Abstract

Individual attitudes, both implicit and explicit, have been identified as one of the multiple drivers of consumer behaviors, including food-related ones. Building on such evidence, in this contribution we seek at increasing implicit and explicit consumer attitudes towards a healthy food, comparing the effectiveness of two different treatments. The former is based on a self-association task, that aims at inducing changes in the evaluation of an object thanks to its positive association with the self. The latter is based on information provision. We test if attitude formation can be moderated by the individual level of nutritional knowledge and health-concern. Additionally, we explored whether the study conditions applied could ultimately affect consumers' preferences for specific product attributes using a Discrete Choice Experiment. The main findings provide insights for future policy strategies aimed at promoting more healthful food consumption. Indeed, the self-association increased implicit attitudes and consumer preferences' towards healthy food, whereas information, that represents the main target of food policy interventions, seems to have no impact on individual attitudes and choice behaviors.

Keywords

consumer behavior; healthy food choice; consumer attitudes; Self-association; policy strategy; information processing.

Changing attitudes towards healthy food via self-association or nutritional information: What works best?

Introduction

The worldwide burden of diet-related chronic diseases of the last two decades, and the consequent need to promote more healthful food choices, have encouraged researchers from different fields to study consumer food-related behaviors and the multiple determinants of their decision making process (Chandon & Wansink, 2007; Haws et al., 2017; Kozup et al., 2003; Richetin et al., 2007; Verbeke, 2008). The common goal of these works is to gain a better understanding of how consumers choose among different product categories, trying to identify the key factors that lead individuals to opt for a 'healthy' versus an 'unhealthy' food alternative. According to the dual-process theory of reasoning (Epstein, 1994; Lieberman, 2003), decision making can result from either impulsive or controlled reasoning routes, commonly referred to as System I and System II, respectively (Evans, 2008; Kahneman, 2011). System I refers to a fast-and-frugal thinking modality, linked to people's automatic reactions resulting from automatic associations activated when a person encounters an object. System II, instead, consists in a more elaborate and controlled reasoning strategy. In the last few decades, the distinction between automatic and deliberative reasoning has played a relevant role in the understanding of how our attitudes affect behaviors. In this 'dual model' perspective the fast-and-frugal route is related to automatic, 'implicit' attitudes which often contrast with the deliberate, 'explicit' attitudes generated by System II (Greenwald & Banaji, 1995).

The literature provides reliable evidence that attitudes play a key role in consumers' purchase intention and behavior (Friese et al., 2008; Furno et al., 2016; Perugini, 2005; Richetin et al.,

2007). Indeed, evidence shows that changes in both implicit (Hollands et al., 2011) and explicit attitudes (Mattavelli, Avishai-Yitshak, et al., 2017) engender changes in food choices. Therefore, as attitudes positively correlate with choices, increasing the positivity of attitudes toward food products should be an effective way to leverage behaviors towards more healthful food consumption.

Associative and propositional attitude change

According to the Associative and Propositional Evaluation (APE) model (Gawronski & Bodenhausen, 2006), implicit and explicit attitudes form and change via different processes, with implicit attitudes being more sensitive to associative based procedures and explicit attitudes being more sensitive to information provided in a propositional form. Among the possible interventions on implicit attitudes, the Self-Referencing task (SR) represents a learning paradigm aimed at inducing changes in attitudes towards an object through the formation of associations between the object and the self. On the other hand, an informative message about the properties of the object can be used to increase explicit attitudes.

Changing attitudes via the self

The paradigm of SR is based on the core idea that the majority of people have high self-esteem and a positive view of themselves (e.g., Yamaguchi et al., 2007) and that perceiving even an apparently meaningless connection between themselves and an object (i.e., the act of pressing the same key to categorize their stimuli) leads to positively evaluate the latter. Attitude change via the self occurs because of spreading of activation between concepts in mind, such that seeing self-related objects activates the self-concept. In consumer research, the reference to the self has been successfully applied to increase consumers' likeability of products and brands. For instance,

some well-known food industries have designed successful advertising campaigns based on this self-referencing principle by customizing the product packaging with customers' names. This strategy is meant to induce the perception of a link between one's self and the product to increase the likeability of the product itself and to have a potential effect on consumers' behavior. Although from a dual process perspective associative paradigms should affect implicit attitudes (Gawronski & Bodenhausen, 2006), it has been shown that, under certain conditions, associative-based procedures such as the SR task can influence both implicit and explicit attitude (see Hofmann et al., 2010 for a meta-analysis on the most paradigmatic of these procedures, that is, evaluative conditioning). Accordingly, a recent meta-analysis has demonstrated the effectiveness of the SR paradigm to form or change both implicit and explicit attitudes (Mattavelli, Richetin, et al., 2017). Although most of the SR studies conducted on food have targeted fictitious brands (e.g., Richetin, Mattavelli, & Perugini, 2016), recent evidence of the impact of such manipulation in changing attitudes towards existing food products is encouraging (Mattavelli, Avishai-Yitshak, et al., 2017). This initial indication of the effectiveness of the SR targeting existing food is in line with research showing that pairing sensory information or images with food items through another form of association-based evaluative learning such as an evaluative conditioning procedure (see Hofmann et al., 2010 for a review) induces implicit attitude change (Hollands et al., 2011; Lebens et al., 2011; Verhulst et al., 2006).

Changing attitudes via information

Information provision is expected to generate a propositional attitude change. Specifically, according to the APE model, it is expected to affect explicit attitudes to a greater extent than implicit attitudes.

Previous studies in the food domain have demonstrated that information can play a primary role in food-related behaviors. Most of these studies have investigated the role of information provision in driving consumers' food choices. The results are consistent in indicating that information is positively associated with selecting more healthful foods with high contents of beneficial components (e.g., fiber and vitamins) and avoiding less healthy ones (Drichoutis et al., 2006; Campos and Hammond, 2011). Although evidence on the relationship between information and food choices and behaviors is quite extensive, there is less evidence regarding the specific relationship between information and attitudes.

Some studies analyzed how information impacts on explicit attitudes (Napolitano et al., 2010; Tudoran et al., 2009; Mialon et al., 2002). For instance, it has been found that providing consumers with positive food-related information (e.g., claims, nutrition facts) lead them to develop more favorable explicit attitudes towards the product at issue (Kozup et al., 2003). However, the results of these studies are mixed, and most importantly, they do not provide evidence on implicit attitudes.

One of the few papers that analyzed the effect of information provision on both implicit and explicit attitudes is the one of Mattavelli, Avishai-Yitshak et al., (2017). They tested the effectiveness of information in changing both implicit and explicit attitudes towards vegetables and demonstrated that a persuasive communication that emphasized the advantages of consuming green vegetables led to changes in explicit, but not implicit, attitudes.

To expand this line of research on the relationship between information and attitudes we took into account the role of nutritional knowledge as a possible moderator of the effect of information on attitude change. The rationale is based on previous evidence demonstrating that increased knowledge augments the degree of understanding of the information content, making

the effect of information itself stronger (Miller and Cassady, 2015). Accordingly, it is reasonable to expect that high nutritional knowledge may ultimately increase the overall effect of our informative message on attitude formation.

Similarly, we considered the individual level of health concern as a possible moderator of attitude formation by means of information provision. As well as knowledge, health concern can be considered a key factor in food-related decisions. The extent to which individuals are concerned about health affects both the amount and complexity of food-related information that they use

while making food choices (Moorman and Matulich, 1993; Cavaliere et al., 2016). As such, high health orientation may empower the effect of information on attitude formation.

Research questions and objectives

Within this framework, the present contribution seeks to explore and compare the effectiveness of two different treatments in forming/increasing positive implicit and explicit attitudes toward healthy foods, focusing on a functional food characterized by low glycemic index (GI). The first treatment is based on a Self-Referencing task (SR), which is an associative learning paradigm that aims at inducing changes in the evaluation of an object through the formation of novel associations between the object and the self. The second treatment is based on the provision of an informative message on low GI food properties. According to the APE model the SR task is meant to be more effective on implicit than on explicit attitudes, while the informative message should have a stronger impact on explicit attitudes. Furthermore, to gain a better understanding of the mechanisms involved in the formation of positive implicit and explicit attitude we took into consideration the role of individual nutritional knowledge and health concern. As both

nutritional knowledge and health concern are recognized to be effective in influencing food choice behavior (Cavaliere et al., 2016; 2017), we explored whether attitude formation is moderated (i.e., increased/decreased) by these two factors. As a third step in our investigation, we inspected the effect of positive attitude formation on respondents' preference for low GI products through a Choice Experiment (CE).

In summary, with this contribution we seek at addressing the following research questions (RQ):

RQ1. Are SR and Information effective in increasing positive implicit and/or explicit attitudes towards functional foods?

RQ2. Is positive implicit/explicit attitude formation moderated by the individual level of nutritional knowledge and/or health concern?

RQ3. Do the SR and the Information treatments ultimately affect food preferences?

This work adds to the extant literature by providing novel findings regarding the effectiveness of treatments based on the activation of System I and System II respectively in leveraging positive behavioral changes through attitude formation. The results provide valuable insight for future marketing and policy strategies aimed at promoting more healthful food consumption.

Methods

Data collection

Data were collected through a computerized experiment on a sample of 415 students (215 women, *Mage* = 22.83, *SD* = 2.84) from two different faculties in two different large public universities (*n* = 256, 138 women and *n* = 159, 77 women, respectively). The experimenters personally approached participants in the two University campuses and told them about the aim of the research and the type of experiment involved, that is, the evaluation of low GI functional

food snacks. Participants were also informed that the snack they were to evaluate contained gluten and sesame as allergens and that they would be given 5 euros as remuneration for their participation. The experiment took place in the computer laboratories of the two Universities during spring 2016 carrying out 5 to 6 experimental sessions per day involving a maximum of 8 participants each. To reduce potential social influence among them, respondents were seated far from each other in a room containing 24 workstations such that they could not see clearly the other respondents' screen and what they were doing. At the beginning of the experiment, participants were asked to read the instructions carefully on the computer screen and were recommended to keep silence until the end of the session. The experimental session included different tasks on diverse experimentally designed low GI snack images. In all tasks, the images of the low GI snacks were labeled with the low glycemic index logo (low GI)[1]. Participants were also asked to taste a real low GI snack called 'Panetti' not yet commercialized at the time of the experiment made with a patented wheat flour containing Arabinoxylans (please see Figure 1 for more details on Arabinoxylans) and to respond to a choice experiment. These two measurements were conducted in a counterbalanced order (i.e., half of the sample completed this phase before the CE task, the other half tasted the low GI snack after completing the CE). Finally, the experiment involved a brief questionnaire concerning respondents' liking of the product, their nutritional knowledge, health-concern, and socio-demographic information.

Experimental design and treatment description

[1] The Low Glycemic Index Logo is a Registered Trademark ® of the Australian Glycemic Index Foundation created to help Australian consumers to easily recognize low GI food products in the supermarket. http://www.gisymbol.com/

The experiment included 4 different conditions in a 2 (informative message: present *vs.* absent) x 2 (Self-referencing: SR task *vs.* control SR task) between-subjects design. Participants were randomly assigned to one of the four experimental conditions. In treatment 1 (Control, 102 respondents, 51 females) they did not receive the informative message on low GI food properties and completed the control SR task. Treatment 2 (SR, 104 participants, 56 women) differed from treatment 1 in that the SR task was designed to relate (i.e., generate an association between) the low GI logo and the self. Ninety-nine participants (50 women) in treatment 3 (Information) received the informative message concerning low GI food properties before completing the control SR task. Finally, in treatment 4 (SR+Information), seventy-nine respondents (43 women) received the informative message and then completed the SR task. After this first phase, participants completed the other tasks, that is, the CE, the tasting, and they responded to the questionnaire. For the tasting phase, each participant was provided at the beginning of the experimental session with a closed white paper box containing a sealed transparent plastic pack with two Panetti. Each pack was labeled with the low GI logo. This way, respondents could not see the product until required to avoid influencing their responses.

The Self-Referencing treatment

The SR task consisted of four blocks of 35 trials. In the first two blocks, participants categorized as quickly as possible pictures of low GI products and words related to 'Self' (e.g., I, me) using one response key (E) on the keyboard and words relating to 'Other' (e.g., they, them) to a different response key (I). Participants then repeated the two blocks of 35 trials by switching the keys assigned to the categories (i.e. 'low GI' and 'Self' assigned to the 'I' key, and 'Others' to the 'E' key). Therefore, participants learned to relate the low GI products with the self through a

common action (i.e., pressing a key). The order in which participants completed these two pairs of blocks, and the proportion of left- vs. right-hand responses was counterbalanced. In case of incorrect classification, a red X appeared on the screen and remained until participants corrected their response. Stimuli comprised five 'Self' words (I, me, my, mine, myself), 5 'Other' words (they, them, their, other, theirs), and 5 pictures of products (i.e., pasta, croutons, unleavened bread, wheat flour, and sliced bread). Participants' intersecting regularities memory (their recollection of source-target pairings) was tested by answering the question, 'The task you just completed consisted in classifying with the same key low GI products and a category of words. Do you remember which category?' Participants could answer 'Self', 'Other', or 'I don't know'. This question is standard in SR studies. Because the transfer of properties from the self to a target results from the intersecting regularities between the two, stronger SR effects are regularly observed when individuals recall the intersecting regularities between the self and the target correctly (see Mattavelli, Richetin et al., 2017).

The control SR task consisted of four blocks of 35 trials. In the first two blocks, participants categorized self-related stimuli with one key (e.g., 'E'), other-related stimuli with an alternative key (e.g., 'I'), and pictures of low GI products with another key (e.g., 'B'). Participants then repeated the two blocks by switching the keys assigned to self and other-related stimuli. Throughout each block, participants classified low GI pictures in 10 trials. In the first two blocks, 12 trials presented self-words, and 13 trials were for other words (and vice-versa in the second two blocks). All stimuli appeared randomly and individually in the middle of the screen. In case of incorrect classification, a red-X appeared on the screen and remained until correction. The stimuli used for each category were identical to those used in the SR. With this procedure participants were exposed to the same stimuli than in the SR task, hence controlling for possible

frequency effects (Zajonc, 2001), but they did not learn to relate the low GI products with the self, due to the lack of common action between the two.

The information treatment

The informative message reported detailed information on the meaning of low glycemic index and the beneficial properties of low GI foods, as illustrated in Figure 1.

> An Italian company wants to launch a line of bakery products characterized by a low glycemic index, thanks to the presence of Arabinoxylans in the wheat.
>
> *The glycemic index (GI) is a measure used for the classification of foods based on their effect on the raise of blood glucose (i.e., the concentration of sugar in the blood) after a meal. This characteristic is typical of the foods containing carbohydrates such as bread, pasta, pizza, rice, other grains, and derivative products.*
> *Numerous scientific studies have shown that low GI diets are associated with a reduced risk of certain diseases such as diabetes, cardiovascular disease and obesity.*
> *Arabinoxylans, which are compounds extracted from the endosperm of the grain, are effective in reducing the glycemic index of foods. In other words, the use of Arabinoxylans favors the reduction of post-prandial blood glucose, thus leading in association with a healthy lifestyle, to health benefits.*
>
> To communicate this feature, the company intends to use the International logo (logo 'Low Glycemic Index' - 'Low GI') shown below.
>
> The purpose of the present study is to analyze the opinion of consumers with respect to the product and the 'Low GI' logo. To do this, you will be presented with some images of low GI products and you will be asked to complete a few simple tasks.
> Thank you for your attention and your time!

Note. The information in italics is present only for treatments 3 and 4. The message has been translated from Italian.

Figure 1. Informative message on low GI

Experimental measures

Implicit attitudes measure

After completing the SR task, respondents in all treatments completed the ST-IAT to assess their implicit attitude towards low GI products. Given the focus on a unique target (i.e., the low GI logo), the single target variant of the IAT, the ST-IAT (Bluemke & Friese, 2006), was used. The ST-IAT is meant to measure how strongly participants associated the low GI logo with positive and negative words. In one critical block, participants were asked to classify four low GI product pictures (i.e., muesli, bread, biscuits, and crackers) and positive words (positive, joy, beautiful, happy) with one response key (e.g., 'D'), and negative words (negative, pain, ugly, sad) using another key (e.g., 'K'). In the other critical block, they used the same key (e.g., 'K') to categorize low GI pictures and negative words and the other key for positive words (e.g., 'D'). The pictures used in the ST-IAT were different from those used in the SR task (control and experimental). Before the critical blocks, participants completed a practice block of 24 trials in which they classified positive and negative words. The two critical blocks consisted of 84 trials each and order was counterbalanced. Within each block, all stimuli were presented in random order. Following Greenwald et al. (1998) and Bluemke & Friese's (2006) procedure, a D score was computed by subtracting the mean reaction times of the critical block 'low GI + Positive' from the mean reaction times of the critical 'low GI + Negative' after correcting error latencies with a 600ms penalty. A positive value of the D score was assumed to indicate stronger positive than negative association with low GI (Cronbach's $\alpha = .66$).

Explicit attitudes measures

Two different types of explicit evaluations towards low GI functional foods were measured during the experiment. The first evaluation was after the ST-IAT. Similar to the measures used in previous research (e.g., Richetin, Mattavelli, & Perugini, 2016), participants were asked to rate a

set of low GI products images (same items as those used in the ST-IAT) separately on 4 bipolar dimensions (ugly-nice, unpleasant-pleasant, worthless-valuable, repulsive-attractive) on 7-point scales from 1 to 7. The average of these four items (that we called *overall liking*), has been used as a first measure of explicit attitudes (Cronbach's α = .76) as done in other SR studies (e.g., Richetin, Mattavelli, & Perugini, 2016). The second type of explicit evaluations, which followed the tasting phase, was specifically focused on the snack Panetti and is constituted by two scores. Participants were asked to rate a sample of Panetti on 7 items. The first four items (*after taste liking)* captured explicit liking towards the product on a 9-point bipolar scale (unpleasant-pleasant, more unpleasant than other similar products- more pleasant than other similar products, not recommended-recommended, bad-good). The remaining three items (*sensorial attribution)* measured specific sensory evaluation (namely, crispness, saltiness, and taste persistence) using 9-point (Not at all-Extremely) hedonic scales (Peryam & Pilgrim, 1957). These two scores were calculated based on the average of the first four and the last three items (Cronbach's α = .91 and Cronbach's α = .61, respectively).

Nutritional knowledge and health-concern

Respondents' level of nutritional knowledge was measured using a shortened version of the validated Nutritional Knowledge Questionnaire developed by Parmenter & Wardle (1999). In detail, we used 29 items in a dichotomous format and summed scores (1 for correct responses) to constitute an individual nutritional knowledge index, which was then standardized.

Health-concern was measured following the approach proposed and validated by Pieniak et al. (2010) based on 4 items ('*Health is very important to me*', '*I care a lot about health*', '*Health means a lot to me*' and '*I appreciate healthy food very much*') rated on 7-point scales from 1 to

7. The health-concern items were used to construct an overall mean, which was then standardized for estimation purposes (Cronbach's α = .84).

Supplementary CE analysis

To explore the effect of positive implicit/explicit attitude formation on respondent's preference for low GI food we conducted a hypothetical CE on a low GI snack characterized by the following four attributes: price, calories, the low GI logo, and a health claim on Arabinoxylans approved by EFSA in the EU Regulation No. 432/2012 (Table 1).

Product: Low GI 'Panetti', 250gr pack		
Attributes	**Description**	**Levels**
Price	Price for a 250g box	€ 3.22 € 3.67 € 4.12 € 4.57
Calories	Calories per 100gr	430 450 470
Logo		Present Absent
Health claim	Consumption of arabinoxylan as part of a meal contributes to the reduction of blood glucose rise after the meal	Present Absent

Table 1. Product attributes and attribute levels.

In CE, respondents are typically asked to make repeated choices selecting their preferred alternative among a set of experimentally designed choice situations. In this study, the choice situations were generated applying an orthogonal optimal in the difference design (OOD) using Ngene software 1.1.2, that resulted in 36 different choice tasks divided into 6 different blocks of

6 choice tasks each. The 6 blocks were randomly and evenly presented to the respondents, and the task order within each block was randomized. As such, each participant was asked to complete 6 choice tasks, each one composed by two buying alternatives and an opt-out option. It is common practice to include the opt-out option to increase the ecological validity of the choice situation. In a real shopping context, indeed, consumers always have the possibility not to buy a product if they do not find one that fits their preferences (Louviere et al., 2000).

Analytical strategy

As a first step in the analysis we assessed the effectiveness of the two treatments running the ANOVA on IBM SPSS software package. As described previously, the effectiveness of the SR and Information treatments in generating positive implicit and/or explicit attitudes towards low GI foods were respectively examined using the Single Target Implicit Association Test (ST-IAT) (Greenwald et al., 1998) and the Semantic Differential (SD).

In line with the aim of the study, as a second step in the analysis, we explored whether nutritional knowledge and health concern moderate positive implicit/explicit attitude formation. To this purpose, we conducted a moderated moderation analysis using the IBM SPSS PROCESS Macro (Hayes & Scharkow, 2013). This analysis has the advantage to test whether either nutritional knowledge or health concern play any role in qualifying the impact of both the SR and the informative message by considering the two treatment both in isolation and in interaction. We decomposed the interaction using the Johnson-Neyman technique (Preacher, Curran, & Bauer, 2006). Unlike a simple slope analysis that indicates whether the effect is significant at low (-1 *SD*), medium, and high (+1 *SD*) levels of the moderator, the Johnson-Neyman approach allows detecting the specific values of the moderator at which the independent variable exerts a

significant effect on the dependent variable. This approach, therefore, allows determining a region of significance (Hayes & Matthes, 2009).

Finally, as a supplementary analysis, we examined the effect of positive implicit/explicit attitude formation on respondents' food choice preferences using a CE. The results of the CE were analyzed using NLOGIT 5 performing a Random Parameter Logit model (all details are reported in Appendix A).

Results

The data from twenty-eight participants were excluded from the analyses because the ST-IAT was not correctly administered due to an error in programming. Four additional participants were excluded from the analyses since they made too many errors (> 25%) in either the SR task or in the ST-IAT. This data preparation led to a final sample of 384 participants.

The effects of SR and Information on implicit and explicit attitudes

To analyze the effect of the treatments on consumer attitudes towards low GI food products, we ran four ANOVAs using the SR and informative message treatments as factors and implicit attitudes, overall liking, after taste liking and sensorial attribution respectively as dependent measures. The descriptive statistics for all conditions are presented in Table 2.

Specifically, we started by examining the effect of the SR treatment on implicit attitudes, using the ST-IAT score as the dependent variable. We found a main effect of the SR manipulation, $F(1,380) = 5.12$, $p = .024$, $\eta_p^2 = .01$, which indicates that participants showed higher implicit preferences for low GI products when these were paired with the self in the SR task. No main effects were found with regard to the effect of SR on overall ($p = .635$) nor after taste liking ($p =$

.834) of the low GI products. The analysis of sensorial attribution showed there was an interaction between the information treatment condition and the SR task condition, $F(1,380) = 5.88$, $p = .016$, $\eta_p^2 = .02$. Specifically, the SR and the informative message showed a subtractive interaction, such that participants exposed to both treatments rated Panetti lower than those exposed to either the SR or the informative message condition alone did.

	Control *n= 102* *Mean (SD)*	**SR** *n= 104* *Mean (SD)*	**Info** *n= 99* *Mean (SD)*	**SR + Info** *n= 79* *Mean (SD)*	**Range**
Dependent variable					
Implicit attitude	0.04 (0.20)	0.05 (0.18)	-0.01 (0.18)	0.07 (0.19)	-0.83 – 0.52
Overall liking	4.93 (1.11)	4.90 (1.12)	4.94 (1.08)	4.98 (1.07)	1.00 – 7.00
After taste liking	6.62 (1.48)	6.81 (1.35)	6.85 (1.41)	6.77 (1.35)	1.75 – 9.00
Sensorial attribution	6.00 (1.30)	6.31 (1.19)	6.28 (1.05)	6.03 (0.98)	1.00 – 8.67

Table 2. Descriptive of dependent variables between experimental groups

Furthermore, as an explorative analysis, we examined the role of gender and age as determinants of implicit attitudes and explicit attitudes towards low GI products. The results highlighted an effect of gender on all measures of explicit attitudes (overall and after taste liking and sensorial attributions) (ps < .001), but not on implicit attitudes ($p = .636$). This result indicates that women have an overall higher explicit preference for these functional foods compared to men. However, we did not find any interaction between gender and the main experimental factors (ps > .185).

The moderating role of nutritional knowledge and health-concern

We then considered respondent's level of nutritional knowledge and health-concern as potential moderators of the main effects of the two treatments (moderation) and their interaction (moderated moderation) on all outcomes. We entered the SR condition as the independent

variable, the informative message as the first moderator, and the nutritional knowledge index or the health-concern index as the second-level moderators. For the sake of simplicity, we limit the description of the results to the significant findings, starting with the impact of participants' nutritional knowledge. Nutritional knowledge did moderate the effect of the two treatments on overall liking, as suggested by the significant three-way interaction between nutritional knowledge, SR condition, and informative message, $\beta = -.11$, $p = .040$. The application of the Johnson-Neyman approach to the significant interaction allowed us to detect that the two-way interaction between the SR condition and the informative message became significant when participants had a level of nutritional knowledge lower than 1.09 *SD* from the mean value. In essence, for low levels of nutrition knowledge, being exposed to both the SR and the information treatment led to the highest overall and after taste liking for low GI products.

We then conducted the same moderated-moderation analysis using the health-concern index as a qualifier of both the main and the conjoint effect of SR manipulation and informative message. The importance attributed to health was a significant predictor of overall liking ($\beta = .28$, $p < .001$) as well as for after taste liking and sensorial attribution ($\beta = .22$, $p < .001$, and $\beta = .14$, $p < .001$, respectively). When focusing on the interactions between health-concern and the two treatments, we found a significant two-way interaction with the SR manipulation on after taste liking, $\beta = -.13$, $p = .011$. The Johnson-Neyman decomposition showed that the SR treatment had a significant positive effect on after taste liking starting from 0.89 *SD* below the mean, which became a negative effect starting from 1.12 *SD* above the mean. This pattern indicates that the impact of the SR on after taste liking is stronger for participants with low health-concerns. No other significant interactions emerged (all *p*s > .161).

CE results

To explore the impact of the experimental treatments on the on respondent's preferences, a hypothetical CE on the snack Panetti has been conducted. Due to a software problem occurred during the data collection the CE analysis was made using a small part of the total sample, namely 150 respondents (77 women, *M*age= 23.13, *SD* = 2.76). As such, the results obtained from this CE should be considered only suggestive. For the data analysis we used the 4 treatments as a segmentation instrument and estimated a Random Parameter Logit model for each experimental condition, such that Model 1 corresponds to the control treatment, Model 2 to the SR treatment, Model 3 to the Information treatment, and Model 4 to the SR + Information treatment (more details on the model estimation can be found in Appendix A).

The results of Model 1 (Table 3) showed that both the presence of the low GI logo and the health claim contribute to determin consumers' preference for Panetti. In particular, respondents show a high preference for the low GI logo, followed by the presence of the health claim on Arabinoxylans. When looking at the results of Model 2, it is possible to notice that respondents in the SR treatment have different preferences compared to individuals in the Control group. Indeed, the only significant attribute is the low GI logo, and the magnitude of its coefficient is higher concerning Model 1 (0.561 and 0.397 respectively). As for Model 3, the results highlight that when providing respondents with the informative message on the low GI benefits, their preference for the low GI logo remains high, even though the coefficient magnitude is lower than the one elicited in Model 2. Moreover, the Information treatment seems to have slightly increased attention towards the calorie content, meanwhile decreasing the utility associated with the HC. Likely, the greater amount of information provided through the informative message was perceived as more exhaustive if compared to the more synthetic contents of the HC. Finally,

the results of Model 4 are consistent with the results obtained in Model 3, but the utility that respondents derived from the presence of the low GI logo is higher. Overall, the low or null significance of their coefficient estimates may suggest that the strong association self-logo generated via the SR task may have considerably increased respondents' preference for low GI products, meanwhile decreasing the importance attached to the other product attributes. As expected, both the price and the No-buy coefficients are significant and negative in all Models and the significant SD of the parameter estimates confirm that there is considerable unobserved heterogeneity in consumer preferences.

		Model 1		**Model 2**		**Model 3**		**Model 4**	
		Control		*SR*		*Info*		*SR+Info*	
		n= 37		*n*= 38		*n*= 38		*n*= 37	
Calories	*Mean*	-0.004		0.000		-0.016	*	-0.014	*
	SD	0.005		0.005	***	0.007	***	0.007	***
Health Claim	*Mean*	0.306	*	0.167		0.077		-0.095	
	SD	0.587	***	0.465	**	0.755	**	0.326	*
Logo	*Mean*	0.397	***	0.561	***	0.495	***	0.550	***
	SD	0.489	**	0.438	**	0.602	**	0.554	***
Price		-2.135	***	-1.294	***	-3.100	***	-1.173	***
No Buy		-11.923	***	-6.891	**	-21.263	***	-13.751	***
Willingness to pay									
Calories		-		-		-0.01 €		-0.01 €	
HC		0.14 €		-		-		-	
Logo		0.19 €		0.43 €		0.16 €		0.47 €	
Models fit									
BIC/N		1.79		1.89		1.71		1.86	
AIC/N[b]		1.62		1.58		1.55		1.69	

Note. Standard errors in parentheses. BIC: Bayesian information criterion. AIC: Akaike information criterion.* Coefficient statistically significant at the 10% level. ** Coefficient statistically significant at the 5% level. *** Coefficient statistically significant at the 1% level.

Table 3. Results of the RPL Model estimates

The willingness to pay (WTP) estimates indicate that the SR treatment leads to an increased WTP for the low GI logo. Indeed, the highest WTP values are observed in Model 2 and Model 4: respondents in the SR treatment are willing to pay on average 0.43 € for products with the low GI logo, while consumers in the SR+Information treatment are willing to pay 0.47 €. Instead, individuals in the Information treatment show considerably lower WTP for the logo (0.16 €) indicating that the Information treatment alone is not able to exert a substantial effect on respondents' preference for low GI products. This can be also observed in Figure 2 showing the cumulative distribution of the individual WTP for the low GI logo across the four experimental groups. The curves corresponding to the Control and the Information treatments on the left-hand side show similar trend, which highlights only a slight difference between the Control and Info conditions.

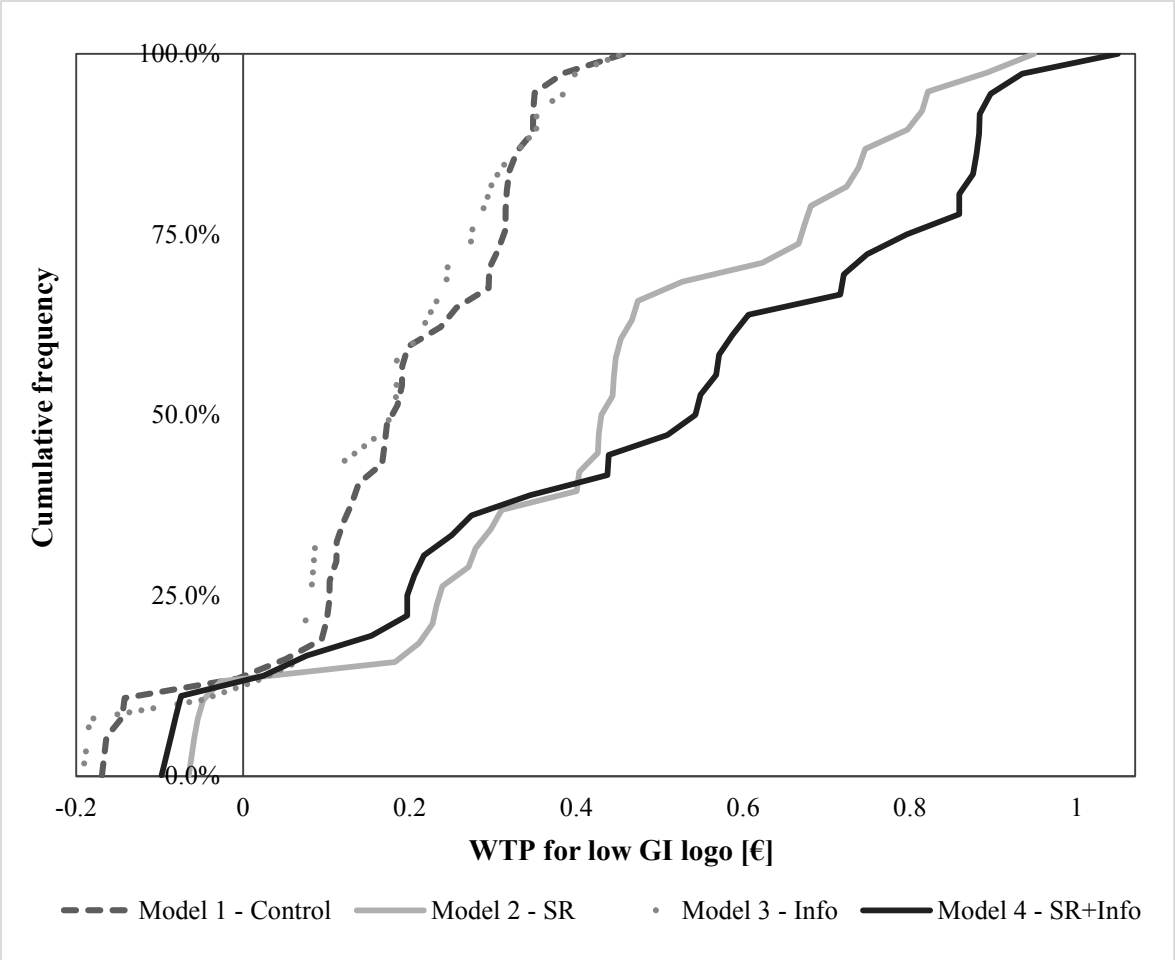

Figure 2. Effect of treatments on WTPs' distribution of cumulative frequencies for low GI logo

Instead, the curves on the right-hand side of the graph (respectively SR and SR+Info) indicate that the SR task increased respondents WTP for the low GI logo to a greater extent. Furthermore, these curves cross around middle values, which seems to suggest that the SR treatment is stronger for higher levels of WTP. Moreover, the curves of Models 2 and 4 illustrate that the data are more dispersed around the mean compared to the control and the Information treatments.

Discussion and conclusions

The present research aimed at exploring and comparing the effectiveness of SR and information in forming/increasing positive attitudes towards low GI foods. Building on the dual process theory of reasoning (Epstein, 1994; Lieberman, 2003) and the APE model, (Gawronski & Bodenhausen, 2006), the SR treatment was expected to be more effective on implicit attitudes, whereas information on explicit.

The main results of our analysis confirmed part of these expectations. Indeed, we found that the SR manipulation was effective in increasing implicit attitudes towards low GI products, whereas it did not show any impact on explicit. As for the Information treatment, instead, we did not find significant results, meaning that the informative message on low GI food properties was ineffective in shaping either implicit or explicit attitudes. Moreover, the effect of SR in increasing implicit attitudes was higher for participants who were not exposed to the informative message suggesting a subtractive effect of the combinations of the two treatments. This finding is in line with those of Mattavelli, Avishai-Yitshak et al. (2017). They explored the impact of an SR task and of a persuasive communication in changing attitudes and behavioral intentions towards green vegetables and showed that only the SR task was capable of affecting implicit attitudes, and that this effect was stronger in the absence of the persuasive message.

To better understand the link between the two treatments and attitude change, we explored the role of respondents' age and gender. While the former showed no significant effects, gender affected explicit evaluations, such that women have an overall higher preference for these functional foods compared to men. This is in line with previous studies showing that women are

typically more concerned with health-related issues and more attentive to the nutritional aspects (Cavaliere et al., 2015).

In the same direction, we examined whether respondents' nutritional knowledge and health concern can moderate the effect of the two treatments on implicit/explicit attitudes. This was, indeed, the objective of our second research question. In this regard, we found that both factors have a moderating effect on explicit attitude formation. As for nutritional knowledge, the results revealed that the two treatments in combination led to the highest overall liking for low GI products when respondents had low levels of knowledge. This suggests that when individuals have scarce nutritional knowledge, providing them with additional information regarding the properties of the product at issue may contribute to positive attitude formation, strengthening the effect of the SR manipulation. As for respondents' health concern, we found that the less individuals are concerned with health-related issues, the stronger the effect of the SR treatment in increasing positive explicit attitudes towards low GI products. This result is conceptually similar to Mattavelli, Avishai-Yitshak, et al.'s (2017), which suggested that pairing healthy products with the self is effective above all for those individuals who are less interested or already committed to a healthy lifestyle.

The superior effectiveness of the SR compared to the informative message seems to emerge also from the CE results. As mentioned previously, the small sample size considered for this part of the analysis does not allow us to derive robust conclusions regarding the effect of the two treatments on choice behavior, which was the subject of our third research question. However, the general trend of the CE results seems to indicate that the associative paradigm of SR may be more powerful in driving food choices compared to information, which involves more complex reasoning. Indeed, respondents who received the SR treatment showed a remarkably stronger

preference for the low GI attribute compared to those in the Control and Information treatments. It is reasonable to attribute this effect to the positive attitude formation towards low GI products occurred via the self, which ultimately increased respondents' preference for the low GI logo as confirmed also by the WTP estimates. Finally, the low or null significance of the HC and Calorie attributes may indicate that the strong self-logo association generated through the SR has decreased the overall importance attached to the other product features.

Taken together, these results stress the idea that interventions based on simple associative manipulations based on the self could be more effective in generating/increasing positive attitudes towards specific food categories. Instead, interventions based on more complex reasoning (i.e., information provision), which involve the activation of System II, may fail to impact on consumer attitudes and, consequently, on their choice behavior. This aspect has potentially remarkable implications both for marketing strategies and food policy formulation. Indeed, up to now, information provision to consumers, mainly through food labels, has been pursued as a main strategy to redirect individuals towards more healthful food alternatives. However, according to our results, this may not be the most effective solution. Previous studies provided evidence that automatic and deliberate cognitions cooperate in driving food-related behaviors under normal cognitive loads, but when the cognitive load is high implicit cognitions dominate (Friese et al., 2008). This likely happens when consumers buy food since people are normally presented with a large amount of information (Jo et al., 2016) and alternatives (Malone & Lusk, 2017) which make the decision making context complicated. Moreover, food choices often occur under high time pressure, and are frequently guided by habit and automaticity (Sharma et al., 2017; Loebnitz et al., 2015). As such, they might be expected to be predicted by implicit attitudes (Panzone et al., 2016; Wood & Neal, 2009).

We propose that SR-based interventions could be adopted not only for marketing purposes to favor brand identification, but also to lead consumers towards more healthful food consumption. Despite we believe that our study provides interesting insights, there are some limitations that have to be acknowledged and that call for further research on these topics. Firstly, our experimental design was lacking of a SR control condition considering food-items without low-GI logo. Adding such control would have been a useful addition to explore whether the SR and information affect attitudes on food in general or only on a specific food item (i.e., low GI food). Secondly, we did not include questions on low GI-specific knowledge. Given that prior knowledge has a crucial role in affecting individuals' perception of a specific food item or product category possibly shaping food choice behavior, it would be important to consider this aspect in future studies. Even though in our specific case it is unlikely that respondents could have knowledge about low GI foods (there are very few food items on the Italian market with this specific characteristic and the low GI logo used is not at all present on the domestic market), to consider this aspect would significantly contribute to better understand the role of prior knowledge on attitude formation. Finally, the analysis conducted in this study does not allow us to establish whether positive attitude formation is directly dependent on the information provided, or if it is mediated by respondents increased knowledge on low GI food due to the provision of the informative message. To investigate this issue was outside the scope of this study, but we acknowledge the importance to investigate further this matter.

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Appendix A: Choice Experiment

Model estimation

The Random Parameter Logit (RPL) was chosen as model specification to account for preference heterogeneity among respondents (Loureiro et al., 2001; Lusk et al., 2003). In the random utility framework (McFadden, 1974), the utility that an individual *n* can derive from selecting an alternative *j* over the other possible alternatives in a choice situation *t* can be described as follows:

$$U_{njt} = \beta' X_{njt} + \varepsilon_{njt'}$$

where X_{njt} is a vector of observed variables related to alternative *j* and individual *n*; β' is a vector of taste parameters which describes the choice; and ε_{njt} is the unobservable part of the utility function, that is, the stochastic error component which is assumed to be identically and independently distributed across individuals, alternatives and choice occasions. According to the attributes chosen to describe the experimentally designed Panetti, the utility that a respondent *n* gets from choosing one of the product alternatives, within each choice task, can be expressed as follows:

$$U_{njt} = \beta_0 * \mathrm{NoBuy}_{nj} + \beta_1 * \mathrm{PRICE}_{nj} + \beta_2 * \mathrm{CALORIES}_{nj} + \beta_3 * \mathrm{LOGO}_{nj} + \beta_4 \mathrm{HEALTH\ CLAIM}_{nj} + \varepsilon_{njt}$$

where $n = 1,...,n$ is the number of respondents, t is the number of choice occasions, j represents the alternatives in each choice situation (namely, alternatives A and B corresponding to the buying alternatives, and alternative C corresponding to the opt-out option); NoBuy denotes a dummy variable taking value 1 when option C is chosen, and 0 otherwise. β_0 is the alternative-specific constant representing the no-buy option. As for the attributes, $PRICE_{nj}$ is the price of the j alternative, $CALORIES_{nj}$ is a continuous variable corresponding to the calorie amount per 100g of Panetti, whereas LOGO and HEALTH CLAIM respectively correspond to the presence (absence) of the low GI logo and of the Arabinoxylans-related health claim.

The estimation results presented in Table 4 were performed using NLOGIT 5.0.

Highlights

1. The interventions are based on the self-association and on a nutritional information
2. Data were collected through an experiment on a sample of 415 Italian students
3. The self-association was effective in changing implicit attitudes
4. The self-association is effective in increasing WTP for low GI healthy products
5. The informative message on low GI product was ineffective in shaping attitudes

Changing attitudes towards healthy food via self-association or nutritional information: What works best?

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Competing interests statement

Authors declare they have no competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.