes toward eco-friendly food more specifically, without necessarily involving concern for the environment. A previous study has shown that environmental concern is related to the effects of eco-labeling in the context of performance measures (Sörqvist, Haga, Holmgren, et al., 2015), while the relationship between environmental concern and subjective ratings of eco-labeled products was non-significant in the same study. Another inconsistency is also reported in the current experiment: the Swedish sample held a more negative attitude toward GM food than the UK sample, still the GM-label effect on taste, health and WTP estimates did not interact with sample origin. It was only in the context of health estimates that this interaction approached significance. One possibility is that the negative attitudes toward GM food arise specifically from health related concerns, which is why the interaction between the GM-label and sample origin is strongest in the context of health estimates. Conversely, the general attitude toward eco-friendly food depends on a wider range of issues, including beliefs about taste differences, health and environmental issues, which is why the interaction between eco-label and sample origin is found for several judgmental dimensions. Taken together, this would also explain why there was a three-way interaction between sample origin, eco-label and GM-label for health estimates: the three-way interaction arises in the context of health estimates, due to the difference between the two countries in terms of general attitudes toward GM food and eco-friendly food, but not in the context of taste and WTP estimates. Collectively, the results presented here and in extant research suggest that different attitudinal dimensions (environmental concern, attitudes toward eco-friendly food specifically, etc.) appear to contribute in functionally independent ways to the eco-label effect depending on the study context, the dependent measure and participants' label knowledge (Samant & Soe, 2016).

The results reported here also contribute further to a growing body of evidence suggesting that socially desirable responding is not responsible for the effects associated with labeling (Litt and Shiv, 2012; Sörqvist et al., 2013). Individual differences in socially desirable responding were unrelated to the self-reported estimates of the present study. An exception was the relation between socially desirable responding and the GM-label effect on taste, but the key finding here is that the GM-label effect "survived" statistical control for socially desirable responding. Taken together, socially desirable responding may contribute to the outcome of the self-reported estimates, making the label effects stronger, but other factors—such as attitudes toward the type of label—contribute to the label effects more strongly.

In conclusion, the positive effect of labeling a food product "eco-friendly"—which arises in populations with positive attitudes toward eco-friendly food such as the Swedish population—may disappear if another label—for which the same sample has a negative attitude—is attached to the same product, at least for raisins.

These negative effects could emerge because people lack education in relation to GM products and have little knowledge in GM practices (Anderson, Wachenheim, & Lesch, 2006; Pew Research Center, 2015). On this view, food and consumer policy programs aiming to change consumer attitudes toward labeled food may therefore benefit more from attempts to change the negative attitudes toward GM-labeling than from attempts to improve the attitudes toward eco-labeled food, in particular in a scenario wherein combinations of GM- and eco-labeled food become more frequently available in the future.

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