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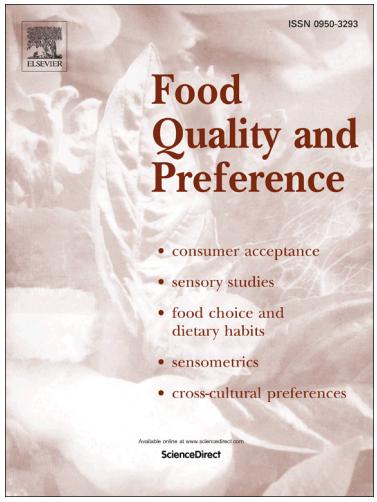

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Measuring consumers attitudes towards health and taste and their association with food-related life-styles and preferences.

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Abstract

The purpose of the current study, was to apply and validate the factor structure of the Health and Taste Attitude Scales in an Italian adult sample of 1224 subjects, recruited on a national basis in order to characterise consumers' food-related attitudes with weak and strong connotations of health and taste. Both exploratory and confirmatory factor analysis were used to evaluate the factor structure of the three sub-scales of *Health* (General health interest, Light product interest, Natural product interest) and three sub-scales of *Taste* (Craving for sweet foods, Using foods as a reward, Pleasure). Results showed that the internal structure was similar to the theoretical proposal, with two exceptions for the *Taste* scale. The *Pleasure* sub-scale presented strong problematic loadings and consequently was removed from the model. The *Craving for sweet foods* sub-scale was split into two new underlying constructs describing attitudes towards craving for sweet food based on their own experience and attitudes towards other-people's craving.

The three Health sub-scales were used as a basis for the derivation of consumers clusters. Three groups of subjects with different interest in food-related health (Low, Medium, and High Interest) were identified. This segmentation confirmed an association between positive attitudes towards health and liking and familiarity with selected food groups. People more convenience-oriented and less interested in product information and food quality had higher probability to have a lower interest in food-related health. Subjects with higher positive attitudes towards using foods as a reward had a higher probability to belong to the cluster with lower interest in food-related health.

KEY WORDS: Health and Taste Attitude Scale; interest in food-related health; familiarity with foods; food preferences

1. Introduction

It is widely acknowledged that healthy eating is a key factor for reducing the risk of many common chronic diseases (WHO & Consultation, 2003), including cardiovascular disease and certain cancers (Trichopoulou, Naska, Antoniou, Friel, Trygg & Turrini, 2003), overweight and obesity (WHO, 2007), diabetes (Schulze & Hu, 2005), as well as a number of other diseases (WHO & Consultation, 2003). Despite this evidence, and public health interventions and recommendations regarding healthy eating, internationally established, the prevalence of dietary-related diseases is still on the increase (Gortmaker, Swinbum, Levy, Carter, Mabry, Finegood, et al., 2011; Branca, Nikogosian, & Lobstein, 2007). Consequently, new strategies to make interventions designed to promote healthy eating more effective need to be studied (McMorrow, Ludbrook, Macdiarmid & Olajide, 2012; Capacci, Mazzocchi, Shankar, Macias et al., 2012). Crucial to the success of such strategies is understanding more in-depth consumers' attitudes towards the relation between food and health. This would constitute valuable information that can be leveraged in promotional interventions to increase healthy food habits.

Consumers are, in general, interested in the relationship between health and food (Rozin, 2007), and health is indeed among the most important motives of food choice and decision making (Verbeke, 2008; Grunert & Wills, 2007; Steptoe, Pollard, & Wardle, 1995). A large amount of consumer research has shown that health, along with taste, represent two central concepts that influence consumers' decision making and their perception of good food quality (Cox, Melo, Zabaras & Delahunty, 2012; Nguyen, Girgis & Robinson, 2015; Brunsø, Fjord & Grunert, 2002). However, Roininen, Lähteenmäki & Tuorila (1999) showed that people differ in the extent to which they incorporate taste and health motives in their food choices. Numerous consumer studies have shown a tendency of some western cultures to see food pleasure as being in opposition to health (Raghunathan, Naylor & Hoyer, 2006; Kivetz & Simonson, 2002; Roininen, Tuorila, Zandstra, de Graaf, Vehkalahti, Stubenitsky & Mela, 2001; Rozin, Fischler, Imada, Sarubin & Wrzesniewski, 1999). It has been observed, however, that a particular food choice is not always made for the best-liked alternative and other factors could be just as or even more important than the hedonic factors (de Graaf, Kramer, Meiselman, Lesher, Baker-Fulco, Hirsch & Warber, 2005). Studies indicated that health is considered equally important to taste in food choice (Dubé, Fatemi, Lu & Hertzer, 2016; Brunsø et al., 2002), and that consumers can form their preferences based on health-related attitudes motivated by expectations of a longer and higher quality life (Roininen et al., 2001).

While food choice has always reflected the interaction of a complex network of interrelated factors, further study of the dichotomy between taste and health motives may contribute to a better understanding of why people eat what they eat. The Health and Taste Attitude Scales (HTAS) were developed to evaluate the importance that consumers assign to perceived health and hedonic characteristics of foods in relation to their food choices (Roininen et al., 1999). The HTAS were originally proved to have a predictive validity and to be useful in segmenting Finnish consumers according to their food choices (Roininen & Tuorila, 1999). Thus, the HTAS were used to find the relationship between the health and taste-related attitudes with 'healthy' and 'unhealthy' snacks preferences (Roininen et al., 1999). It was found that both the health-scale (specifically, *General health interest* and *Light product interest*) and the taste-scale (particularly, *Craving for sweet foods* and *Using food as a reward*) were good predictors of the choice between apples and chocolate bars. Subsequently, it was shown (Zandstra, de Graaf & van Staveren., 2001) that people who had lower fat intakes and increased consumption of vegetables and fruits, rated high on *General health interest*, whereas people with a *Light product interest* consumed less high-fat snacks and more low-fat dairy products. Conversely, taste-related attitudes were not associated with any type of dietary behaviour, with the exception of *Craving for sweet foods*, which predicted high-fat sweet snacks consumptions. The HTAS were also shown to be useful tools for characterizing consumers' attitudes within and between countries in a multi-country study, including Finland, United Kingdom and The Netherlands, (Roininen et al., 2001).

The factor structure of the HTAS has not yet been confirmed on an Italian sample, although the internal consistency reliabilities of its subscales were already measured in a previous study (Endrizzi, Torri, Corollaro, Demattè, Aprea, Charles, Biasioli, & Gasperi, 2015). The general purpose of the current study was, therefore, to apply and validate the factor structure of the HTAS in an adult Italian sample, to characterize consumers' food-related attitudes with weak and strong connotations of health. In particular, the present research addresses the following objectives: 1) to test the dimensional structure of the HTAS and their internal consistency reliability in an adult Italian population sample as an instrument to reveal consumers' attitudes towards health and hedonic characteristics of foods; 2) to profile segments of consumers with different health-related attitudes according to their food-related lifestyles, food habits, food neophobia and preferences.

2. Methodology

The present study is part of the "Italian Taste" Project, a large scale study aimed at investigating, with a multidimensional approach, the influences (biological, genetic, physiological, socio-cultural, psychological and personality-related) on food choice and preferences in a large population sample, and their relevance in determining individual differences within a given food culture framework. A complete overview of the research and further details on the study protocol are described elsewhere (Monteleone, Spinelli, Dinnella, Endrizzi, Laureati, Pagliarini, et al., 2017). The present study is focused on attitudes towards health and hedonic characteristics of food (HTAS questionnaire), food-related lifestyles (FRL questionnaire), food preferences and familiarity with foods.

2.1 The sample

Data were collected on 1224 Italian subjects recruited on a national basis as part of a wider study (Monteleone et al., 2017). Inclusion criteria were to be in the age 18-60 years and be born in Italy or having lived at least 20 years in Italy. The participants were sampled in the main geographical areas of Italy. The sample was composed of 61% female and a mean age of 36.9 years (SD=12.8). The age classes distribution was the following: 18–30 (41.2%); 31–45 (27.2%); 46–60 (31.6%). The participants' recruitment method of relying on internet announcements in the Italian sensory science society website (www.scienzesensoriali.it), project website, social networks, magazines, emails, pamphlet, and word of mouth resulted in an overrepresentation of younger age groups and higher education. The sample had higher education than the national mean population, with about 43.8% of subjects having upper secondary school education and 49% of subjects having a tertiary education (university degree or post university degree, like a master or PhD), against the national mean of 30.2% of secondary school and 11.2% of tertiary education (Istat data for year 2011 of Italian population aged 6 and over) (http://seriestoriche.istat.it/).

2.2 Questionnaires

Socio-demographic (gender, age, education) information and anthropometric data, including weight (kg) and height (m) (that were used to calculate the Body Mass Index, in kg/m^2), and familiarity with foods, were collected through online questionnaires in advance of the test sessions. Measures of health and taste attitudes, food-related lifestyles, food habits, food neophobia and preferences were collected during the test sessions in sensory labs. When an Italian validated version was not available, the questionnaires were translated into Italian by two different bilingual Italian native-speakers and then back translated into the source language. Back translations were

reviewed by a bilingual expert in semantics and adjustments were made when necessary to select the most appropriate translation. For details on the procedures, see Monteleone et al. (2017).

2.2.1 Attitudes related to health benefits and sensory issues of foods (HTAS)

Food-related attitudes were measured by the HTAS proposed by Roininen et al. (1999), consisting of six subscales focusing on perceived health and taste aspects of foods. The three subscales of health predicted: *General Health interest* (eight items, deal with a general interest in healthy eating); *Light product interest* (six items, measuring the interest in eating reduced-fat or reduced sugar food products); *Natural product interest* (six items, related to an interest in eating food that does not contain additives or is unprocessed). The three subscales of taste were: *Craving for sweet foods* (six items, describing the strength of cravings for chocolate, sweets and ice-cream); *Using food as a reward* (six items, measuring attitudes towards using foods as a reward; *Pleasure* (six items, relating to the importance of obtaining pleasure from foods). Each subscale is composed of an equal number of positively and negatively worded statements (Roininen et al., 1999). As proposed by Roininen et al. (1999), negative statements were reversed and re-coded for calculation of the final scores. All items were scored on a seven-point category scale with the scales labelled from ‘‘disagree strongly” to ‘‘agree strongly”. For each participant and each subscale, after the re-codification of negatively-worded items, a mean score was computed from the individual scores. The Italian version of HTAS is reported in Appendix A of the Supplementary data.

2.2.2 Food-related lifestyles (FRL)

The food-related lifestyles (FRL) questionnaire (Grunert, Brunsø, & Bisp, 1993) contains 69 attitudinal statements each measured on a 7-point scale (from 1 ’completely disagree’ to 7 ‘completely agree’). The 69 items are grouped in 23 dimensions (each composed of three items) belonging to five different domains of food-related lifestyles: *ways of shopping* (six dimensions), refers to consumers’ shopping behaviour, where they shop, and their use of information; *cooking methods* (six dimensions), refers to how much effort and time is spent in meal preparation and who is responsible for, looking for new ways, convenience; *quality aspects* (six dimensions), refers to the attributes consumers seek from products; *consumption situations* (two dimensions), addresses where and when food is eaten; *purchasing motives* (three dimensions), encompasses desired consequences of a meal. In this FRL approach, it is assumed that lifestyle is a mental construct connected to personal values and is the process by which people try to achieve their values through various modes of expression, including food purchasing and consumption. This instrument has been tested in several European countries and other western food cultures for its cross-cultural validity,

as well as its intra-cultural stability (Scholderer, Brunsø, Bredhal, & Grunert, 2004; Bredhal & Grunert, 1997).

2.2.3 Food preferences and familiarity

The stated liking for a selection of 100 items in the categories of *fruits and vegetables* (n=34), *fish* (n=9), *red meat* (n=6), *preserved processed meat products* (n=7), *cheese* (n=9), *saturated* (n=3) *and unsaturated* (n=3) *fats, sweets* (n=17), *alcoholic beverages* (n=8) and *spirits* (n=4) was measured using the IT-Food Preference Questionnaire (IT-FPQ) developed within the Italian Taste project (Monteleone et al., 2017). The IT-FPQ includes 184 items, measured using the 9-point hedonic scale (Peryam & Pilgrim, 1957) with the addition of the option "never tasted". On the same items, the consumption frequency of each item was used as measure of food habits (IT-Food Familiarity Questionnaire) (hereafter, IT-FFQ) (Monteleone et al., 2017). The respondents were asked to rate each item on a 5-point labelled scale (*1 = I do not recognize it; 2 = I recognize it, but I have never tasted it; 3 = I have tasted it, but I don't eat it; 4=I occasionally eat it; 5 = I regularly eat it*) developed by Tuorila, Lähteenmäki, Pohjalainen, & Lotti (2001). The familiarity 5-items of the IT-FFQ responses were re-coded in three categories: "Not consumed" (grouping scores 1-3), "Consumed occasionally" (score=4) and "Consumed regularly" (score=5). For both food preferences and consumption frequency, the item order within each product category and the product category order were randomized across participants.

2.2.4 Food Neophobia

Food neophobia (FN) was measured using the Italian version of the Food Neophobia Scale (FNS) (Pliner & Hobden, 1992), as described by Laureati et al. (2018). The FNS consists of ten statements, of which five positively and other five negatively worded, each measured on a 7-point scale ranging from 1 'strongly disagree' to 7 'strongly agree'. A FNS index, with a theoretical 10-70 range, was computed for each individual as sum of the scores given to the ten items. The five items of FNS reflecting neophiliac food attitudes were reversely recoded before analyses. The respondents were classified into three groups (low, medium, high) according to their FN level. The low FN group included respondents within the lowest quartile (FNS≤18), the group within medium FN comprised the respondents within the second and third quartile (FNS higher than 18 and lower than 36) and the group with high food neophobia had FNS within the highest quartile (FNS≥36) (Laureati et al. 2018).

2.3 Data analysis

2.3.1 Health and Taste Scales

To examine the construct validity of the HTAS, the factor structure and the internal consistency reliability of the subscales were explored. Therefore, the two dimensions of Health and Taste were separately analyzed by means of Exploratory Factor Analysis (EFA) using the Maximum Likelihood estimation (oblique rotation method) (Hair, Black, Babin & Anderson, 2010).

The suitability of the data for EFA was assessed using the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity (Hair et al., 2010). Then, data were submitted to EFAs with maximum-likelihood estimations and nonorthogonal oblique rotations. To determine whether the present study replicated the structures identified by previous studies (Roininen et al., 2001; Roininen et al., 1999; Roininen & Tuorila, 1999), the acceptability of factors models was evaluated by a combination of conceptual foundation (interpretability of the factor solution based on the prior research) and empirical evidence (Hair et al., 2010; Costello & Osborne, 2005). Item loadings on more than one factor with salient cross-loadings (≥ 0.35) were eliminated to make each variable associated with only one factor, and make factors represent separate concepts (Hair et al., 2010; Campbell-Sill Liverant, & Brown, 2004). To determine the number of factors to retain, an *a priori* criterion of three factors was specified for both health and taste dimensions, to replicate previous studies and extract the same number of factors found in other European studies. Factor analyses were repeated until a satisfactory solution was derived.

Thereafter, a Confirmatory Factor Analysis (CFA) (Brown, 2015) was applied to test the factor solution's statistical robustness obtained from the exploratory factor analyses on the two dimensions of Health and Taste. Goodness of fit between the factor-solution and the observed data was evaluated using the cut-off criteria of the following indexes (Brown, 2015; Hu & Bentler, 1999): the Root Mean Square Error of Approximation (RMSEA; values close to 0.06 or below); the Standardized Root Mean Square Residual (SRMR; values close to 0.08 or below). Standardized loading estimates of 0.30 and above, measuring the relationship between the observed variables and their associated construct, are commonly considered as salient results (Brown, 2015). The relative Average Variance Extracted (AVE) above the recommended level of 0.50 is commonly considered, indicating convergent validity (Hair et al., 2010), whereas the cut-off of 0.85 of standardized estimated correlations is considered for distinctiveness of the factors and assessing discriminant validity (Kline, 2011). CFAs were performed by arbitrarily setting one indicator to unity, for each different latent construct, to define the scale of the factor (Kline, 2011). The internal consistency of the various constructs was assessed by Cronbach alpha coefficients (Cronbach, 1951).

2.3.2 Segmentation of the respondents

The sample was segmented using a Latent class Cluster Analysis (LCA), based on the mean scores of the three sub-dimensions of the Health section of the HTAS questionnaire. LCA is a model-based clustering approach outperforming traditional cluster analysis (e.g. K-means) (Magidson & Vermunt, 2002; Vermunt & Magidson, 2002). This model-based method is built on an underlying probability distribution to identify groups of cases that are similar with respect to a latent variable (Vermunt & Magidson, 2002). The model's parameters are determined using the maximum likelihood method. LCA does not assume linearity, normally distributed data or homogeneity of variance. The number of classes into which to divide the sample is defined by testing the extent to which the various statistical models fit increasing numbers of latent classes. The optimal choice is represented by the model that has an adequate fit and the lesser number of classes possible (Vermunt & Magidson, 2002). The most used set of model selection tools in LCA cluster analysis are information criteria like the Bayesian Information Criterion based on the log-likelihood (BIC_{LL}), and the Akaike's Information Criterion based on the log-likelihood (AIC_{LL}). In the present study, four criteria were taken into account when choosing the best fitting model: the BIC_{LL}, the AIC_{LL}, the p-value based on conditional bootstrap assessing the significance of fit improvement between consequent models, and the classification error (which indicates the proportion of respondents that is classified in a suboptimal group). The rule of thumb for choosing the best fitting model requires the BIC_{LL} and AIC_{LL} be smaller compared to other models, and the classification error be relatively lower compared to the other viable models (Vermount & Magidson, 2002). The appropriateness of the selected model was further evaluated through the size of the bivariate residual, which did not exceed the critical value of 1 (Vermount & Magidson, 2002).

Based on internal consistency reliability considerations, a reduced version of the FRL instrument, including only those parts of the FRL that exhibited satisfactory reliability, was applied for the following analyses. The reliability performance of the dimensions was assessed by Cronbach alpha coefficients (Cronbach, 1951). The principle followed was that dimensions or sub-dimensions with poor reliabilities were taken out. The value of 0.60 was marked as the lowest acceptable limit for the satisfactory internal consistency of the measure (Bagozzi & Yi, 1988; Kline, 2011). On the retained dimensions, average scores were calculated on the items in each retained sub-dimension.

Chi-square cross-tabulation tests, one-way ANOVAs, post-hoc Tukey's HSD test, and Kruskal-Wallis tests were performed to assess differences among groups of subjects who were classified according to their attitudes towards health. For each food group selected from the IT-Food Preference Questionnaire, individual mean scores were determined and compared among groups of

subjects classified according to their attitudes towards health and taste using one-way ANOVAs and post-hoc Tuckey's multiple comparison test. Subjects who were not familiar with a food item did not answer the preference question for that item and the observation was removed from calculation.

The groups of subjects were tested for statistically significant differences in the declared uses of each food group (frequency of food items *not consumed*, *occasionally consumed* or *regularly consumed*) derived from the IT-Food Familiarity Questionnaire. Chi-square tests were applied on 3 × 3 contingency tables to test the independence between the groups of subjects and declared use. Differences between the groups of subjects of each class of use were assessed using the nonparametric analysis of variance (Kruskal–Wallis). For values of K higher of the threshold of statistical significance, multiple pairwise comparisons were run using Dunn's procedure with Bonferroni correction (two-tailed test).

Multinomial logistic regression models were performed to explore the relationship between a set of independent (predictor) variables included in the analysis to describe the k identified clusters, and the cluster's membership category as dependent (outcome) variable. Initially, multinomial logistic regression models were used to determine which of the k-1 clusters a person belongs to given certain information, i.e. given all the independent variables. Successively, the final multinomial logistic regression models included only those independent variables that were found to be statistically significant ($p \leq 0.05$, Wald chi-square test for model effects). The results are presented as odds ratios (OR) with 95% confidence intervals (CI).

The statistical analyses were performed using the SPSS software version 24.0 (SPSS, Inc., USA) and the XLSTAT software version 19.02 (Addinsoft). A *p*-value of 0.05 was considered as threshold for statistical difference.

3. Results

Normality checks on the measured variables for the Health and Taste questionnaire found the distributions to have kurtosis and skewness quite close to |1| with few values > |1| but under |2|, indicating values acceptable to prove normal univariate distributions (George & Mallery, 2010) (results not shown, but they can be acquired from the first author). All sample adequacy statistics were ≥ 0.89 and Bartlett's test was statistically significant ($p<0.001$), suggesting the suitability of the data for explorative factor analysis (EFA).

3.1 Health and Taste scales validation

The exploratory factor analysis extracted a 3-factor structure for the Health dimension (Table 1). The solution explained 46.20% of the variance in the items, and the Cronbach's alpha coefficients

for all the subscales ranged from 0.74 to 0.81, indicating satisfactory to good internal consistency. Factor loadings (ranging from 0.37 to 0.84) indicated stable factors, except for the item GH1.R. 'The *healthiness of food has little impact on my food choice*' (loading= 0.24). The dimensionality of the 3-factor solution was then checked by performing CFA. The structure demonstrated a good fit to the data ($\chi^2(159) = 860.16$; p=0.000; RMSEA=0.060; CFI=0.90; SRMR=0.050), with standardized factor loadings ranging from 0.32 to 0.82 (Table 1) and all standardized correlations among constructs under 0.65 (results not shown). The AVE of the three factors ranged from 0.30 to 0.41, indicating that, on average, more error remains in the items than variance explained by the latent factor structure. However, removing items from these factors did not significantly improve AVE. Therefore, as the internal consistency and the goodness of fit indices were highly satisfactory and relying on the conceptual foundation hypothesised (Roininen et al., 1999), we kept these factors unchanged.

-----Table 1 about here-----

The original 3-factor structure of the Taste dimension extracted by the exploratory factor analysis showed problems with the interpretation of the *Pleasure* subscale factor loadings. Its internal consistency reliability was very low (Cronbach $\alpha = 0.34$). The following three items did not load at all on any factor (their loadings were lower than 0.16): P3 '*When I eat, I concentrate on enjoying the taste of food'; P4 'It is important for me to eat delicious food on the weekdays as well as weekends'; P6.R. 'I finish my meal even when I do not like the taste of food'*. On the contrary, the following three items loaded on the *Using food as a reward* sub-dimension: '*I do not believe that food should always be source of pleasure'; 'The appearance of food makes no difference to me'; 'An essential part of my weekend is eating delicious food'*. This finding indicated that the *Taste* dimension was not represented by the *Pleasure* subscale. Therefore, the items of the *Pleasure* subscale were not considered. A subsequent explorative factor analysis extracted a final 3-factor structure for the *Taste* dimension (*Craving for sweet foods* and *Using food as a reward*) accounting for 70.88% of the variance (Table 2). The *Craving for sweet foods* subscale was split into the two subscales: *Understanding other people craving* (factors loading ranging from 0.88 to 0.97) and *Personal craving for sweet foods* (factors loading ranging from 0.82 to 0.87). There was a significant correlation between the two sub-dimensions (0.41, Table 2) that, however, assured the absence of collinearity and the ability to separate the construct in two new sub-dimensions (Hair et al., 2010). The *Using food as a reward* showed factor loadings ranging from 0.42 to 0.81. This factorial structure of the *Taste* dimension, checked by performing CFA, indicated a good fit to the

data ($\chi^2(46)$ =262.45, p=0.000; RMSEA=0.062; CFI=0.98; SRMR=0.051), with standardized factor loadings ranging from 0.34 to 0.97 and all correlations among constructs under 0.50. As shown in Table 2, the alpha coefficients for all the subscales ranged from 0.88 to 0.96, indicating very reliable internal consistency. Also, AVE were found very satisfactory indicating convergent validity of the three latent factors of *Taste*.

-----Table 2 about here-----

3.2 Food-related lifestyle dimensions

Cronbach's alphas for the FRL structures were calculated for all the original 23 FRL sub-dimensions in the total sample. The sub-dimensions with reliabilities lower than 0.60 were taken out. Table 3 shows only the FRL dimensions and sub-dimensions retained for the following analyses, and their Cronbach alpha values.

-----Table 3 about here-----

3.3 Identification of consumer groups based on the Health scale

The sample of respondents was classified using a LCA according to the three subscales of the Health dimension. A three-cluster model satisfied the selected criteria (BIC_{LL} = 10902.17, AIC_{LL} = 10799.97, p=0.000, classification error = 0.16). The mean values of the 3 segmenting variables indicated statistically significant differences (p<0.001) across the three clusters for *General health interest* and *Natural product interest*, whereas *Light Product interest* did not show significant differences (Table 4). The three segments have been labelled as *Low health interest* (n=344), *Medium health interest* (n=653), and *High health interest* (n=225).

3.4 Health-related clusters' profiles

Table 4 shows the frequency of subjects based on socio-demographic characteristics, BMI and FNS, and mean scores for five subscales of the HTAS Questionnaire and the retained FRL lifestyles dimensions. Age and gender were the only socio-demographic characteristics significantly different across the three clusters. BMI did not significantly differ among the three clusters, although the cluster *Low health interest* showed the highest percentage of males with obesity. The subscales *Other people craving* (p<0.05) and *Using food as a reward* (p<0.0001) were significantly associated with the cluster membership, whereas the *Personal Craving* was not significantly different among the three segments of subjects. Analyses of Variance showed significant differences among segments for most of the FRL sub-dimensions (p<0.001). The three clusters did

not significantly differ in their mean FNS index (data not shown) and in FN level's frequency distribution. However, the *High health interest* segment included the highest number of low-neophobic subjects (31.6%) and the lowest of high-neophobic subjects (23.1%) as opposed to the other clusters. For *Low health interest* it was the opposite. In the following, clusters profiles will be commented only on those variables statistically significant ($p<0.05$).

-----Table 4 about here-----

The *Low health interest* Cluster, was composed of 28.2% of the total sample, primarily consisting of consumers who placed less importance on health. The mean scores of the two sub-dimensions *General health interest* and *Natural product interest* were quite low (respectively, 3.3 and 3.1) and clearly different from those of the other two segments. The *Low health interest* segment was also had the highest percentage of younger people (aged 18-30, 53,1%) and males (45.8%). It was composed of subjects who were least interested in product information, specialty shops or using a shopping list when buying (mean scores, respectively, 4.8, 3.6 and 4.7). Its members placed the lowest importance on food quality aspects, such as healthiness (mean score = 4.5), organic foods (mean score = 3.3), and freshness (mean scores =5.8). In addition, they were less interested in cooking (mean score = 5.0) or looking for new ways when cooking (mean score = 5.0). As with the other two clusters, the *Low health interest* cluster members were not interested in convenience, although they showed mean scores closer to the neutral point than the other two groups.

The *Medium health interest* cluster was the most numerous (53.4% of the total sample), the majority of whom were female (59.9%) and the age group distribution was quite close to that of the total sample. This segment included people who were rather interested in product information when shopping (mean score = 5.4), had positive attitudes towards specialty shops (mean score = 4.5) and used a shopping list when buying (mean score = 4.9). They placed high importance on food quality aspects, mainly in food healthiness (mean score = 5.7) and freshness (mean score = 6.2). Cooking was regarded as an enjoyable activity (mean score = 5.2) and they placed high importance on looking for new ways of cooking (mean score = 5.3), as well as on self-fulfilment in food (mean score = 5.2).

Finally, the *High health interest* cluster, was the smallest cluster with 18.4% of the sample. This group had the highest mean scores in *General health interest* and *Natural product interest* (respectively, 5.2 and 5.6). The principal aspects that differentiated these subjects from those of the other two clusters were both the highest percentage of females (75.6%) and people aged 46-60 years (48.0%), and the lowest percentage in the 18-30 years age group (21.8%). It also had the lowest

mean score for *Using food as a reward* (mean score=4.0). Moreover, more than in the other two groups, its members emphasized the importance of the dimensions related to the *Ways of shopping* and food *Quality aspects*. This cluster showed the highest interest in product information when shopping (mean score = 6.0), in specialty shops (mean score = 5.1) and in the use of a shopping list when buying (mean score = 5.3). Healthiness, freshness and interest in novelty and organic foods were more highly valued in this segment (mean scores, respectively, 6.5, 6.6 and 5.5). Finally, the *High health interest* cluster members had the greatest interest in looking for new ways of cooking (mean score =5.6) and for them, more than in the other clusters, food products were important for achieving basic values such as self-fulfilment (mean score = 5.5).

3.5 Predicting the health-related cluster's membership

Initially, all the variables shown in Table 4 were included in the logistic regression analysis to determine the association between the predictor variables and the belonging to each of the three clusters (data not shown). Two final multinomial logistic regression models were therefore performed by including only those variables that were found to be statistically significant (Wald chi-square test, $p < 0.05$) The final associations (odds ratios) between each predictor variable and the cluster's membership are presented in Tables 5. The membership in the High health interest cluster was set as the reference level.

With regards to the probability to belong to the *Low health interest* cluster rather than to the *High health interest*, the lowest age class (≤18-30 years) had the strongest probability to be associated with the cluster *Low health interest* (OR=3.16), rather than to the High health cluster. Males (OR=2.63) and the medium age class 31-45 years, (OR=1.94), followed. The other significant covariates positively associated with the *Low health interest* cluster's membership were the FRL sub-dimensions *Convenience in cooking* (OR=1.46) followed by the HTAS sub-dimension *Using food as a reward* (OR=1.38). The *Personal craving* sub-dimension followed with a lower odd ratio (1.20). Their significant odd ratios tell us that a unit increase in the sub-dimensions *Convenience*, *Using food as a reward* and *Personal craving* increased the probability by, respectively, 46%, 38% and 20% to belong to the *Low health interest* cluster, rather than to *High health interest* cluster. On the contrary, a unit increase in the FRL sub-dimensions *Health* and *Organic*, decreased the probability to belong to the *Low health interest* cluster by, respectively 70% (1-OR=1-0.30), 61% (1-OR=1-0.39). The sub-dimensions *Shopping list*, *Importance of product information* and *Other people craving* followed with lowest odd ratios. A unit increase in the variables *Shopping list*, *Importance of product information* decreased the probability to be a

member of the cluster *Low health interest* by, respectively, 23% (1-OR=1-0.77), and 21% (1-OR=1-0.79). Whereas a unit increase in *Personal craving* increased the probability to belong to the *Low health interest* cluster by 20% (1-OR=1-1.20).

As regards the probability to belong to the *Medium health interest* cluster rather than to the *High health interest*, similarly, the lowest age class (≤18-30 years) had the strongest probability to be associated with the cluster *Low health interest* (OR=2.20), followed by males (OR=1.97). The other significant covariates associated with the *Medium health interest* cluster's membership followed patterns similar to those found for the *Low health interest* cluster's membership, although with lower odd ratios values. However, *Other people craving*, *Personal craving* and the medium age class (31-45 years) were not significantly associated with the *Medium health interest* cluster's membership.

3.6 Health-related clusters' profiles in regard to food preferences and familiarity

The ANOVA revealed significant differences between clusters in mean food preferences for the categories 'Vegetables and Fruits', 'Fish', 'Red meat + preserved processed meat products', 'Fat (saturated)', and 'Alcoholic beverages' (Table 6). The *High health interest* cluster had the highest mean scores of liking for 'Vegetables and Fruits', and for 'Fish' compared to the other two segments of respondents, and lowest for 'Red meat + preserved processed meat products', 'Fat (saturated)', and 'Alcoholic beverages'. The *Low health interest* cluster, on average, scored lower than the other two segments of respondents on the food categories 'Vegetable and Fruits' and higher 'Red meat + preserved processed meat products' and 'Fat (saturated)', but were no different than the *Medium health interest* cluster for 'Fish' and 'Alcoholic beverages'. The *Medium health interest* cluster, compared to the other two clusters, showed intermediate values in food preferences.

Table 7 reports the frequency distribution of cluster subjects in three classes describing the consumption frequency for specific food groups. The *High health interest* cluster included a highest number of regular users of a higher variety of 'vegetable & fruits' and fish, and lower users of 'red meat + preserved processed meat products', saturated fat and alcoholic beverages. The *Low health interest* cluster was composed of subjects with the highest regular use of 'red meat + preserved processed meat products', and saturated fat, and the lowest regular use of vegetables.

4. Discussion

The internal consistencies of the HTAS Italian version were quite in line with the original work of Roininen et al. (1999) and other later studies (Roininen et al., 2001; Zandstra et al., 2001; Talvia, Räsänen, Lagström, Anglè, Hakanen, Aromaa, et al., 2011), indicating that the items were associated one with another within each dimension. The construct validity referring to the adequacy of specific items selected to assess the domain of interest highlighted, instead, some problems. The HTAS Italian version comprised three factors related to the Health dimension, distinct from one another. However, for each of them, a large average percentage of variation was not explained by its items. This is consistent with the findings of other studies (Roininen et al., 2001; Talvia et al., 2011), namely that the factor structure of the Health scale showed very low values of individual communalities for a few of its items. This would suggest that the Health scale needs further investigation. Likewise, the original three-factor model of the *Taste* scale was not here confirmed. The original sub-dimension *Craving for sweet foods* was, indeed, split into two new underlying sub-dimensions describing attitudes towards *Personal craving* and *Other people's craving*. This division in two sub-dimensions has been found also in previous researches carried out in Brazil (Koritar, Philippi, & Alvarenga, 2017) and Finland (Talvia et al., 2011). Even the cross-national validation of the HTAS tool carried out from Roininen et al. (2001), highlighted some problems of interpretation of the structure solution for *Craving for sweet foods* in each of the involved countries (Great Britain, The Netherland, Finland), made evident by the presence of a few significant cross-loadings. Concerning the *Pleasure* subscale, its statements did not load together on a single construct. Three items loaded, indeed, on the *Using foods as a reward* subscale, suggesting thus that those statements may have been understood differently by the Italian sample. However, this finding mirrors the weakness of the *Pleasure* factor structure that emerged also in British and Dutch samples (Roininen et al., 2001), raising the question that, despite a good translation, there could be cross-culturally different interpretation of the *Pleasure* scale items.

Generally speaking, Italian respondents rated the Health scale, on average, in the same way as other Europeans (Roininen et al., 2001), except for *Light product interest* whose low average values indicated that Italian respondents were little interested in those products. This finding might show a lower attraction of Italians towards healthy properties of foods as compared to consumers of other countries (Saba, Vassallo, Shepherd, Lampila, Arvola, Dean, et al., 2010). Social and institutional-based trust is indeed an important factor in influencing consumer's perception of health benefits of such products (Siegrist, Stampfli, & Kastenholz, 2008; Mazzocchi, Stefani, & Henson, 2004; Urala, Arvola, & Lähteenmäki, 2003). This may be therefore another reason explaining a smaller attractiveness of such products in Italy, where trust that people place in food manufacturers and

bodies responsible of consumer protection is low (Lobb, Traill, Mazzocchi, & McCrea, 2006; Observa, 2003).

In response to the second objective, this study provided an analysis on a few characteristics of an Italian sample of adults in relation to their interest in food-related health. Consumers who belonged to different clusters responded differently to the *Using foods as a reward* subscale. The two clusters with low and medium health interest showed, on average, more positive attitudes in using food as reward, meaning that people less interested in following a healthy diet could be more inclined to search for immediate rewards. On the other hand, the logistic regression results confirmed that those subjects with higher positive attitudes towards using foods as a reward were more likely to belong to the cluster with low interest in food-related health aspects. This result is in line with what some authors argued, namely that unhealthy diets may attract subjects who look for immediate gratification from foods (Barlow, Reeves, McKee, Gale, & Stuckler, 2016; MacKillop, Amlung, Few, Lara, Lawrence, & Munafò, 2011). The personal craving for sweet foods was associated with low interest in food-related health. The stronger was craving for sweet foods, the higher was the probability to have weaker positive attitudes towards health. Indeed, food reward is among the main reasons for unhealthy food consumption (Verhoeven, Adriaanse, de Vet, Fennis, & de Ridder, 2015) and food craving may precede unhealthy eating behaviour (Finlayson, Arlotti, Dalton, King, & Blundell, 2011). Our results are also consistent with findings from studies reporting that impulsiveness leads consumers to make food choices not based on long term health considerations (Sarmugam & Worsley, 2015; Jasinska, Yasuda, Burant, Gregor, Khatri, Sweet, & Falk, 2012).

The importance given to food-related health aspects was also associated with a few dimensions of food-related lifestyles. People more concerned about food products quality in terms of naturalness of products and interest in organic foods were less likely to belong to the two groups of subjects with low and moderate interest towards health. Even those subjects more inclined to use a shopping list for their food purchases and those interested in investing time and efforts to check information on a product were more likely to have weaker positive attitudes towards food-related health. In addition, a higher inclination towards convenience in meal preparation increased the probability to have less interest towards health, as confirmed by other studies that highlighted the perception of less quality and healthiness associated to convenience compared to non-convenience foods (Costa, Schoolmeester, Dekker, & Jongen, 2007; De Boer, McCarthy, Cowan, & Ryan, 2004). However, it has to be pointed out that the price consciousness when shopping for food, did not emerge here as significant variable to determine the cluster's membership. This finding is not in line with other studies where price was found to be one of the most important food choices motives (Eertmans, Victoir, Vansant, & Van den Bergh, 2005; Lindeman & Vaananen, 2000; Steptoe, et al.,

1995). However, one possible reason of such discrepancy may be that the present study is focused on attitudes towards health rather than behaviour or intention to purchase foods. Then, the measurement of attitudes could have minimized the importance of price.

The present results are consistent with a number of researches indicating females to be more positively motivated towards food-related health aspects than males (Hearty, McCarthy, Kearney, Gibney, 2007; Gough & Conner, 2006; Sobal, 2005; Roininen et al., 2001), and studies showing that healthy eating motivations become stronger with increasing age (Hearty et al., 2007; Roininen et al, 1999; Kearney, Kelly, & Gibney, 1998).

Based on these findings, the group of subjects with low interest towards food-related health could be therefore less responsive to general messages promoting healthy diet. This would mean that providing these subjects with accurate information could prove more effective by using other ways to inform them about healthy eating patterns. On the other hand, it could be crucial for food manufacturers to realize that the quality of foods, more of interest for this group of consumers, should not be compromised by offering convenience foods.

The existing literature highlighted that dietary healthfulness varies with the level of food neophobia, denoting that this personality trait exerts its influence on food choice (Eertmans et al 2005). In our study, subjects' segmentation according to the importance given to food-related health aspects was not associated with significant differences in food neophobia. However, the number of respondents classified as "food neophobic" was lower in the group of people with a higher interest in health. Therefore, the limited difference in food neophobia observed between consumers segments points out that attitudes towards food-related health aspects were marginally influenced by this personality trait. Moreover, in our sample, the individuals more concerned about in food-related issues were also more interested in food quality aspects such as novelty in meal preparation, although this interest was found non-significantly associated with the cluster's membership. Other studies showed that neophobia was associated with an unwillingness to try healthy alternative versions of already familiar products (Schickenberg, van Assema, Brug, & de Vries, 2007) and increasing neophobia was associated with reduced dietary variety (Knaapila, Silventoinen, Broms, Rose, Perola, Kaprio, et al et al., 2011).

Subjects with different level of interest in food-related aspects showed significant differences in liking for, and consumption frequency of, selected food groups. The *High health interest* cluster rated familiarity with and liking for healthy foods (vegetables/ fruit and fish) higher than the *Low* and *Medium health interest* clusters. Red meat and preserved processed meat products, alcohol and spirit were less familiar and less liked by the *High health interest* cluster than in the other groups. On the other hand, subjects from *Low health interest* rated familiarity with and liking for healthy

food lower than the other clusters. The *Health* scale was confirmed as a useful tool for segmenting in groups with different levels of interest in health and a good predictor for healthy vs unhealthy food preference and consumption (Roininen et al., 2001). Vegetable liking, and consumption were significantly higher in the group with greater appreciation of health (Aggarwal, Monsivais, Cook, & Drewnowski, 2014; Zandstra et al. 2001; Beydoun & Wang, 2008). Furthermore, these results confirm the positive relation between familiarity with and preference for foods: foods that had been tasted less often tended to be less liked (Cooke, 2007). Gender and age significantly affected the interest in food-related health aspects thus influencing liking for and familiarity with healthy foods. In accordance with the existing literature, our results confirmed that females and older subjects are the most interested in health, and are more familiar and enjoy healthy foods, particularly vegetables (Appleton, Dinnella, Spinelli, Morizet, Saulais, Hemingway et al., 2017; Jaeger, Rasmussen & Prescott, 2017; Laureati et al., 2018). Food preferences of consumers with more positive attitudes towards health were not associated with education levels, albeit social differences, such as education or income, were barriers to healthy eating, as found by other studies (Skuland, 2015; Beydoun & Wang, 2008). However, another study (Prättälä, Hakala, Roskam, Roos, Helmert, Klumbiene et al., 2009) showed that the educational level had a weak effect on the consumption of vegetable in the Mediterranean countries, including Italy. This could be due the higher availability and affordability of vegetables in the Mediterranean countries and to the presence of habits and tradition of using vegetables in everyday cooking.

5. Conclusion

The present research lends support to the validity of the questionnaire as a tool to distinguish consumers belonging to different groups according to their attitudes towards health. Particularly, the ability of the Health scale of the HTAS Italian version to differentiate among segments of subjects according to their healthy attitudes towards food-related behaviours was here confirmed. However, the factor structure of the Health dimension was not quite robust, and the *Taste* scale showed different construct patterns. Further investigations are needed to clarify this issue and determine whether the findings for the *Taste* scale can indeed be attributed to differences in culture.

However, theoretical considerations aside, from a practical point of view our findings confirmed that there is a relation between positive attitudes towards food-related health and preferences and familiarity with eating a healthy diet. Furthermore, people with stronger positive attitudes towards eating a healthy diet were more receptive to higher food products quality and showed more interest in food information compared to people with weaker positive attitudes. These findings would suggest, therefore, that health promotion strategies for improving healthy eating need more insights

on attitudes, food preferences and consumption habits in order to apply appropriate strategies to appeal different consumers segments.

This study has a few limitations. First, we did not collect data on test-retest reliability, therefore an important source of psychometric quality could not be evaluated. Moreover, the investigation of the HTAS Italian version was conducted on a sample of volunteers not well balanced in gender and age, being females and the younger age categories overrepresented in the population. As a result, these findings cannot be generalised to the overall population. For the above considerations, further researches need to be undertaken both to ensure that the questionnaire is valid in the whole range of age of the Italian adult population, and to explore also other external variables that might mediate the association with the interest towards food-related health.

Author contributions

AS took primary responsibility for writing the manuscript. FS contributed for writing. AS, FS, EM, CD, contributed to plan the analyses. AS and FS performed the analyses. AS, FS, EM, CD, ML, LT, MP and ESC contributed critically to the interpretation of the results and to the content of the manuscript. CD, FG, AB, ML, FS, SS, LT, IE, SP, TGT, collaborated in the design of the project Italian Taste. All authors helped with data collection, reviewed and offered critical comments on the manuscript.

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Table 1. Latent factor structure of the original data resulting from the Exploring Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) conducted on the Health dimension. As to EFA, retained items and their respective factor loadings for each factor are shown. Standardized factor loadings, item error (e) and Average Variance Extracted (AVE) are shown for CFA.

	EFA factor loadings			h^2	CFA factor loadings		
	Factor 1	**Factor 2**	**Factor 3**		**Factor 1**	**Factor 2**	**Factor 3**
items	*General health interest*	*Light product interest*	*Natural product interest*		*General health* interest	*Light product interest*	*Natural product interest*
General health interest *(Cronbach's alpha = 0.78)*							
1.R The healthiness of food has little impact on my food choice	**0.24**	-0.01	0.14	0.10	**0.32** *(e=0.90)*		
2. I am very particular about the healthiness of food I eat	**0.54**	-0.04	0.09	0.36	**0.61** *(e=0.63)*		
3.R I eat what I like. I do not worry much about the healthiness of food	**0.48**	-0.02	0.18	0.36	**0.62** *(e=0.62)*		
4. It is important for me that my diet is low in fat	**0.59**	0.11	-0.07	0.33	**0.54** *(e=0.70)*		
5. I always follow a healthy and balanced diet	**0.84**	-0.03	-0.23	0.53	**0.61** *(e=0.62)*		
6. It is important for me that my daily diet contains a lot of vitamins and mineral	**0.72**	-0.02	-0.06	0.47	**0.61** *(e=0.62)*		
7.R The healthiness of snacks makes no difference to me	**0.48**	-0.01	0.14	0.32	**0.57** *(e=0.68)*		
8.R I do not avoid food even if they may raise my cholesterol	**0.46**	0.17	0.02	0.25	**0.50** *(e=0.75)*		
AVE					*0.31*		
Light product interest **(***Cronbach's alpha = 0.81)*							
1.R I do not think that light products are healthier than conventional product	-0.02	**0.76**	0.00	0.57		**0.64** *(e=0.59)*	
2.R In my opinion, the use of light products does not improve one's health	0.00	**0.84**	0.01	0.70		**0.78** *(e=0.40)*	
3.R In my opinion, light products don't help to drop cholesterol levels	0.01	**0.75**	0.06	0.57		**0.82** *(e=0.33)*	
4. I believe that eating light products keeps one's cholesterol level under control	0.06	**0.53**	-0.01	0.29		**0.60** *(e=0.64)*	
5. I believe that eating light products keeps one's body in good shape	0.10	**0.58**	0.00	0.36		**0.57** *(e=0.67)*	
6. In my opinion by eating light products one can eat more without getting too many calories	-0.05	**0.37**	0.01	0.14		**0.33** *(e=0.89)*	
AVE						*0.41*	
Natural product interest **(***Cronbach's alpha = 0.74)*							
1. I try to eat food that do not contain additives	0.24	-0.10	**0.54**	0.50			**0.70** *(e=0.50)*
2.R I do not care about additives in my daily diet	0.14	-0.05	**0.63**	0.51			**0.66** *(e=0.56)*
3. I do not eat processed foods, because I do not know what they contain	0.05	-0.03	**0.41**	0.20			**0.48** *(e=0.77)*
4. I would like to eat only organically grown vegetable	0.08	0.03	**0.54**	0.34			**0.57** *(e=0.68)*
5.R In my opinion, artificially flavoured are not harmful for my health	-0.13	0.01	**0.55**	0.24			**0.41** *(e=0.83)*
6.R In my opinion, organically grown foods are no better for my health than those grown conventionally	-0.16	0.14	**0.59**	0.27			**0.35** *(e=0.88)*
AVE							*0.30*
Estimated correlations							
General health interest vs Light product interest		*0.14*					
General health interest vs Natural product interest		*0.65*					
Light product interest vs Natural product interest		*- 0.08*					

Negative statements are marked with an 'R' after the statements number; these statements were recoded for the final scores. Communalities calculated for EFA are marked with h^2

Table 2. Latent factor structure of the original data resulting from the Exploring Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) conducted on the Taste dimension. As to EFA, retained items and their respective factor loadings for each factor are shown. Standardized factor loadings, item error (e) and Average Variance Extracted (AVE) are shown for CFA.

	EFA factor loadings			h^2	CFA factor loadings		
	Factor 1	**Factor 2**	**Factor 3**		**Factor 1**	**Factor 2**	**Factor 3**
items	*Other people craving*	*Using food as a reward*	*Personal craving*		*Other people craving*	*Using food as a reward*	*Personal craving*
Craving for sweet foods							
Other people craving *(Cronbach's alpha = 0.96)*							
1.R In my opinion it is strange that some people have cravings for chocolate	**0.92**	0.03	0.03	0.89	**0.95** (e=0.11)		
2.R In my opinion it is strange that some people have cravings for sweets	**0.97**	0.03	-0.02	0.94	**0.97** (e=0.07)		
3.R In my opinion it is strange that some people have cravings for ice-cream	**0.88**	0.02	0.05	0.82	**0.91** (e=0.17)		
AVE					*0.94*		
Personal craving *(Cronbach's alpha = 0.88)*							
4. I often have cravings for chocolate	0.05	-0.04	**0.84**	0.70		**0.84** (e=0.29)	
5. I often have cravings for sweets	0.04	-0.04	**0.87**	0.76		**0.88** (e=0.23)	
6. I often have cravings for ice-cream	-0.03	0.01	**0.82**	0.67		**0.80** (e=0.35)	
AVE						*0.84*	
Using food as a reward *(Cronbach's alpha = 0.91)*							
1. I reward myself by buying something really tasty	-0.03	**0.81**	0.09	0.71			**0.85** (e=0.27)
2. I indulge myself by buying something really delicious	-0.08	**0.73**	0.00	0.52			**0.74** (e=0.45)
3. When I am feeling down I want to treat myself with something really delicious	0.12	**0.77**	0.10	0.66			**0.82** (e=0.33)
4.R I avoid rewarding myself with food	0.11	**0.67**	-0.12	0.42			**0.58** (e=0.67)
5.R In my opinion, comforting oneself by eating is self-deception	0.07	**0.46**	-0.10	0.19			**0.34** (e=0.88)
6.R I try to avoid eating delicious food when I am feeling down	0.18	**0.42**	-0.02	0.23			**0.37** (e=0.86)
AVE							*0.62*
Estimated correlations							
Other people craving vs Personal craving		*0.41*					
Other people craving vs Using food as a reward		*0.19*					
Personal craving vs Using food as a reward		*0.50*					

Negative statements are marked with an 'R' after the statements number; these statements were recoded for the final scores. Communalities calculated for EFA are marked with h^2

Table 3. The retained Food-Related Lifestyle dimensions and sub-dimensions, and their Cronbach alpha values

Ways of shopping, 5 sub-dimensions	***Cronbach's alpha***
	0.74
Importance of product information	
V1. To me product information is of high importance. I need to know what the product contains. V29. I compare labels to select the most nutritious food.	
V11. I compare product information labels to decide which brand to buy.	
Enjoyment from shopping	0.61
V4. Shopping for food does not interest me at all.	
V53. I just love shopping for food.	
V46. Shopping for food is like a game to me.	
Speciality shops	0.73
V25. I do not see any reason to shop in specialty food stores.	
V12. I like buying food products in specialty stores where I can get expert advice.	
V36. I like to know what I am buying, so I often ask questions in stores where I shop for food.	
Price criteria	0.63
V41. I always check prices, even on small items.	
V15. I notice when products I buy regularly change in price.	
V28. I look for ads in the newspaper for store specials and plan to take advantage of them when I go shopping.	
Shopping list	0.72
V47. Before I go shopping for food, I make a list of everything I need.	
V60. I make a shopping list to guide my food purchases.	
V6. Usually I do not decide what to buy until I am in the shop.	
QUALITY ASPECTS, 4 sub-dimensions	
Health	0.81
V56. I prefer to buy natural products, i.e. products without preservatives.	
V35. To me the naturalness of the food that I buy is an important quality.	
V49. I try to avoid food products with additives.	
Novelty	0.60
V40. I love to try recipes from foreign countries.	

V67. I like to try new foods that I have never tasted before.

V8. Well-known recipes are indeed the best.

Organic products 0.75

V16. I always buy organically grown food products if I have the opportunity.

V9. I make a point of using natural or ecological food products.

V30. I do not mind paying a premium for ecological products.

Freshness 0.72

V22. I prefer fresh products to canned or frozen products.

V39. It is important to me that food products are fresh.

V48. I prefer to buy meat and vegetables fresh rather than pre-packed.

COOKING METHODS, 4 sub-dimensions

Interest in cooking 0.79

V43. I like to have ample time in the kitchen.

V62. Cooking is a task that is best over and done with.

V18. I do not like spending too much time on cooking.

Looking for new ways 0.78

V69. I like to try out new recipes.

V24. I look for ways to prepare unusual meals.

V37. Recipes and articles on food from other culinary traditions make me experiment in the kitchen.

Convenience 0.71

V52. Frozen food account for a large part of the food products I use in our household.

V14. We use a lot of ready-to-eat foods in our household.

V59. I use a lot of mixes, for instance baking mixes and powder soups.

Woman's task 0.68

V57. I consider the kitchen to be the woman's domain.

V26. It is the woman's responsibility to keep the family healthy by serving a nutritious diet.

V32. Nowadays the responsibility for shopping and cooking ought to lie just as much with the husband as with the wife.

PURCHASING MOTIVES, 1 sub-dimension

Self-fulfilment in food

V51. Being praised for my cooking adds a lot to my self-esteem. 0.67

V63. Eating is to me a matter of touching, smelling, tasting and seeing, all the senses are involved. It is a very exciting sensation.

V54. I am an excellent cook.

Table 4. Cluster's profile and the total sample based on percentage frequencies of socio-demographic characteristics and BMI, mean scores for each of the three sub-scales of the HTAS (*Personal Craving, Other people Craving, Using food as Reward*) and the retained FRL lifestyles dimensions. Results of χ^2 testing and one-way ANOVA differences between clusters are shown.

	Total sample	***Low health interest***	***Medium health interest***	***High health interest***		
	(n=1224)	*(28.2%)*	*(53.4%)*	*(18.4%)*	χ^2	***Sig.***
Socio-demographic characteristics	*n*	*%*	*%*	*%*		.
Age					70.97	0.00
18 - 30	262	53.1	41.6	21.8		
31 - 45	168	28.1	25.7	30.2		
46 - 60	214	18.8	32.7	48.0		
Gender					27.08	0.00
male	475	45.8	40.1	24.4		
female	749	54.2	59.9	75.6		
Education						n.s
until lower secondary school (age 14)	85	4.3	7.8	8.4		
upper secondary school (age 19)	536	42.3	46.3	38.7		
university degree	425	36.5	33.0	36.4		
post degree (master or PhD)	178	16.8	12.7	16.4		
Body Mass Index (kg/m^2) [§]						
Female						n.s
< 18.5 (underweight)	42	5.1	6.4	5.9		
18.5-25.0 (normal weight)	539	71.2	71.7	74.1		
25.0-30.0 (overweight)	119	14.8	18.7	15.3		
≥ 30.0 (obesity)	49	8.9	3.2	4.7		
Male						n.s
< 25.0 (underweight and normal weight)	260	53.6	58.0	52.7		
25.0-30.0 (overweight)	168	37.2	31.2	40.0		
≥ 30.0 (obesity)	45	9.2	10.8	7.3		
Food Neophobia level						n.s
Low	329	26.4	25.5	31.6		
Medium	573	43.5	49.1	45.3		
High	322	30.1	25.4	23.1		

			mean		***F***	***Sig.***
	n	*%*	*%*	*%*		
HTAS dimensions						
General health interest	4.1	3.3 [c]	4.0 [b]	5.2 [a]	611.81	0.00
Natural product interest	4.5	3.1 [c]	4.7 [b]	5.6 [a]	1013.2	0.00
Light product interest	3.4	3.4	3.5	3.4		
Other people Craving	5.4	5.3[b]	5.5[ab]	5.6[a]	3.22	0.04
Personal Craving	4.2	4.2	4.2	4.0		
Using food as Reward	4.5	4.6[a]	4.5[a]	4.0[b]	18.65	0.00
Food-related dimensions						.
Ways of shopping						
Importance of product information	5.4	4.8[c]	5.4[b]	6.0[a]	77.38	0.00
Enjoyment from shopping	5.5	5.4	5.5	5.6		
Speciality shops	4.4	3.6[c]	4.5[b]	5.1[a]	12.80	0.00
Price criteria	4.9	4.8	4.9	4.9		
Shopping list	4.4	4.7[b]	4.9[b]	5.3[a]	91.62	0.00
Quality aspects						

Health (natural, no additives)	5.7	4.5[c]	5.7[b]	6.5[a]	267.82	0.00
Novelty	5.1	5.1[b]	5.1[b]	5.3[a]	3.67	0.03
Organic products	4.5	3.3[c]	4.5[b]	5.5[a]	236.86	0.00
Freshness (versus packaged)	6.2	5.8[c]	6.2[b]	6.6[a]	62.94	0.00
Cooking methods						
Interest in cooking	5.3	5.0[b]	5.2[b]	5.6[a]	8.56	0.00
Looking for new ways	5.2	5.0[c]	5.3[b]	5.6[a]	12.04	0.00
Convenience	2.6	2.9[a]	2.6[b]	2.0[c]	41.60	0.00
Woman's task	2.2	2.1	2.3	2.2		
Purchasing motives						
Self-fulfilment in food (skill)	5.2	5.0[c]	5.2[b]	5.5[a]	12.79	0.00

n.s. = non significant

§The first two BMI categories, for males, were merged due to the small number of people underweight (n= 5)

ANOVA test: different letters within the same row denote significant differences according to post-hoc Tukey's test (at $p<0.05$).

Table 5. Multivariate logistic regression analysis on the influence of some explanatory variables on the cluster's membership. The membership in the *High Health Interest* cluster was set as the reference level.*

Explanatory variables	Odds ratio	95% C.I. for odds ratio		Sig.
		Lower	*Upper*	
***Low Health Interest* cluster**				
Importance of product information	0.79	0.63	0.98	0.04
Shopping list	0.77	0.65	0.91	0.00
Health (natural, no additives)	0.30	0.22	0.40	0.00
Organic products	0.39	0.32	0.49	0.00
Convenience	1.46	1.20	1.78	0.00
Other people craving	0.76	0.65	0.96	0.00
Personal craving	1.20	1.03	0.87	0.02
Using foods as a reward	1.38	1.13	1.39	0.02
Males	2.63	1.61	1.68	0,00
18-30 years	3.16	2.40	4.60	0.00
31-45 years	1.94	1.21	3.84	0.01
***Medium Health Interest* cluster**				
Importance of product information	0.79	0.65	0.95	0.01
Shopping list	0.81	0.71	0.93	0.00
Health (natural, no additives)	0.57	0.43	0.74	0.00
Organic products	0.67	0.56	0.80	0.00
Convenience	1.27	1.07	1.51	0.01
Other people Craving	0.92	0.82	1.03	0.17
Personal craving	1.05	0.93	1.18	0.44
Using foods as a reward	1.29	1.10	1.50	0.00
Males	1.97	1.33	2.92	0.00
18-30 years	2.20	1.41	3.41	0.00
31-45 years	1.19	0.78	1.82	0.43

*The reference category for age class is ’46-60 years’; for gender is ‘females’

Table 6. Reported liking (average and standard error) of items for product class by the total sample and of consumers' clusters.

			Mean (Standard Error)				
Product class	***n. Items***	***Total sample*** *(n=1224)*	***Low health interest*** *(28.2%)*	***Medium health interest*** *(5.4%)*	***High health interest*** *(18.4%)*	**F**	***Sig.***
Vegetables and Fruits	34	6.8	6.5^{c} (0.05)	6.8^{b} (0.04)	7.2^{a} (0.07)	36.89	***
Fish	9	6.8	6.7^{b} (0.08)	6.7^{b} (0.06)	7.0^{a} (0.10)	5.71	**
Red meat + preserved processed meat products	13	7.0	7.3^{a} (0.06)	7.0^{b} (0.05)	6.6^{c} (0.08)	22.63	***
Cheese	9	7.1	7.0 (0.07)	7.1 (0.05)	7.1 (0.09)		
Fat (saturated)	3	5.6	5.9^{a} (0.08)	5.6^{b} (0.06)	5.2^{c} (0.10)	18.22	***
Fat (unsaturated)	3	6.6	6.6 (0.07)	6.6 (0.05)	6.4 (0.08)		
Sweets	17	6.8	6.7 (0.05)	6.8 (0.04)	6.8 (0.07)		
Alcoholic beverages	8	6.2	6.3^{a} (0.09)	6.2^{a} (0.06)	5.9^{b} (0.11)	4.86	**
Spirits	4	4.7	4.8 (0.11)	4.8 (0.08)	4.4 (0.13)		

ANOVA test; *** p< 0.001; ** p<0.01.

Different letters within the same row denoted significant differences according to post-hoc Tukey's test (at p<0.05).

Table 7. Percent (%) Familiarity distribution of each food category within the clusters and total sample

	(% frequency)				
	Low health interest	***Medium health interest***	***High health interest***		
	(28.2%)	*(53.4%)*	*(18.4%)*	**K**	***Sig.***
Vegetables + Fruits (34) (χ^2= 6.15 ns; df=4)					
Not consumed [1]	29.8[a]	25.7[b]	20.8[c]	58.12	***
Consumed occasionally	39.0[a]	37.1[a]	31.3[b]	30.18	***
Consumed regularly	31.3[c]	37.2[b]	47.9[a]	78.21	***
Fish (9) (χ^2= 1,12 ns; df=4)					
Not consumed	33.9	33.0	31.1		
Consumed occasionally	51.4	51.5	49.1		
Consumed regularly	14.6[b]	15.5[b]	19.8[a]	13.68	***
Red meat + preserved processed meat products (13) (χ2= 7.73 ns; df=4)					
Not consumed	19.6[b]	21.8[b]	34.0[a]	36.18	***
Consumed occasionally	50.3	52.4	47.3	6.43	
Consumed regularly	30.1[a]	25.8[b]	18.7[c]	27.70	***
Cheese (9) (χ2= 0.67 ns; df=4)					
Not consumed	27.3	23.6	27.9		
Consumed occasionally	46.6	47.6	47.0		
Consumed regularly	26.1	28.7	25.2		
Fat (saturated) (3) (χ2= 5.67 ns; df=4)					
Not consumed	35.4[c]	40.3[b]	47.8[a]	23.33	***
Consumed occasionally	45.3	46.1	42.9		
Consumed regularly	19.3[a]	13.6[b]	9.3[c]	26.34	***
Fat (unsaturated) (3) (χ^2= 2.39; ns df=4)					
Not consumed	21.0[b]	23.9[b]	29.1[a]	14.25	***
Consumed occasionally	30.5[a]	28.8[a]	23.5[b]	8.93	*
Consumed regularly	48.5	47.3	47.4		
Sweets (17) (χ^2= 0.47 ns; df=4)					
Not consumed	35.0	34.1	38.3		
Consumed occasionally	52.3	52.5	48.7		
Consumed regularly	12.6	13.3	12.9		
Alcoholic beverages (8) (χ2= 3.27 ns; df=4)					
Not consumed	34.3[b]	34.7[b]	44.1[a]	16.79	***
Consumed occasionally	52.7	51.6	47.3		
Consumed regularly	13.0[a]	13.7[a]	8.6[b]	11.35	***
Spirits (4) (χ2= 2.88 ns; df=4)					
Not consumed	64.8[b]	64.7[b]	74.2[a]	11.54	**
Consumed occasionally	32.5[a]	32.7[a]	24.4[b]	9.54	**
Consumed regularly	2.7	2.6	1.3		

Kruskal-Wallis test, *** p<0.001; ** p<0.01; * p<0.05

Different letters within the same row denoted significant differences according to Dunn's test (at p<0.05)

[1] Familiarity ranks (1-3 of the IT-Familiarity Questionnaire)

Highlights

- The original three-factor model of the *Taste* scale of the HTAS was not confirmed
- The *Health* scale was effective in differentiating subjects according to their healthy attitudes by clustering
- Attitudes towards health are positively associated with liking and familiarity with healthy diet
- More interest in convenience increased the probability to be less interested in health
- More interest in product information and food quality increased the probability to be more interested in health