

Article

Readiness to Change and the Intention to Consume Novel Foods: Evidence from Linear Discriminant Analysis

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Abstract: The challenges associated with climate change have led to the need for pro-environmental behaviors, including the consumption of sustainable novel foods. Despite the importance of sustainable food for the environment, there is still a need to further investigate the psychological determinants of consumer behavior change putatively able to promote the use of novel foods. In line with this, the aim of the present study was to investigate the role of readiness to change (RTC) in shaping the intention to consume sustainable foods (e.g., chia seeds and edible insects). RTC refers to a valuable construct composed of seven different dimensions, namely perceived importance of the problem/change, motivation, self-efficacy, effectiveness of proposed solution, social support, action and involvement, and perceived readiness. In keeping with this, a cross-sectional study was conducted by collecting from 1252 participants through an online and anonymous survey. In line with the aim above, a linear discriminant analysis was performed to explore potential non-linear relationships between RTC and novel food consumption. The results highlighted certain RTC dimensions (e.g., perceived importance of the problem, action, and self-efficacy) able to positively support the intention to consume novel foods (e.g., chia seeds and spirulina algae). In conclusion, the study pointed out evidence regarding psychological determinants in terms of RTC able to improve sustainable behaviors, namely the use of novel foods. In the context of sustainability, the present study represents a groundwork for the implementation of future studies in this field of research as well as the development of future policies aimed at promoting awareness and encouraging the adoption of sustainable eating behaviors.

Keywords: novel foods; readiness to change; sustainable behaviors



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1. Introduction

In recent decades, climate change has been one of the pressing challenges for humanity by affecting both planet (e.g., reduced biodiversity) and human (e.g., mental and physical well-being) health [1–4]. The latest COP28 (XXVIII United Nations Climate Change Conference) reports highlighted that the global average temperature is at risk of surpassing the thresholds outlined in Paris Agreements, which would increase extreme climate events and threaten both ecosystems and human societies [5]. A strong body of evidence in the literature proved that this phenomenon is primarily driven by greenhouse gases produced by human activity [6,7]. Food has been identified as one of the consumption categories with the greatest environmental impact, accounting for 20 to 30% of the various environmental impacts of private consumption, with this share rising to over 50% for eutrophication [8]. Its environmental footprint originates at every stage of the supply chain: from farming and

manufacturing to processing, packaging, storage, transportation, consumption, and disposal [9]. Intensive livestock farming is a major contributor to food-related environmental pollution, driven by factors such as methane emissions produced by cattle during digestion and the high water consumption required for meat production, with estimates suggesting that producing one kilogram of beef consumes up to 15,000 L of water [10,11]. Another example of food-related environmental pollution is the consumption of out-of-season food, particularly when transported over long distances via refrigerated shipping. This process generates a significant amount of carbon emissions due to the energy required for refrigeration and long-haul transportation [12]. Given this significant environmental impact of food production, current food systems resulted in an unsustainable carbon footprint.

Within this framework, several food policies have been developed to foster a sustainable food system [13,14], including the Farm to Fork (F2F) strategy [15–17], a key component of the European Green Deal (EGD) (2019), that was designed to propel Europe towards becoming the first emissions-neutral continent by 2050 [15–17]. The F2F strategy implements specific actions, from ensuring sustainable food production to promoting healthy diets and waste reduction [15,16,18,19] involving both consumers and food producers and by assuming the crucial link between human health and environmental health [19], namely the One Health perspective [19,20]. The One Health approach involves implementing sustainable agriculture strategies to improve the health of people, animals, and the environment [20,21]. In this context, sustainable food production assumes a crucial role, not only in mitigating climate change impacts and respecting biodiversity, but also in producing healthy and nutritious food [15,22–24]. In line with this, the development of sustainable foods includes, for example, the creation of alternative protein sources, the promotion of local foods, and increasing the shelf life of food [25,26]. In this context, novel foods and clean meat are also included [27,28]. Novel foods refer to food products included within one of the categories found in Regulation (EU) 2015/2283 and not widely used in Europe before 1997 [28,29], such as chia seeds, spirulina algae, baobab pulp, cricket flour, and edible insects [30–34]. On the other hand, clean meat refers to meat developed in vitro from animal stem cells with low environmental impact [27]. However, to implement a sustainable food system and support new strategies, a behavioral change is needed, particularly those of consumers [19]. Accordingly, knowing consumer behaviors and the cognitive constructs behind them is essential to promoting sustainable food consumption [35]. For this reason, several scholars have adopted different psychological models (e.g., Social Cognitive Theory, Theory of Planned Behavior, and Theory of Reasoned Action) to investigate predictors of behavioral intentions associated with sustainability dimensions in this context [35].

In general, the main dimensions able to influence dietary habits are associated with biological (e.g., taste and genetics), personal (e.g., beliefs and attitudes), social (e.g., cultural context), environmental (e.g., food availability), and experiential (e.g., associative conditioning) factors [35–37]. In addition, other factors related to familiarity, disgust, and neophobia for food and novel food technology [36] can be obstacles to the intake of novel foods. Based on this, in their systematic review, Günden and colleagues [36] highlighted putative strategies able to mitigate the barriers' above impact; notably, communicating the sustainability benefits as well as the production techniques of novel foods can, for example, mitigate the factors that hinder their acceptance [36,38]. In line with this, it has been observed that factors such as receiving information about sustainability and perceived nutritional aspects of consuming edible insects are associated with a high willingness to consume them ($r^+ = 0.32\text{--}0.55$) [38]. On the other hand, disgust and neophobia are linked with a low willingness to consume edible insects ($r^- = -0.33\text{--}0.55$) [38]. Summing up, several factors can hinder the intention to consume novel foods. However, there are also opposing strategies that can instead incentivize the intake of sustainable food. Based on

this, to encourage behavior change in terms of sustainable food consumption, it is necessary to investigate the role that certain psychological dimensions may play in the intention to stimulate the behavior change itself.

1.1. Psychological Determinants of Novel Foods Consumption

As pointed out by the literature findings, there are several psychological factors that may contribute or contrast the intake of novel foods [26,36,37]. As mentioned before, food neophobia may represent one of the psychological dimension able to inhibit the use of sustainable foods [26]. Food neophobia consists in avoiding or not intaking novel or non-familiar foods [26,39,40], and it seems to have a negative impact on the consumption of novel foods in terms of consumption of food derived by the use of new technologies (e.g., clean meat) in terms unnaturalness perception [37]. On the other hand, having a curious temperament may be considered a strengthens factor for the intake of novel foods [37]. In keeping with this, previous scholars also highlighted other putative psychological factors able to support the consume of novel foods, namely beliefs, attitudes, and personality construct [26,36]. In fact, the work of Günden and colleagues [36] underlined how the psychological factors above may have a positive effect on motivational process by supporting and improving the intake of novel foods. Moreover, emotions may also play a pivotal role in the engagement of such behavior [37]. In line with this, the review of Monaco and colleagues [37] pointed out that emotions like fear and disgust may influence the consumption of novel food; however, the combination of positive emotions, such as feeling happy or joyful, may promote novel food intake as a kind of sustainable behavior [37]. Finally, among psychological determinants, cognitive heuristics (e.g., affect and trust heuristics) may influence decision-making concerning the use of sustainable foods [37].

1.2. The Construct of Readiness to Change

Recent research highlighted readiness to change (RTC) as a valuable construct for assessing an individual's inclination to engage in pro-environmental behaviors [41–45], as it captures both mental and physical preparedness to accept, embrace, and implement specific actions [46]. Although a relatively recent construct, RTC is grounded in various psychological models that focus on change predisposition and intention, operating before actual behavior change occurs. In keeping with this, the theory of reasoned action [47,48], theory of planned behavior [48,49], Triandis's attitude–behavior theory, and protection motivation theory [50] all converge on the idea that intention is the primary predictor of human behavior. This concept of intentionality, reflecting decisions and motivations toward specific actions, is crucial for understanding behavior across a wide range of contexts, including pro-environmental actions. The transtheoretical model of behavior change [51] assumes that RTC aligns with the initial stages of change: precontemplation, contemplation, and preparation. Here, an individual moves from lack of intention to change, to awareness of the need to change, and finally to readiness for action. By definition, RTC represents the potential of people to take action towards adopting sustainable behaviors [41]. By focusing on RTC as a multidimensional framework, as proposed by Duradoni et al. [41], the construct encompasses seven essential factors: perceived importance of the issue/change, motivation, self-efficacy, effectiveness of the proposed solution, social support, action and involvement, and perceived readiness. Duradoni and colleagues [41] contributed to this framework also by emphasizing how RTC layered nature can support pro-environmental behaviors. Each dimension of RTC (i.e., perceived importance of the issue/change, motivation, self-efficacy, effectiveness of the proposed solution, social support, action and involvement, and perceived readiness) is linked to the adoption of eco-sustainable be-

haviors, underscoring a direct relationship between these factors and the likelihood of engaging in pro-environmental actions [41,42].

In light of all the above, the present study aims to expand upon the analysis of the associations between readiness to change (RTC) and sustainable dietary behaviors, previously investigated by Duradoni et al. [41]. While the earlier work focused on the reduction of meat consumption as investigated by the scale of Markle [52], this study seeks to explore how RTC contributes to both the consumption (where allowed and sufficiently widespread) and the intention to consume specific types of sustainable foods, including chia seeds, water chestnuts, spirulina algae, baobab pulp, krill oil, clean meat, cricket flour, and edible insects. Summing up, differently to Duradoni and colleagues [41], the present work expands this field of research by investigating the link between RTC dimensions and specific sustainable foods by deepening on the presence of putatively linear or non-linear associations. Moreover, the recent literature has highlighted the possibility that environmental antecedents and pro-environmental behaviors (PEBs) may exhibit non-linear, potentially quadratic relationships [53]. To address this, our approach will examine sustainable food consumption intentions by focusing on extreme values (i.e., the minimum and maximum levels of intention). This strategy is expected to yield valuable insights into how the dimensions of RTC are related to sustainable dietary intentions, while also accounting for potential non-linear dynamics within a predominantly linear analytical framework. Finally, with respect to previous literature findings, the added value of the present work is the examination of psychological determinants in terms of RTC being able to promote the consumption of specific novel foods instead of general sustainable foods, expanding the literature findings in this field of research [41]. In keeping with this, the results of the present study may be more useful in the development of tailored sustainable foods campaigns.

2. Methods

2.1. Recruitment of Participants

Before recruiting participants, a power analysis using G*Power [54,55] was conducted to determine the sample needed to achieve the aims of the study. Regarding the Student's t-test analysis, a sample composed of 698 participants (group 1 = 233; group = 465) would be sufficient for performing the analysis by assuming a small effect size ($d = 0.2$), a power of 0.80, a significance level of 0.05, and an allocation ratio (N_2/N_1) equal to two. Concerning the correlation analysis, a sample consisting of 616 participants is needed to achieve a statistical power of 0.80 and to identify a small effect size ($r = 0.10$) by assuming a significance level of 0.05 [56]. Finally, regarding the multiple linear regression analysis, a sample composed of 725 would be sufficient to reach a statistical power of 0.80 and to identify a small effect size ($f^2 = 0.02$) by assuming a significance level of 0.05. Between April 2023 and July 2023, a total of 1252 participants were anonymously and voluntarily recruited by the administration of a Google Form-Survey through the most popular social networks (e.g., Facebook and Instagram). Inclusion criteria for participating in the study were following: (a) being 14 years old or older and (b) knowledge of Italian language. Notably, a tailored campaign was developed in order to collect opinions about climate change with the aim of contrasting social desirability bias by collecting anonymous data [57]. The study was carried out in line with Italian law's privacy requirements (Law Decree DL-101/2018) and EU regulations (2016/679). The study was approved by the Comissão de Ética do Centro de Estudos Sociais (CE-CES) (University of Coimbra; date: 24 October 2022; protocol number: 02319461). The sample size was composed of 31% men, 64.6% women, and 4.4% people belonging to the LGBTQIA+ community, with a mean age of 27.92 (standard deviation = 11.258) (Table 1).

Table 1. Sample size description.

	Males	Females	LGBTQIA+	Total
%	31.0	64.6	4.4	100
Mean age (sd)	27.825 (10.913)	27.800 (11.188)	30.345 (14.275)	27.919 (11.258)

2.2. Measures

The questionnaire included questions concerning socio-demographic variables as well as related to novel food in terms of chia seeds, water chestnuts, spirulina algae, baobab pulp, krill oil, clean meat, cricket flour, and edible insects. In detail, images referring to the novel foods above were presented. Notably, after viewing the image, participants underwent the following questions, “How intentional would you be to consume the presented product?” (question 1) and “Do you already use the presented product?” (question 2). The response options were scored on a 5-point Likert scale for the first question and dichotomously (0 = ‘No’; 1 = ‘Yes’) for the second question. Moreover, the following instrument was also included:

The Readiness to Change Scale [41]: The scale measures subjective readiness to change (RTC) and is composed of 29 items scored on a 5-point Likert scale (1: “strongly disagree”; 5: “strongly agree”) and seven dimensions with good internal consistency (McDonald’s ω ranging from 0.74 to 0.87). Notably, the dimensions assess the perceived importance of the problem (Items 1 to 4), motivation to change (Items 5 to 8), self-efficacy (Items 9 to 13), effectiveness of the proposed solution (Items 14 to 17), social support (Items 18 to 21), action (Items 22 to 25), and perceived readiness (Items 26 to 29) [41]. In the present study, all the RTC dimensions were characterized by an optimal internal consistency (McDonald’s ω : perceived importance of the problem = 0.92, motivation for change = 0.95; self-efficacy = 0.91, effectiveness of proposed solution = 0.91, social support = 0.91, action = 0.95, and perceived readiness = 0.92).

2.3. Data Analysis

Firstly, descriptive statistics were performed to observe percentage values concerning the use of novel foods among participants (question 2). Moreover, regarding RTC dimensions, skewness and kurtosis values were extracted to control normality distribution. Specifically, in accordance with Hair (2010), we assumed that the variables were normally distributed if the skewness and kurtosis values were within ± 2 and ± 7 , respectively [58]. Moreover, Student’s t-test for independent samples was carried out to compare RTC mean values among people who have or have not taken the novel foods above. In addition, both Pearson’s correlation analysis and stepwise multiple regression analysis were performed to observe associations between the intention to intake novel food and the RTC dimensions. Finally, linear discriminant analysis (LDA) [59,60] was carried out with the aim of discriminating the intention to intake novel food by RTC dimensions. One of the key strengths of linear discriminant analysis (LDA) lies in its ability to effectively manage imbalanced class distributions, while enhancing the distinction between different classes by maximizing the ratio of variance between them and minimizing the variance within each class [60–64]. In the present paper, values of 1 and 5 on the 5-point Likert scale (question 1) were taken into consideration to distinguish between people who did not have (1) or had (5) intention to intake novel food. Statistical Package for the Social Sciences (SPSS) software (version 23) and JASP package (version 0.19.1.0) were used to perform statistical analyses.

3. Results

3.1. Descriptive Results

The most consumed novel foods were chia seeds (38.8%) and spirulina algae (32.3%), especially among women and the LGBTQIA+ community. Next, the foods with the highest intake were water chestnuts (8.4%) and baobab pulp (3.2%) (Figure 1).

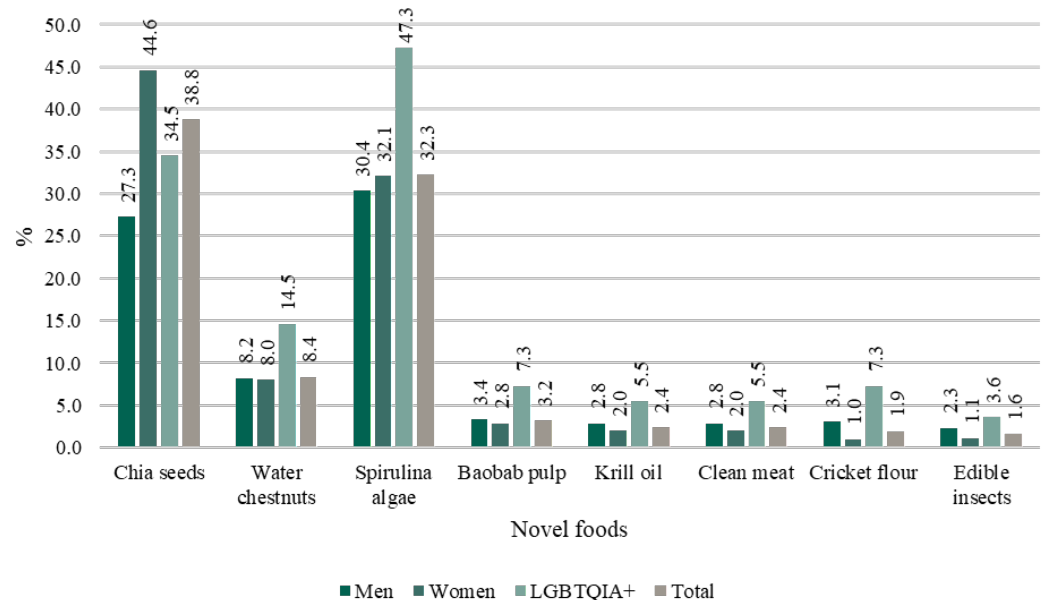


Figure 1. Percentages of novel foods intake.

Concerning the distribution of RTC dimensions, as shown in Table 2, all variables were normally distributed.

Table 2. Descriptive statistics.

Variables	Min.	Max.	Mean	Sd	Skew.	Kurt.
RTC—Perceived importance of the problem	4	20	15.53	2.720	−0.885	1.874
RTC—Motivation for change	4	20	14.81	3.029	−0.685	1.004
RTC—Self-efficacy	5	25	18.04	3.365	−0.569	1.130
RTC—Effectiveness of proposed solution	4	20	14.41	2.555	−0.458	0.827
RTC—Social support	4	20	13.50	2.786	−0.301	0.369
RTC—Action	4	20	14.69	2.845	−0.662	0.887
RTC—Perceived readiness	4	20	14.80	2.740	−0.493	0.748

Notes: RTC, readiness to change; Min., Minimum; Max., Maximum; Sd, standard deviation; Skew., Skewness; Kurt., Kurtosis.

3.2. Inferential Results

3.2.1. Student's T-Test Results

Based on the power analysis outputs (see Section 2.1), Student's t-test was conducted only among those people who did or did not consume chia seeds and spirulina algae. Due to different numerosity in the two investigated groups as well as the assumption of differences in groups' variances, the Welch test was used. Concerning differences among consumers and non-consumers of chia seeds, the results pointed out differences in mean values for the seven RTC dimensions (Table 3). On the other hand, concerning the spirulina algae, differences between consumers and non-consumers for only RTC-Effectiveness solution and RTC-Action were observed (Table 4).

Table 3. Student's t-test results for chia seeds.

		Mean	SD	St. EM	t	df	Cohen's d	SE Cohen's d
RTC-PI	Non-consumer	15.24	2.726	0.098	−4.774 ***	1053.297	−0.278	0.058
	Consumer	15.99	2.651	0.120				
RTC-M	Non-consumer	14.49	3.041	0.110	−4.821 ***	1057.885	−0.281	0.058
	Consumer	15.33	2.940	0.133				
RTC-SE	Non-consumer	17.69	3.387	0.122	−4.695 ***	1061.794	−0.273	0.058
	Consumer	18.60	3.258	0.148				
RTC-ES	Non-consumer	14.18	2.540	0.092	−3.905 ***	1031.978	−0.226	0.058
	Consumer	14.76	2.541	0.115				
RTC-SS	Non-consumer	13.37	2.820	0.102	−2.128 *	1059.600	−0.124	0.058
	Consumer	13.71	2.720	0.123				
RTC-A	Non-consumer	14.24	2.868	0.104	−7.211 ***	1087.512	−0.415	0.059
	Consumer	15.39	2.665	0.121				
RTC-PR	Non-consumer	14.48	2.757	0.100	−5.148 ***	1064.260	−0.300	0.058
	Consumer	15.29	2.643	0.120				

Notes: df, degree of freedom; SD, standard deviation; St. EM, Standard Error Mean; RTC-PI, RTC—Perceived importance of problem; RTC-MC, RTC-Motivation for change; RTC-SE, RTC-Self efficacy; RTC-EPS, RTC-Effectiveness of proposed solution; RTC-SS, RTC-Social support; RTC-A, RTC-Action; RTC-PR, RTC-Perceived readiness. *, $p < 0.05$; ***, $p < 0.001$.

Table 4. Student's t-test results for spirulina algae.

	RTC Dimensions	Mean	SD	St. EM	t	df	Cohen's d	SE Cohen's d
RTC-PI	Non-consumer	15.45	2.789	0.096	−1.409	855.540	−0.086	0.060
	Consumer	15.69	2.566	0.128				
RTC-M	Non-consumer	14.74	3.141	0.108	−1.275	887.384	−0.075	0.060
	Consumer	14.96	2.776	0.138				
RTC-SE	Non-consumer	17.92	3.424	0.118	−1.880	836.528	−0.115	0.061
	Consumer	18.30	3.228	0.161				
RTC-ES	Non-consumer	14.26	2.641	0.091	−3.033 **	885.961	−0.179	0.061
	Consumer	14.71	2.338	0.116				
RTC-SS	Non-consumer	13.42	2.792	0.096	−1.463	798.553	−0.089	0.060
	Consumer	13.67	2.770	0.138				
RTC-A	Non-consumer	14.58	2.861	0.098	−1.975 *	807.874	−0.120	0.061
	Consumer	14.92	2.802	0.139				
RTC-PR	Non-consumer	14.75	2.744	0.094	−0.845	795.791	−0.051	0.060
	Consumer	14.89	2.733	0.136				

Notes: df, degree of freedom; SD, standard deviation; St. EM, Standard Error Mean; RTC-PI, RTC-Perceived importance of problem; RTC-MC, RTC-Motivation for change; RTC-SE, RTC-Self efficacy; RTC-EPS, RTC-Effectiveness of proposed solution; RTC-SS, RTC-Social support; RTC-A, RTC-Action; RTC-PR, RTC-Perceived readiness. *, $p < 0.05$; **, $p < 0.01$.

3.2.2. Correlation Analysis Results

Correlation analysis showed several significant associations between RTC dimensions and intentions to use novel foods (Figure 2). In line with Gignac and Szodorai's thresholds [56] (small: 0.10; typical: 0.20; large: 0.30), large and positive correlations between the intention to use chia seeds and RTC dimensions in terms of action ($r = 0.272$, $p < 0.01$), perceived readiness ($r = 0.265$, $p < 0.001$), motivation ($R = 0.259$, $p < 0.01$), and perceived importance of the problem ($r = 0.256$; $p < 0.01$) were observed (Table 4). Moreover, strong associations were also found between the intentions to use baobab pulp and RTC dimensions such as perceived importance of the problem ($r = 0.230$, $p < 0.01$), motivation ($r = 0.227$, $p < 0.01$), action ($r = 0.203$, $p < 0.01$), and perceived readiness ($r = 0.203$, $p < 0.001$) (Table 5). In general, results pointed out how being ready to change own behavior support the intake of novel foods.

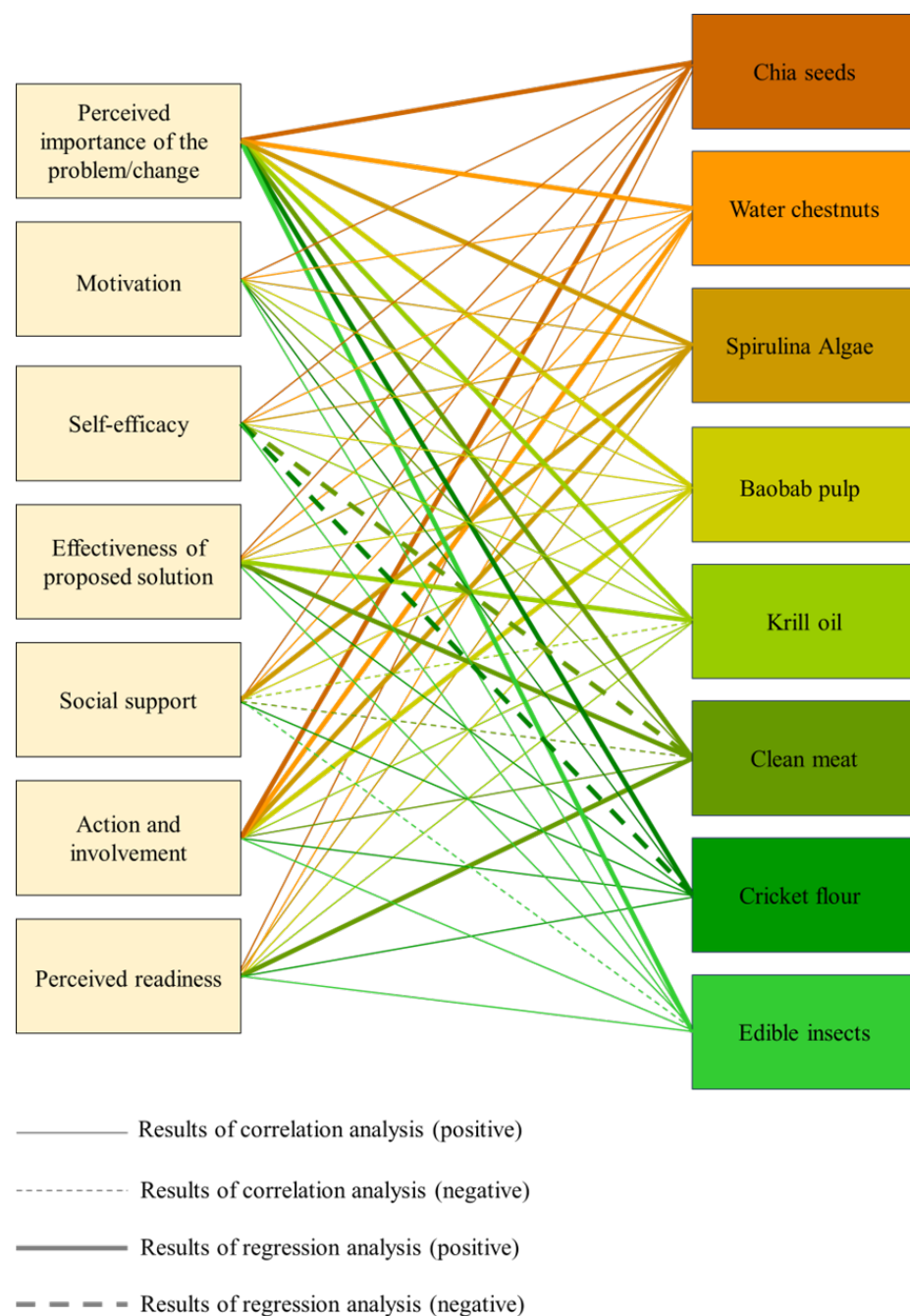


Figure 2. Synthesis of correlation and multiple regression analysis results.

Table 5. Correlation matrix concerning intentions to use novel foods and RTC dimensions.

RTC	Chia Seeds	Water Chestnuts	Spirulina Algae	Baobab Pulp	Krill Oil	Clean Meat	Cricket Flour	Edible Insects
RTC-PI	0.256 **	0.174 **	0.192 **	0.230 **	0.116 **	0.141 **	0.153 **	0.084 **
RTC-M	0.259 **	0.162 **	0.161 **	0.227 **	0.113 **	0.139 **	0.116 **	0.079 **
RTC-SE	0.157 **	0.098 **	0.111 **	0.088 **	0.064 *	−0.059 *	−0.010	0.015
RTC-ES	0.146 **	0.112 **	0.114 **	0.141 **	0.103 **	0.080 **	0.054	0.061 *
RTC-SS	0.061 *	0.037	0.010	0.049	0.034	−0.019	0.011	−0.005
RTC-A	0.272 **	0.162 **	0.153 **	0.203 **	0.086 **	0.091 **	0.086 **	0.071 *
RTC-PR	0.265 ***	0.151 ***	0.147 ***	0.203 ***	0.101 ***	0.110 ***	0.091 **	0.079 **

Notes: RTC, readiness to change; RTC-PI, RTC-Perceived importance of the problem; RTC-MC, RTC-Motivation for change; RTC-SE, RTC-Self efficacy; RTC-EPS, RTC-Effectiveness of proposed solution; RTC-SS, RTC-Social support; RTC-A, RTC-Action; RTC-PR, RTC-Perceived readiness. *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

3.3. Multivariate Results

3.3.1. Multiple Regression Analysis Results

The stepwise multiple linear regression analysis highlighted positively and significantly associated factors with the intentions to consume novel foods (Figure 2). Notably, results pointed out how much the perceived importance of the problem can be considered a predictive factor for the intake of chia seeds ($\beta = 0.162$; $p < 0.001$), water chestnuts ($\beta = 0.125$; $p < 0.001$), spirulina algae ($\beta = 0.158$; $p < 0.001$), baobab pulp ($\beta = 0.172$; $p < 0.001$), krill oil ($\beta = 0.087$; $p < 0.01$), clean meat ($\beta = 0.116$; $p < 0.01$), cricket flour ($\beta = 0.181$ $p < 0.001$), and edible insects ($\beta = 0.084$; $p < 0.01$). Conversely, negative and significant associations were observed between RTC-Social support and spirulina algae intake ($\beta = -0.062$; $p < 0.05$), and RTC-Self-efficacy and clean meat ($\beta = -0.230$ $p < 0.001$) and cricket flour ($\beta = -0.076$; $p < 0.05$) (Table 6). Summing up, the results highlighted that perceiving the importance of the problem, being actively engaged, perceiving social support, having self-efficacy, and recognizing effective solutions can be considered positive factors that may improve the consumption of novel foods.

Table 6. Multiple linear regression analysis.

Independent Variables	Beta	t	Sig.	CI (95%)		R ²	R ² -Adjusted
				LB	UB		
Chia seeds							
RTC-Action	0.192	6.233	0.000	0.052	0.100	0.094	0.092
RTC-Perceived importance of the problem	0.162	5.260	0.000	0.042	0.092		
Water chestnuts							
RTC-Perceived importance of the problem	0.125	3.931	0.000	0.025	0.075	0.038	0.036
RTC-Action	0.100	3.156	0.002	0.015	0.062		

Table 6. Cont.

Independent Variables	Beta	t	Sig.	CI (95%)		R ²	R ² -Adjusted
				LB	UB		
Spirulina algae							
RTC-Perceived importance of the problem	0.158	4.961	0.000	0.045	0.104	0.045	0.042
RTC-Action	0.099	2.967	0.003	0.015	0.074		
RTC-Social support	−0.062	−2.070	0.039	−0.056	−0.001		
Baobab pulp							
RTC-Perceived importance of the problem	0.172	5.491	0.000	0.045	0.096	0.064	0.062
RTC-Action	0.119	3.779	0.000	0.022	0.071		
Krill oil							
RTC-Perceived importance of the problem	0.087	2.791	0.005	0.010	0.056	0.017	0.015
RTC-Effectiveness solution	0.064	2.048	0.041	0.001	0.050		
Clean meat							
RTC-Perceived importance of the problem	0.116	3.488	0.001	0.026	0.093	0.052	0.049
RTC-Self-efficacy	−0.230	−6.313	0.000	−0.125	−0.066		
RTC-Perceived readiness	0.146	3.881	0.000	0.037	0.112		
RTC-Effective solution	0.079	2.258	0.024	0.006	0.081		
Cricket flour							
RTC-Perceived importance of the problem	0.181	6.032	0.000	0.056	0.110	0.028	0.027
RTC-Self-efficacy	−0.076	−2.526	0.012	−0.050	−0.006		
Edible insects							
RTC-Perceived importance of the problem	0.084	2.983	0.003	0.011	0.056	0.007	0.006

Notes: RTC, readiness to change; Sig., Significance; CI, Confidence Interval; LB, Lower bound; UB, Upper bound.

3.3.2. Linear Discriminant Analysis Results

With respect to LDA results, higher accuracy classification values were observed concerning the intention to edible insects (95.8%), krill oil (95.7%), cricket flour (92.4%), baobab pulp (85.7%), and chia seeds (83.9%) (Table 7). In line with the regression analysis outputs, the perceived importance of the problem still has a crucial role concerning the intention to consume chia seeds, water chestnuts, and spirulina algae (Table 8). However, other factors in terms of RTC-Self-efficacy have an impact on the intentions of consuming novel foods in terms of baobab pulp, clean meat, and cricket flour. Interestingly, it is observed that RTC-dimensions are associated differently with the investigated novel foods in terms of directionality and strength (e.g., the perceived importance of the problem and motivation for change). This highlights the need to treat novel foods and possible determinants of intention to consume, separately.

Table 7. Outputs of linear discriminant analysis.

Groups	Accuracy	Precision	Recall	Sensitivity	Specificity
Chia seeds	0.839	0.822	0.839	0.712	0.660
Water chestnuts	0.771	0.728	0.771	0.639	0.564
Spirulina algae	0.577	0.596	0.577	0.583	0.587
Baobab pulp	0.857	0.753	0.857	0.632	0.500
Krill oil	0.957	0.916	0.957	0.657	0.500
Clean meat	0.734	0.729	0.734	0.628	0.565
Cricket flour	0.924	0.854	0.924	0.649	0.500
Edible insects	0.958	0.917	0.958	0.657	0.500

Table 8. Linear discriminant coefficients.

RTC	Chia Seeds	Water Chestnuts	Spirulina Algae	Baobab Pulp	Krill Oil	Clean Meat	Cricket Flour	Edible Insects
RTC–PI	0.492	0.823	0.957	0.361	−0.196	0.152	0.545	−0.312
RTC–M	0.281	−0.322	−0.482	0.235	0.263	0.177	−0.048	0.753
RTC–SE	−0.166	−0.108	0.200	−0.458	0.228	−0.905	−0.841	−0.309
RTC–ES	−0.119	−0.017	−0.116	−0.006	0.510	0.701	0.255	0.380
RTC–SS	−0.358	−0.230	−0.277	0.028	−0.430	−0.514	−0.093	−0.689
RTC–A	0.353	0.758	0.444	0.450	0.700	0.187	0.513	0.168
RTC–PR	0.399	0.062	0.236	0.402	−0.215	0.556	0.343	0.406

Notes: RTC, readiness to change; RTC-PI, RTC-Perceived importance of the problem; RTC-MC, RTC-Motivation for change; RTC-SE, RTC-Self-efficacy; RTC-EPS, RTC-Effectiveness of proposed solution; RTC-SS, RTC-Social support; RTC-A, RTC-Action; RTC-PR, RTC-Perceived readiness.

4. Discussion

As global temperatures approach the thresholds set in the Paris Agreement, the effects of climate change become more severe, making it one of the most pressing issues confronting humanity today [5]. Numerous scientific studies have shown that human-induced greenhouse gas emissions are mostly to blame for the current phenomenon [6,7]. The food system is a major contributor to greenhouse gas emissions, with the ‘food and drink’ category responsible for 20–30% of private consumption’s environmental impacts and over 50% for eutrophication [8]. To reduce the carbon footprint of food production, more sustainable alternatives such as novel foods and clean meat have been developed [20,27,28]. It is therefore essential to model the intention to consume these more sustainable foods, as this can provide deeper insights and facilitate the transition to sustainable food production systems. The present study contributed by expanding the evidence on the role of readiness to change (RTC) [41,42] in relation to sustainable dietary behaviors, focusing on both the actual consumption and the intention to consume a variety of sustainable foods.

From a more strictly descriptive perspective, the present work highlights that chia seeds and spirulina algae are the most commonly consumed novel foods among the participants in this study. This result may be due to the fact that these specific novel foods have gained increasing popularity in recent years [65–70]. More in general, the consumption rates observed in the present work is in line with market availability of the novel foods. Notably, while chia seeds and spirulina algae are relatively easy to obtain [71, 72], others, such as cricket flour and cultivated meat, are less readily accessible [73,74].

Consequently, the findings highlighted clusters of accessibility and normativity of novel foods. Furthermore, the results highlighted that novel foods are primarily consumed by women and people belonging to the LGBTQIA+ community. These findings are in line with the existing literature, which has pointed out that women are generally more inclined to consume novel foods, while the LGBTQIA+ community is actively engaged in pro-environmental behaviors, including the adoption of sustainable foods, as demonstrated by eco-queer movements [26,75]. However, the consumption of novel foods represents a key resource in addressing issues related to climate change and sustainability [76–79]. Consequently, understanding the psychological barriers and obstacles to the consumption of novel foods constitutes a crucial area of research [36,37,79]. In line with this, the low consumption rates of certain novel foods investigated in the present study (e.g., clean meat, cricket flour, and edible insects) can be interpreted in light of the psychological factors that may hinder their acceptance. Specifically, the reduced consumption of these foods may be influenced by cognitive biases and heuristics (e.g., the natural-is-better and affect heuristics), as well as by food neophobia [36,37,79]. Therefore, investigating the antecedents of novel food consumption, particularly in terms of consumption intention, plays a crucial role. In keeping with this, the findings of this study investigating readiness to change are consistent with this need. In fact, except for the negative links between the self-efficacy (RTC) and the intention to use clean meat and cricket flour and between social support (RTC) and clean meat, the results pointed out that all the RTC dimensions positively support the intention to intake of novel foods. Although RTC represents a general measure [41] while novel foods a more specific measure, it is possible to hypothesize the reasons why some of the observed links are negative. Regarding the results concerning the effect of self-efficacy on the specific novel foods mentioned above, it is reasonable to assume that higher scores in this dimension may be associated with a reduced belief in the need to consume foods such as clean meat and cricket-flavored products, which are notoriously among the least accepted novel foods [80,81], in order to adopt sustainable dietary behaviors. On the other hand, concerning the negative link between social support and the intention to consume clean meat, this may depend on the low social acceptability linked with this kind of novel food [82,83].

Moreover, the linear analysis conducted on continuous variables revealed that the results for the RTC dimensions are characterized by low levels of explained variance (adjusted R^2 range: 0.6–9.2%). In contrast, the discrete analysis (linear discriminant analysis) focusing on the minimum (value 1 on the 5-point Likert scale) and maximum (value 5 on the 5-point Likert scale) intention values showed higher classification accuracy, ranging from 57.7% to 95.8%. Overall, the outputs from the different analyses highlight the complexity of the phenomenon under investigation. Indeed, while some factors appear consistently associated, either positively or negatively, with the intention to consume each type of sustainable food, other RTC dimensions show variability in the direction of their association. In summary, the findings of this study reveal a complex picture in which, despite certain overlaps, the intention to consume a specific eco-friendly food seems to be relatively independent, with only limited points of contact across different food types.

Taking the LDA results into account, in most cases, the RTC dimension most strongly and positively associated with the intention to consume novel foods—such as chia seeds, water chestnuts, spirulina algae, baobab pulp, clean meat, and cricket flour—is the perceived importance of the problem. This finding aligns with the literature. Specifically, as shown in the work of van Valkengoed and Steg [84], risk perception is a key factor associated with behavioral intention, as it can also motivate pro-environmental behavioral adaptation. Moreover, the results also revealed a positive relationship between RTC-Motivation and the intention to consume chia seeds, baobab pulp, krill oil, clean meat, and

edible insects. In line with this, the study by Günden and colleagues [36] highlights the potential factors influencing motivation to consume novel foods. Notably, personality traits, values, and beliefs may exert both positive and negative effects on motivation [36]. For example, open-minded individuals, as well as those engaged with environmental issues, tend to demonstrate a stronger motivation to consume novel foods [36,85–98]. Moreover, people who are able to maintain a balance between their motivational drives tend to exhibit a more stable and consistent intention to engage in sustainable eating behaviors, compared to those with misaligned or inconsistent motivation [99].

On the other hand, it has been observed that RTC-Self efficacy is positively associated only with the intention to consume spirulina algae and krill oil. Despite the low number of positive associations, the construct of self-efficacy remains one of the key psychological factors that strongly support the enactment of behavioral changes, including those related to sustainability [41,100]. Furthermore, RTC-Action was found to be positively linked with the intention to consume all the novel foods investigated in this study. This dimension appears to be closely related to the engagement in other forms of sustainable behaviors [41]. More generally, engagement in other pro-environmental behaviors may reinforce and support the intention to adopt additional ones, including potentially the consumption of novel foods [41,101–103].

Consistent with this result, RTC-Perceived readiness also appears to positively support the intention to consume novel foods, with the exception of krill oil. Specifically, this finding seems to be supported by the existing literature, which has shown that perceived readiness is associated with the purchase of environmentally friendly products [41,104–106]. Within this context, novel foods could be considered part of the broader category of green product consumption.

Finally, in contrast to the results presented so far, RTC-Social support negatively predicts the consumption of novel foods, with the exception of baobab pulp. Social support has a significant impact on promoting sustainable behaviors [41]; indeed, the literature has shown that novel food consumption tends to increase when it is supported and accepted by one's social community [36,76,107–109]. However, society can also exert negative influences. In this regard, it has been observed that societal perceptions of novel foods (e.g., as non-masculine or incompatible with the cultural norms of the local diet) can negatively impact their consumption [36,108,110–113]. On the other hand, in general, the results pointed out that RTC-Perceived importance of the problem represents a substantial predictive factor across multiple novel foods. The strong link between this dimension and pro-environmental behaviors has already been observed in previous studies [41,42], and this association may depend on the existing link between risk perception and both greater adaptive ability and the enactment of sustainable behaviors [41,84,114,115]. Indeed, perceiving environmental problems as an issue to be countered leads to increased engagement in pro-environmental behaviors, including the use of sustainable food [41,84,114,115].

In summary, this study highlights the potential psychological determinants underlying the intention to consume novel foods. Given the growing need to promote the consumption of this category of food products, the findings may serve as a solid groundwork for the development of future policies in the field.

Implication for Food Policies

From a more strictly practical perspective, the present study highlighted how the promotion of sustainable behaviors, as well as social and community support, have a strong impact on the intention to consume novel foods. Given the importance of these types of foods in addressing environmental challenges [76–79], social policies aimed at strengthening both of these dimensions are necessary. Specifically, interventions and programs that broadly

encourage the adoption of sustainable behaviors are desirable. Moreover, considering the impact of social perception on the specific type of sustainable behavior investigated in this study, awareness campaigns focused on novel foods are needed in order to reshape community perceptions and ultimately promote their consumption [36,41,76,107–109]. Moreover, in this scenario, we believe it is also crucial to take into consideration the model of needs, opportunities, and abilities (NOA) [116,117] as a reference for investigating the engagement in pro-environmental behaviors of citizens concerning production and consumption. Specifically, the NOA model points out the interconnection between factors such as needs, opportunities, and abilities by also incorporating two additional components in terms of behavioral control and motivation to act able to mediate the factors above [116,117]. Notably, the latter construct could support the importance of RTC and related outputs as groundwork for the implementation of policies that can act on change, including the use of novel foods.

5. Strengthens of the Study

From our perspective, the present work sheds light on the potential psychological antecedents associated with novel food consumption, an emerging area of research whose further exploration may offer concrete benefits in addressing environmental challenges and promoting sustainable behaviors. Particularly, as mentioned before, the study may represent a solid groundwork for the development of food policies as well as future studies in this field of research. Moreover, differently to previous studies on the topic, the emerged findings are related to the link between RTC dimensions and specific and not generic novel foods by supporting tailored awareness campaign as well as intervention programs.

6. Limitations of the Study

Although the findings are significant, the study presents certain methodological limitations. Firstly, the cross-sectional nature of the research does not allow for causal relationships to be inferred between RTC dimensions and the intake of novel foods. Additionally, the use of self-administered questionnaires may have introduced bias related to social desirability, a particularly relevant issue given the sensitive nature of the topic. However, this risk appears to be mitigated by the complete anonymity guaranteed to participants. Moreover, another kind of bias that may be induced by the use of self-report questionnaire may be memory recall bias [118]. Another limitation concerns the non-probabilistic sampling method, which may reduce the generalizability of the results to the broader population as well as representativeness. Moreover, the use of social media and targeted environmental awareness campaigns for data collection may have introduced a potential bias in sample recruitment considering that people already potentially aware of the topic may have participated in the study. In light of these considerations, future research should aim to replicate or expand the study in diverse socio-cultural and demographic contexts to assess the robustness and generalizability of the evidence collected.

7. Conclusions

In conclusion, the findings of the present study shed light on important scientific evidence regarding a topic of great relevance within the field of sustainability. Specifically, the study highlights potential associations between psychological determinants, namely, readiness to change (RTC), and the intention to consume novel foods, a topic still under investigation in the scientific literature. Specifically, the study pointed out how psychological determinants in terms, for example, perceiving the importance of the problem or being actively engaged may have a pivotal role in the consumption of novel foods (e.g., chia seeds and spirulina algae) by contributing to an emergent engagement in pro-environmental

behaviors. Moreover, in line with the NOA model [116,117], the results of the present work may represent a key factor concerning the motivation to act which is in turn associated with useful dimensions for behavioral change. From our perspective, this aspect represents one of the main add of the study. Future studies are needed in terms of longitudinal, randomized control, and qualitative studies in order to investigate the temporal role of RTC in the use of novel foods as well as motivations behind the intake of these kinds of sustainable foods. Moreover, further research is also needed to explore these results both qualitatively and quantitatively, in order to support the development of effective policies and social interventions related to the consumption of sustainable foods.

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