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On the association between risk attitude and fruit and vegetable consumption: insights from university students in Italy

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Abstract

As a novel contribution, this paper explores the possible association between individual risk attitudes and consumer fruit and vegetable (FV) intake. Inspired by the literature, the study also investigates the relationship between FV consumption frequency and health consciousness, perceived health benefits, trust, and attitude towards eating the recommended five-a-day FV portions. An ordered logit model is estimated on data collected through direct interviews among university students. The results show that risk aversion has a positive effect on consumer choice to eat the recommended number of FV servings, similar to the individual health consciousness and the perception of health benefits. The results pave the way for new research that aims to provide useful evidence for the implementation of new strategies to foster people's FV intake in compliance with the five-a-day recommendation.

Keywords: Fruit and vegetable intake, Risk attitude, Consumer behaviour, Health benefit, Healthy diet

Introduction

Healthy eating has attracted great public attention in recent years; indeed, it is essential for promoting healthy living and for reducing many pathologies (Shepherd et al. 2006). Among other food products, fruits and vegetables (FV) are an important component of a healthy diet. In fact, adequate intake is widely reported to play a protective role for people's health (Kongsbak et al. 2016; Angelino et al. 2019; de Villier and Faber 2019) (e.g., regarding the prevention of health-related risks of some major lifestyle diseases[1]). As the beneficial effect of FV on health is determined, the World Health Organization (WHO 2003) currently recommends an individual intake of at least 400 g of FV per person per day (or five portions). Moreover, in recent years, several supportive policies and interventions have emerged to promote FV consumption (e.g., "the school fruit, vegetable and milk scheme" that resulted from a European Union (EU) political

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[1]For a more thorough description, see https://ec.europa.eu/jrc/en/health-knowledge-gateway/promotion-prevention/nutrition/fruit-vegetables

commitment in the context of the Common Agricultural Policy). However, so far, the majority of these have achieved modest success, i.e., consumption varies largely among EU countries. Based on statistical data, Bonanno et al. (2017) depict Italy as one of the EU countries where FV eating is more consistent with the WHO guidelines. However, Italians are reported to eat less than the recommended daily intake[2]: in 2017, FV consumption (between two and four a day) was widely below the benchmark of five portions, and approximately 83% of the 3-year-old and over population claimed to consume one portion per day (IMH 2019). Verain et al. (2020) state that the understanding of the factors that influence people to meet the WHO recommended amount of FV represents an open issue.

In this context, although a great deal of research (especially in the medical and nutritional sector) has ascertained that regular FV intake benefits individual health, little research has specifically investigated the association between consuming the recommended FV amount per day and the relative health dimension perceived in terms of lowering the risk of developing some pathologies for the individual. Against this background, the purpose of this study is to advance this understanding. Moreover, for the first time, this paper investigates whether and how consumers' risk attitudes influence regular FV daily consumption as a novel contribution. In addition, this study attempts to understand the degree to which several other factors influence a high FV daily consumption frequency. The choice of these factors is rooted in the current literature on FV intake (see, for instance, Howard Wilsher et al. 2019) and particularly regarding the perception of health benefits (i.e., health risk reduction associated with the recommended FV daily intake), the individual health consciousness, people's trust in the information conveyed by many sources on health benefits, and finally, the attitude towards eating the recommended FV portions. More precisely, from risk theory, we borrowed the concept of risk attitude and, in order to better explore health as a motivator of FV eating, also the risk to health, this latter was analysed in terms of benefits to the general health from FV eating (namely, reduction of health risks).

Findings from our sample show that more risk-averse subjects tend to consume the recommended daily amount of FV and similarly those who link health outcomes to the recommended FV daily intake and who are more health conscious. The results could be an inspiration for researchers to develop new FV consumer segmentations (i.e., based on the individual risk attitude). Accordingly, this may have important policy and marketing implications (e.g., in designing and implementing more tailored strategies to foster FV consumption in compliance with the five-a-day recommendation).

Background

Much research suggests that modern consumers are very sensitive to health issues when choosing their own diet (Padel and Foster 2005; Yiridoe et al. 2005; Shafie and Rennie 2012; Raaijmakers et al. 2018). Nevertheless, health as a general motivator can have several interpretations[3] (Howard Wilsher et al. 2019). A growing body of research

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[2]Interestingly, in 2017, the Italians' market expenditure in fruits and vegetables recorded an increase (+ 4% for both) compared with 2016 (ISMEA 2018).
[3]See for instance the paper by Geeroms et al. (2008) that investigated six different health-related motive dimensions: energy, emotional or physical wellbeing, social responsibility, self-management, and outward appearance.

has been carried out to investigate the influential factors related to FV consumption: these range from social to economic, personal (e.g., attitude), cultural, and environmental factors. It is well documented that health concerns and the perceived benefits from healthy eating are key determinants of high FV intake (Appleton et al. 2016) among young adults (Larson et al. 2008). Interestingly, a study by Krebs-Smith et al. (1995) showed that young Americans aged 18–24 years were less likely to think that five FV portions per day were necessary for good health. In contrast, some authors (Wardle et al. 2000; Hartman et al. 2013) have shown the existence of a strong association between individuals' perceived health benefits from FV consumption and their fruit and vegetable intake. Nevertheless, to our knowledge, the interplay of high FV consumption (i.e., consuming the recommended FV amount per day) with the individual perception of health benefits that derive from this (i.e., specifically intended as the prevention of some diseases or health risk reduction) is poorly understood, thus deserving additional investigations as in this study (that is, if the perception of health benefits has a positive impact on FV consumption, then diet-related health education efforts should stress the need to eat five FV servings per day).

In addition, the link between risk attitude and FV consumption frequency has not been addressed before; hence, it mainly inspired this study. Risk attitude represents the extent to which individuals are willing to take on risk and is integral to decision-making (Siegrist et al. 2000) regarding eating choices. Consequently, analysing decisions under uncertainty is increasingly important in food economic research. To the best of our knowledge, the only other studies aiming to provide insights into the correlation between risk attitude and food consumption are Lusk and Coble (2005) and Giampietri et al. (2020). A negative correlation between risk aversion and the consumption of genetically modified (GM) food was found in the former, whereas a positive correlation between organic food consumption and risk aversion emerges in the latter. Moreover, it is worth noting that both GM food and organic food categories are clearly linked to health benefits or health risk perception, similar to fruit and vegetables. In light of this and in the absence of empirical evidence, we suspect that risk aversion may also influence individual decision-making with regard to FV intake. Put differently, we can assume that the individual degree of risk aversion may be potentially (positively) associated with consumer preference for WHO-recommended FV consumption. Moreover, this study is one of the first to include an experimental method to elicit risk attitudes in conjunction with data on FV consumption frequency, hence contributing to the ongoing debate on consumers' fruit and vegetable intake. Based on the above, we posit the following two principal hypotheses[4]:

H_1: The perception of health benefits (i.e., prevention of some diseases or health risk reduction) from a high FV intake is significantly associated with eating the recommended five-a-day FV portions.

H_2: Risk attitude is significantly associated with eating the recommended five-a-day FV portions.

In addition to risk attitude and perceived health benefits (which represent the most innovative contribution of the study), we considered some other factors within our

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[4]For brevity, we report only the hypotheses related to the two factors representing a novel contribution to the literature on FV intake.

proposed conceptual framework: particularly, the choice of these was built on the existing literature on FV consumption. For instance, academic research shows that having a favourable attitude towards meeting the WHO-recommended amount of FV per day represents an important predictor of this eating habit. Indeed, this is well documented by a large number of studies using the theory of planned behaviour (Ajzen 1991) to study adherence to five FV servings per day both in youth and in adults (Blanchard et al. 2009; Guillaumie et al. 2010). The influential effect of attitude on FV intake was also found by Hartman et al. (2013) on university students from New Zealand. In this paper, we explicitly analyse the attitude towards eating the five recommended FV servings per day.

Recently, another factor has been found to play a decisive role in predicting FV eating choice, namely, health consciousness. In a recent study of Italian university students, Carfora et al. (2016) found that the individual perception of being a healthy eater (i.e., health consciousness) positively affects both the individual intention to eat five FV servings per day and actual future behaviour (namely, the more salient the identity, the higher the intention to eat FV more frequently and the behaviour). We believe that it is interesting to test the effect of health consciousness on FV intake together with another, apparently similar, factor, namely, the perceived health benefits. It should be noted that while the first (health consciousness) represents the individual subjective predisposition towards health, the second (perceived health benefit from FV consumption) can be affected by other factors, such as knowledge and information Furthermore, another relevant factor to consider when studying FV intake is consumer trust. Trust refers to the credibility of health promotion messages conveyed by reputable sources (e.g., press, television, radio, medical practitioners, and consumer groups) and represents a structural factor in decision-making (Siegrist et al. 2000). Indeed, people can reject or accept the information that, if credible, can motivate their eating choice in terms of being in compliance with the five-a-day norm. Following Taylor et al. (2012), people eating less than the recommended amount of FV servings per day are less likely to trust press, radio, and television. In contrast, Coulson (2002) showed that adolescents are more likely to trust information about healthy eating received from their family instead of the media. It follows that the investigation of consumer trust in experts' advice can be of interest to refine the promotion communication about FV consumption.

Moreover, a great piece of literature ascertained the relationship between FV consumption frequency and several features of the individual (e.g., lifestyle characteristics such as smoking) (Birkett 1999; Adams and Colner 2008; Bonanno et al. 2017) or organic consumption habits (Pelletier et al. 2013; Denver et al. 2019). Finally, the literature is replete with studies reporting associations between consumers' demographic characteristics and FV consumption. Hence, we also included these variables to control for their effect on our sample. Figure 1 shows the conceptual framework of our study.

Methods

The analysis was performed by collecting data through a survey of 311 students from the University of Padova during November 2019. They were randomly selected outside of several canteens in the university district of the city and were directly interviewed by administering a structured questionnaire previously tested on a sample of 15 students.

Fig. 1 Conceptual framework
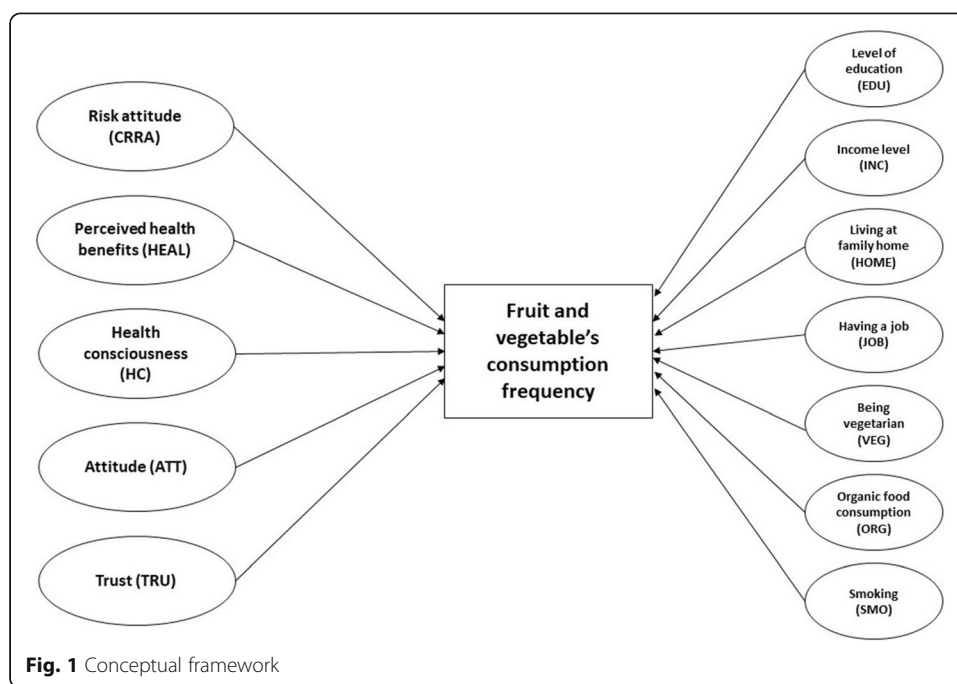
A total of 284 fully completed questionnaires were collected. The questionnaire was divided into four sections. First, the self-reported daily frequency of FV consumption was asked (c_FV), whereby the respondents were given some examples of an FV portion as a whole fruit, a plate of salad, a portion of cooked or fresh vegetable, a cup of fruit salad or a glass of fruit juice. In the second section, the interviewees were asked to rate their agreement with several statements on a 7-point Likert scale (1 = totally disagree; 7 = totally agree). Among these, three items measured the perception of health benefits (i.e., prevention of some diseases or health risk reduction) deriving from consuming at least five FV portions per day (HEAL); three items measured the subjective general trust towards the information about health benefits that derive from consuming the recommended daily FV intake (TRU); three items measured the health consciousness (HC), which refers to the consumers' readiness to identify themselves with health actions and to undertake these (Hansen et al. 2018); and finally, three items measured the individual attitude towards eating five FV portions per day (ATT). Except for risk attitude, it is worth noting that this research builds on the literature with respect to the factors that we considered as independent variables: in particular, the works of Lusk and Coble (2005) and Mazzocchi et al. (2008) inspired the selection of the items for HEAL and TRU, respectively, while the items for HC and ATT were derived from Squires et al. (2001) and Carfora et al. (2016) with adjustments, respectively. The final scales were derived by averaging the three items into a composite score. The third section of the questionnaire measured the individual risk attitude by means of a lottery. Finally, the last section investigated whether the individual is a smoker (SMO), if he follows a vegetarian diet (VEG), if he lives at the family home (HOME), and if he has a job while studying (also part-time) (JOB) through dummy variables (1 if the subject meets the criteria and 0 otherwise). Moreover, we asked for the individual weekly organic food consumption frequency (ORG) as a three-level categorical variable and some

other major sociodemographic information, such as age, sex, education (EDU), and income level (INC).

Focusing on the lottery, we used this tool analogously to Lusk and Coble (2005) and Lawless et al. (2015), as it is considered highly successful in predicting health-related risk behaviours. For this purpose, respondents' risk attitudes (hereafter referred to as CRRA) were measured following the elicitation method outlined by Eckel and Grossman (2008). This is a gamble task, in which the individual choice represents the risk attitude, and it represents an intuitive and accurate elicitation method compared with other lottery tasks (Dave et al. 2010). More specifically, among six different gambles (see Table 1), respondents were asked to select the one they wished to play: each gamble had two possible outcomes (low roll or high roll), and each roll had a 50% chance of occurring. With the exception of gamble 1, the payoff for each roll was different (low payoff and high payoff). In particular, each respondent was asked to imagine that the payoff (i.e., 50 €) represented the average amount in euros that he, as a university student, usually receives from the family as a weekly budget to spend; this context setting was used to reduce any possible errors in decision making. A more risk-averse respondent is expected to choose the first gambles (for more details, see Charness et al. 2013). Risk attitude was estimated through the Arrow-Pratt Coefficient of Relative Risk Aversion (CRRA): assuming the utility function $U(x) = x^{(1-r)}/(1-r)$, with r being the risk attitude coefficient and x the wealth, the lottery task provided a range of r for each gamble, and we used the lower bound for the analysis (see Menapace et al. 2012).

As the dependent variable (namely, the daily FV consumption frequency) is a discrete and ordinal ranking (0, 1, 2, 3), an ordered logit model was estimated to assess how the frequency of consumption is influenced by several factors. In particular, the consumption frequency is set as a four-level variable: 3 = high frequency (five times per day), 2 = medium frequency (three-four times per day), 1 = low frequency (one to two times per day), and 0 = no consumption. In particular, we tried to study how changes in the considered independent variables (x) translate into a particular ordinal value of the dependent variable (y). Behind the ordered logit model, there is the idea of a latent construct (y_i^*) underlying the ordered responses of individual *i* observed by the researcher:

$$y_i^* = \beta X_i + \varepsilon_i \tag{1}$$

where βX_i represents the linear combination of the parameter vector β and the vector of independent variables X_i, and ε_i represents the error term. Hence, the researcher can only observe the ordered responses through the cut points that represent the thresholds that discriminate the ordinal categories of the dependent variable, namely, the level of preference of individual *i*, which are estimated along with β via maximum likelihood estimation. Hence, the observed variable y is linked to the latent variable y* in the following way:

$$
\begin{aligned}
y &= 0 \text{ if } y_i* \leq \text{cut1} \\
y &= 1 \text{ if cut1} < y_i* \leq \text{cut2} \\
y &= 2 \text{ if cut2} < y_i* \leq \text{cut3} \\
y &= 3 \text{ if cut3} < y_i*
\end{aligned}
\tag{2}
$$

It follows that the probability of a specific outcome (y = 0, 1, 2, or 3) depends on the probability that y* falls within the range defined by the estimated cut points or

intercepts (i.e., cut1, cut2, or cut3), with F representing the cumulative density function of ε_i. Hence, the probability of having j as an outcome is:

$$
\begin{aligned}
\text{Prob}\left(y_i = j\right) &= \text{Prob}\left(cut_{j-1} < y_i* \leq cut_j\right) = \text{Prob}\left(cut_{j-1} < \beta X_i + \varepsilon_i \leq cut_j\right) \\
&= \text{Prob}\left(cut_{j-1} - \beta X_i < \varepsilon_i \leq cut_j - \beta X_i\right) = F\left(cut_j - \beta X_i\right) - F\left(cut_{j-1} - \beta X_i\right).
\end{aligned} \tag{3}
$$

As the ordered logit model adopts the proportional odds assumption (or parallel regression assumption), which is a constant effect (i.e., same slope) of the covariates across the response categories, we tested this hypothesis through a likelihood-ratio test (LR): its lack of significance provides evidence that the ordered logit model does not violate the proportional odds assumption (LR test) and thus is appropriate. Finally, the marginal effects were computed.

Results

As shown in Table 2, on average, the study consisted of 21-year-old subjects, the majority of which had not graduated (68%) and were women (78%). Respondents mainly declare a net family income of 2500 € per month (50%). Only a minority of respondents (36%) declare that they work (including part-time work) in addition to studying, whereas the majority (72%) still live at home with parents. A total of 19% state that they are smokers, and 62% state that they eat organic food at least once a week, whereas vegetarians represent only a small proportion (7%). Finally, the majority of the sample (47%) consumes one to two portions of FV every day, followed by three to four portions (43%) and five servings (7%), while a minority (3%) reports null consumption on a weekly basis. This evidence is in agreement with recent statistics from IMH (2019) that relate to Italian consumers, showing that the majority consume one FV portion per day (20%) and between two to four FV portions per day (75%), whereas only a minority (5%) consume at least 5 daily portions. Furthermore, our finding is in line with a recent

Table 1 Gamble task

Imagine having € 50 (your weekly budget as a university student) to play heads or tails. The game provides that, among the 6 different possibilities offered (from A to F), you can make one and only one choice. Each choice has two possible outcomes (a low payoff and a high payoff) with the same probability (50% both). For example: if you chose to bet your € 50 on gamble A, you would always win € 50 (i.e. you would lose nothing); if you chose gamble B, instead, you would have a 50% chance of winning € 40 (thus losing € 10 of your weekly budget) and a 50% chance of winning € 70. Please, indicate which gamble (from A to F) you prefer to play.

Gamble	Roll	Payoff	Chance
A	low	50 €	50%
	high	50 €	50%
B	low	40 €	50%
	high	70 €	50%
C	low	30 €	50%
	high	90 €	50%
D	low	20 €	50%
	high	110 €	50%
E	low	10 €	50%
	high	130 €	50%
F	low	0 €	50%
	high	150 €	50%

review of the academic literature of the last 10 years by Mello Rodrigues et al. (2019), which confirms that the majority of college students do not meet the WHO recommendations.

With regard to the Likert scales, Table 3 shows that the average scores are always above the mean value, indicating high HC, HEAL, TRU, and ATT. In particular, respondents claim to consider themselves to be health concerned; they can reduce health risks by consuming the recommended five FV portions per day; they trust the information conveyed by many sources on the health beneficial effect of FV; and they have a positive attitude towards consuming five FV servings. The four composite scores show satisfactory reliability through Cronbach's α measure: HC (0.857), HEAL (0.822), TRU (0.793), and ATT (0.935).

Regarding the lottery, risk attitude was measured assuming the subjects' constant relative risk aversion (CRRA). As shown in Table 4, the sample is mainly composed of risk-averse subjects; in particular, 33% are the more risk-averse individuals, namely, those who firmly avoid loss. Table 5 shows the correlations between the investigated variables.

Table 6 shows the estimation using Stata 13, and the pseudo-R^2 is 17%. The results indicate that the coefficients related to HC, HOME, and VEG are statistically significant

Table 2 Sample descriptive statistics (N = 284)

Variable	Code	Description	Obs	Percentage	Mean	SD
Age (min = 18; max = 26)		Number of years			21.4	1.9
Gender		(0) Male	63	22.2		
		(1) Female	221	77.8		
Education level	EDU	(0) No bachelor degree	192	67.6		
		[1] Bachelor degree	92	32.4		
Family income	INC	(1) Less than 2500 (€/month)	59	20.8		
		(2) 2500 (€/month)	141	49.6		
		(3) More than 2500 (€/month)	84	29.6		
Having a part-time job (also part-time) besides studying	JOB	(0) No	183	64.4		
		(1) Yes	101	35.6		
Still living at home with parents	HOME	(0) No	79	27.8		
		(1) Yes	205	72.2		
Being a smoker	SMO	(0) No	229	80.6		
		(1) Yes	55	19.4		
Being a vegetarian	VEG	(0) No	265	93.3		
		(1) Yes	19	6.7		
Weekly organic food consumption frequency	ORG	(0) Never	84	29.6		
		(1) 1 or more times	176	62.0		
		(2) Every day	24	8.4		
Number of FV portions eaten per day	c_FV	(0) 0	7	2.5		
		(1) 1 or 2	134	47.2		
		(2) 3 or 4	123	43.3		
		(3) 5	20	7.0		

Note: Obs number of observations, *SD* standard deviation

at 1%, whereas risk attitude (CRRA) and HEAL are statistically significant at 10%. It follows that respondents who are more risk averse tend to consume 5 portions of FV per day, as those who are more health conscious and those who link health outcomes to the recommended FV consumption, as expected. Moreover, the individuals who still live at home with their parents and those who follow a vegetarian diet are more likely to eat five servings per day. Interestingly, our findings show that risk attitude is a driver of recommended FV consumption, representing the novelty of this research. Finally, the findings show no significant evidence for trust, attitude, education, income, organic consumption frequency, and having a job.

With regard to the marginal effect of the significant independent variables in the estimated model, Table 7 shows that more risk-averse subjects are 8% more likely to eat three to four FV portions per day and 9% less likely to eat one to two servings. Regarding the more health-conscious individuals, they are 3% more likely to eat the recommended daily FV intake and, interestingly, 19% more likely to consume three to four portions. Moreover, those who link health benefits to FV consumption are 1.4% more likely to be in compliance with the five-a-day norm, although they are 8% more likely to consume three to four FV portions per day. In addition, respondents who still live at the family home are 3% and 20% more likely to eat five and three to four FV portions,

Table 3 Description of factors measured through Likert scales: health consciousness, perceived health benefits, and trust

Variables	Mean	SD	Cronbach's alpha
Health consciousness (HC)	5.22[a]	1.10	0.857
I think of myself as a health-conscious consumer.	5.06	1.33	
I use to eat healthy food.	5.55	1.19	
Compared to others my age, I am in better health.	5.06	1.23	
Perceived health benefits (HEAL)	5.54[a]	0.97	0.822
It is possible to reduce health risks by consuming at least five FV portions/day.	5.41	1.24	
I think that the consumption of at least five FV portions/day represents a healthy behaviour.	5.83	1.00	
By eating at least five FV portions/day, I can be less exposed to the risk of new diseases.	5.38	1.13	
Trust (TRU)	5.56[a]	0.97	0.793
I trust when the media (TV, internet, newspapers and magazines, radio, etc.) claim that consuming at least five FV's portion/day reduces risks to human health.	5.03	1.44	
I trust when the authorities responsible for public health (doctors, National Ministry of Health, WHO, consumer health organizations, etc.) argue that consuming at least five FV's portion/day reduces risks to human health.	5.85	1.00	
I trust when the results of the research (universities, foundations, etc.) demonstrate that the consumption of at least five FV's portion/day reduces risks to human health.	5.80	1.02	
Attitude toward eating five portions of fruit and vegetable per day (ATT)	5.99[a]	0.97	0.935
The consumption of at least five FV's portion/day is bad/good to me.	6.03	0.07	
The consumption of at least five FV's portion/day is negative/positive to me.	6.16	1.00	
The consumption of at least five FV's portion/day is unfavourable/favourable to me.	6.02	1.04	

Note: Examples of diseases are obesity, diabetes, etc. *SD* standard deviation, *FV* fruit and vegetable. [a]This mean represents a mean of items

Table 4 Lottery: CRRA ranges and relative percentage of respondents

Gamble	Low payoff (50%)	High payoff (50%)	Expected payoff	Risk[a]	CRRA ranges	Respondents (%)
A	50 €	50 €	50 €	0	r > 1.7	33.1
B	40 €	70 €	55 €	15	0.8 < r < 1.7	31.0
C	30 €	90 €	60 €	30	0.5 < r < 0.8	21.5
D	20 €	110 €	65 €	45	0.4 < r < 0.5	5.6
E	10 €	130 €	70 €	60	0.3 < r < 0.4	1.1
F	0 €	150 €	75 €	75	0.2 < r < 0.3	7.8

Note: [a]The risk is calculated as the standard deviation of the expected payoff

respectively. Furthermore, those who follow a vegetarian diet are 8% more likely to consume the recommended amount per day and 21% more likely to eat three to four servings. Finally, the predicted probabilities of being in classes 0, 1, 2, and 3 are 3%, 47%, 43%, and 7%, respectively.

Discussion

The results show that respondents who are generally more prone to avoid risk (health risk included) tend to meet the WHO recommendation. No previous studies assessing this relationship were found in the context of FV consumption. However, Giampietri et al. (2020) found a similar result in relation to organic food consumption among university students. Consistent with this, we found that those who perceive that they can reduce health risks as diseases by eating the recommended amount of FV show frequent FV consumption on a daily basis. This is consistent with earlier research that identified health benefits from healthy eating as important motivators; see, for instance, Larson et al. (2008), who investigated young adults (i.e., 18–23 years old). Furthermore, we found that individuals who are more health conscious are more likely to eat five-a-day FV portions, which is consistent with what was found by Howard Wilsher et al. (2019) in young adults. In particular, Carfora et al. (2016) and many other authors that they cited stated that it is plausible to assume that the recommended consumption is

Table 5 Pearson correlations between variables

Var.	1	2	3	4	5	6	7	8	9	10	11	12	13
1 (c_FV)	1												
2 (TRU)	.193[**]	1											
3 (HEAL)	.245[**]	.750[**]	1										
4 (HC)	.451[**]	.213[**]	.221[**]	1									
5 (ATT)	.176[**]	.625[**]	.558[**]	.160[**]	1								
6 (CRRA)	.059	.018	− .025	− .004	.037	1							
7 (EDU)	.074	.055	.027	.098	.103	− .047	1						
8 (INC)	.062	.037	.015	.063	− .009	− .109	.031	1					
9 (HOME)	.076	− .122[*]	− .042	− .144[*]	− .147[*]	− .055	− .141[*]	.078	1				
10 (JOB)	.128[*]	.069	.058	.132[*]	.121[*]	− .060	.177[**]	− .062	.116[*]	1			
11 (VEG)	.182[**]	.030	.036	.126[*]	.092	− .055	.025	− .074	− .117[*]	.037	1		
12 (ORG)	.202[**]	.074	.076	.266[**]	.103	− .067	.084	.106	− .064	.055	.171[**]	1	
13 (SMO)	− .097	− .074	− .043	− .117[*]	− .059	− .092	− .035	.078	− .054	.083	− .024	.056	1

Note: * $p < 0.1$; ** $p < 0.05$.

Table 6 Ordered logit estimation

Dependent variable: fruit and vegetable's consumption frequency (c_FV)	β	Standard error	p
Constant relative risk aversion (CRRA)	0.392	0.234	*
Health consciousness (HC)	0.880	0.140	***
Perceived health benefits (HEAL)	0.378	0.199	*
Trust (TRU)	− 0.097	0.211	
Attitude toward eating five portions of fruit and vegetable per day (ATT)	0.108	0.184	
Level of education (EDU)	0.138	0.272	
Income level (INC)	0.105	0.181	
Living at family home (HOME)	0.940	0.302	***
Having a job (JOB)	0.243	0.270	
Being a vegetarian (VEG)	1.266	0.483	***
Organic food consumption frequency (ORG)	0.358	0.228	
Being a smoker (SMO)	− 0.176	0.324	
/cut1	4.051	1.233	
/cut2	8.546	1.290	
/cut3	11.779	1.394	
Number of observations	284		
Log-likelihood	− 234.50125		
LR χ²	96.12		
Prob > χ²	0.0000		
Pseudo R²	0.170		

Note: *LR* likelihood-ratio. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

driven, among others, by the personal desire to confirm the own perception of being a healthy eater (health consciousness). Hence, it is reasonable to assume that to achieve a more effective promotion of FV intake, more attention should be given to implementing more holistic dietary campaigns that educate not only about the nutritional properties but also about the prevention of health risks associated with FV intake more explicitly. Indeed, this may represent an appealing approach that may increasingly stimulate consumers to meet the recommended consumption amount per day to avoid risks to their general health, especially the more risk-averse individuals. Additionally, health promoters should consider that different levels of both perceived health benefits and risk attitudes correspond to different levels of FV daily intake.

In terms of the role of the individual characteristics, we found that residing at a parental home facilitates high FV consumption, in contrast to living independently. This is consistent with the study by Sharma et al. (2009) in young adults in Germany and the cross-sectional study by El Ansari et al. (2012) among European university students, while other authors found mixed results from a sample of university students (van den Bogerd et al. 2019). In a study of young adults from the UK, Howard Wilsher et al. (2019) state that living at the family home can facilitate FV consumption, as subjects can find already cooked FV. Furthermore, Higgs and Thomas (2016) asserted that eating choices tend to converge with those taken from the individual's social connections, such as the family. Likewise, in a recent study of adolescents in the USA, Lenne et al. (2019) showed that health concerns of the family are in turn associated with healthy behaviours in adolescents, including FV consumption habits. In contrast, Alsunni and

Badar (2015) found that students at a Saudi university living with their families follow fewer WHO recommendations for FV consumption. In line with Pearson et al. (2009), from a marketing and policy point of view, our finding suggests that targeting the family environment could be instrumental in promoting FV consumption among university students, at least for those who live at home.

Interestingly, our findings show a significant and positive effect of being vegetarian, as expected. Indeed, the effect of this personal ideology confirms what has already been shown by the literature (see, for instance, Pollard et al. 2002), although this association cannot be retrieved among young adults as university students, so far as we know. For this purpose, Dinu et al. (2017) stated that vegetarians tend to be more health conscious.

Conversely, we found no significant effect regarding the organic consumption habit, as opposite to the findings in literature (e.g., Pelletier et al. 2013; Denver et al. 2019), showing that organic consumers are more likely to eat FV frequently. Accordingly, no significant influence emerges concerning the variables income and education, which are often found to be two strong determinants (Hall et al. 2009; Rehm et al. 2016; Poscia et al. 2017). Additionally, in contrast to some authors who found a negative correlation between smoking and the likelihood of eating five FV portions per day[5] (see Bonanno et al. 2017), even among university students (Adams and Colner 2008), this study found no significant effect.

However, as the scarce attention to risk attitude and perceived health benefits (considered as reduction in diseases) mainly inspired this study, the most intriguing results are represented by the significant and positive effect of these two variables. Despite its exploratory nature, this paper actually makes inroads in this gap, as it shows a positive association between risk attitudes and consumers' FV intake for the first time. As a consequence, our finding can be of inspiration to develop new research: indeed, we can suppose that, by segmenting consumers according to their risk attitude, further studies could reveal new useful information for policy makers and health promoters in order to design and implement more tailored strategies and interventions to foster FV consumption in compliance with the five-a-day recommendation:, e.g., new nutritional labelling policies and more tailored public information campaigns stressing FV benefits in terms of health risk reduction. Accordingly, a great effort has been made by legislators to incentivize healthy food choices in recent years; see, for instance, the promotion of health claims in the European Union (Reg. EU No 432/2012[6]). Consequently, the evidence showing that risk aversion and the perceived reduction of risks to health from FV consumption motivate consumption of the WHO-recommended amount among people can be inspiring to deliver more tailored policy interventions or FV health advertisements and to develop new research avenues in this field.

Nevertheless, one main limitation that pertains to the use of a nonrepresentative sample should be mentioned. Indeed, this limits the generalizability of the results at this research stage, but we highlight that the overarching objective of this explorative paper

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[5]Accordingly, the literature suggests that smokers are generally more inclined to have a lifestyle linked to risk and uncertainty (i.e., less risk averse) than non-smokers (Coletta et al. 2018; Riddel and Hales 2018).
[6]Commission Regulation (EU) No 432/2012 of 16 May 2012 establishing a list of permitted health claims made on foods, other than those referring to the reduction of disease risk and to children's development and health.

Table 7 Marginal effects from the estimated ordered logit

Variable	Dependent variable's levels							
	c_FV = 0	p	c_FV = 1	p	c_FV = 2	p	c_FV = 3	p
CRRA	− 0.004 (0.003)		− 0.094 (0.056)	*	0.084 (0.050)	*	0.014 (0.009)	
HC	− 0.010 (0.004)	**	− 0.210 (0.035)	***	0.188 (0.033)	***	0.032 (0.008)	***
HEAL	− 0.004 (0.003)		− 0.090 (0.048)	*	0.081 (0.043)	*	0.014 (0.008)	*
HOME	− 0.013 (0.007)	*	− 0.215 (0.065)	***	0.199 (0.063)	***	0.029 (0.010)	***
VEG	− 0.009 (0.004)	**	− 0.278 (0.088)	***	0.208 (0.051)	***	0.079 (0.047)	*
Predicted probability	2.46		47.43		43.14		6.97	

Note: Standard errors in parentheses. *c_FV*, fruit and vegetable's consumption frequency (0 = never; 1 = low frequency; 2 = medium frequency; 3 = high frequency, as recommended); *CRRA* risk attitude, *HC* health consciousness, *HEAL* perceived health benefits, *TRU* trust, *ATT* attitude toward eating five portions of fruit and vegetable per day, *EDU* level of education, *INC* income level, *HOME* living at family home, *JOB* having a job, *VEG* being vegetarian, *ORG* organic food consumption frequency, *SMO* being a smoker. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

is not to provide practical implications but to provide a foundation for future research (i.e., regarding the potential FV consumer profiling based on risk attitude). It is worth specifying that our convenience sample derives from a purposive choice as, consistent with Dosman et al. (2001) and Alimi and Workneh (2016) who stated that a higher education is directly linked to a greater perception of risks, we can suppose that our interviewees were fully aware of the research topic and able to elicit their risk attitude easily, as it was indeed. However, the use of a sample of university students is widespread in the literature that investigates the impact of FV consumption on health as well as consumer preference for FV (see, for instance, Deliens et al. 2018 and van den Bogerd et al. 2019). Accordingly, these subjects are in control of their (healthy) food choices (for instance, at lunch at the university canteen, where the survey took place) while living in a period important for the development of their proper attitudes (as towards healthy eating) and healthy dietary habits that are likely to last a lifetime (Coulson 2002). To conclude, although it is desirable to include evidence from a variety of risky behaviours in addition to smoking habits, at this research stage, we preferred to focus more on the measure of risk attitudes instead of adding too many variables to the questionnaire; notwithstanding, it is our intention to investigate this further.

Conclusion

In the context of promoting the consumption of fruits and vegetables, the current study pioneers the investigation of the association between risk attitude and FV intake and similarly between individuals' perceived health benefits and FV consumption. Interestingly, the results from our sample show that risk aversion positively influences a high FV consumption frequency. Further research may extend the analysis to a more representative sample and may also use an incentivized lottery to provide inferential content. Indeed, our statistical calculations are descriptive only, and this is justified by the explorative nature of the research (see Hirschauer et al. 2019); for this reason, we cannot derive any policy implications from our results because, as in most of the extant literature, we do not investigate the antecedents of risk attitudes. In addition, it may be interesting to cluster consumers with different risk attitudes in future studies and to test

the indirect effects among variables, and much could also be learned by monitoring risk attitudes over time. Moreover, our results suggest the importance of strengthening individuals' perception of health benefits from high FV consumption (i.e., nutrition knowledge) to contribute to improving people's dietary quality. To conclude, due to the low R^2, we expect that other factors can be relevant determinants of FV intake: in line with this, future research could combine ambiguity and time preference to analyse the role of risk attitude.

Abbreviations
FV: Fruit and vegetable; WHO: World Health Organization; EU: European Union; c_FV: Fruit and vegetable's consumption frequency; CRRA: Constant relative risk aversion; HC: Health consciousness; HEAL: Perceived health benefits; TRU: Trust; ATT: Attitude toward eating five portions of fruit and vegetable per day; EDU: Education; INC: Income; HOME: Living at family home; JOB: Having a job; VEG: Being vegetarian; ORG: Organic food consumption frequency; SMO: Smoker; LR: Likelihood-ratio test; USA: United States of America; UK: United Kingdom

Authors' contributions
EG and ST conceived the research idea and designed the questionnaire for the survey and the work; GB conducted the survey and analysed the literature; EG and ST analysed and interpreted data; EG drafted and reviewed the paper. ST supervised the execution of the study. The authors read and approved the final manuscript.

Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare no competing interests.

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