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Climate change worry and eating-related eco-concern: a network analysis of psychological and behavioral correlates in the general population

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Abstract

Background As climate change intensifies, ecological concerns and climate worry are becoming more prevalent, paradoxically driving both pro-environmental behaviors and mental health risks. Their impact on eating behaviors remains unclear. This study uses network analysis to examine the complex relationships between eating-related eco-concerns, climate change worry, sustainable dietary behaviors, and disordered eating in the general population.

Methods The participants filled in the Eating-related eco-concern (EREC), the Eating Disorder Examination Questionnaire (EDE-Q), the Eating Habits Questionnaire (EHQ), Depression Anxiety and Stress Scale (DASS-21), the Climate Change Worry Scale (CCWS), and the Sustainable and Healthy Dietary Behaviors Questionnaire (SHDB). Network analysis was performed using R.

Results The sample included 846 participants, 13.8% men, 84.3% females, 1.2% non-binary, and 0.7% undisclosed, with a mean age of 35.91 years. Network analysis revealed that EREC and SHDB represented the nodes with the greatest strength centrality. Positive associations emerged between EREC and CCWS, SHDB, and EHQ, as well as between SHDB and EHQ and between CCWS and DASS-21-Stress. Negative associations emerged between EREC and EDEQ, SHDB and DASS-21-Stress, and SHDB and CCWS.

Conclusions Findings suggest that general heightened concerns about climate change and psychological distress may impede sustainable dietary behaviors, while specific ecological concerns over food choice may motivate such behaviors, albeit favoring disordered eating in terms of orthorexia nervosa symptoms. Longitudinal studies are needed to explore their evolution over time. Eating disorder specialists should consider climate-related distress, especially in environmentally conscious patients.

Plain English summary

As climate change becomes more serious, people are increasingly worried about the environment. This worry can lead to both positive actions, like choosing sustainable foods, and negative effects on mental health. However, it's unclear how these concerns affect eating habits overall. In this study, researchers surveyed 846 people from the

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general population to explore the links between climate worry, eco-friendly eating, mental health, and disordered eating patterns. They used a type of analysis called network analysis that looks at how these factors are connected like a web with important links between different points called nodes. The results showed that people's concern about how their eating affects the environment and their sustainable eating habits were key nodes of this network. People who were more worried about climate change tended to have more stress, and those with eco-concerns about eating were more likely to show signs of both healthy habits and disordered eating, like obsessively healthy eating (orthorexia). The study concludes that while concern about food and the environment can encourage people to eat more sustainably, it may also lead to unhealthy obsessions with food. Mental health professionals should take climate-related stress into account, especially for patients who are very focused on the environment. More long-term research is needed to understand how these patterns develop over time.

Keywords Eco-concern, Climate change worry, Eating disorders, Orthorexia nervosa, Pro-environmental behaviors

Introduction

In recent years, growing concerns about environmental degradation and climate change have sparked increasing interest in their psychological implications. Concerns about ecological and climate breakdown can take many forms and several constructs that have gained notable attention are eco-anxiety, climate anxiety and climate change anxiety, which describe various forms of the distress and apprehension individuals experience in response to environmental threats and the consequences of climate change [12, 26, 34, 44] with important implications for mental health and adaptive coping [12, 14, 24, 55]. As climate change intensifies and exposure to extreme environmental events becomes more frequent, climate-related distress is expected to pose an increasing mental health challenge (Intergovernmental Panel on Climate Change, 2023), with evidence linking it to negative psychological outcomes such as anxiety, depression, and suicidality [13, 15, 17, 25].

One area in which there have been increasing calls for further research into the potential role of climate change worries is eating disorders (EDs), as individuals may restrict their food intake or eliminate entire food groups as a means of reducing their carbon footprint, driven by environmental concerns and ethical considerations related to their perceived contribution to climate change [48]. To date, with the exception a clinical case [49] and the development of a psychometric measure capturing eating-related eco-concern [47], scarce data had emerged in this emerging domain. Some authors [47, 48] propose that distress associated with the ecological and climate crisis may interact with disordered eating patterns, particularly dietary restraint and weight concerns, due to its psychological impact, as was found in a recent study where eating-related concerns correlated with orthorexia nervosa symptomatology [52]. Orthorexia nervosa, a proposed eating disorder [27], involves an obsessive focus on consuming "pure" foods, potentially harming well-being. It may be linked to climate concerns, as worries over climate change's impact on food quality [51] can heighten stress, guilt, and rigid eating behaviors.

However, ecological and climate concerns are not solely maladaptive; closely related eco-anxiety has also been recognized as a potential driver of pro-environmental engagement, motivating individuals to adopt sustainable behaviors [55]. Further investigation is needed to clarify its dual role, particularly in fostering environmentally responsible actions. On a broader scale, as global efforts intensify to restructure political, social, and economic systems toward sustainability in alignment with the United Nations' 2030 agenda [54], understanding the psychological mechanisms underlying eco-anxiety and eco-concerns becomes increasingly urgent.

In this context, eco-concerns can serve a dual function: on one hand, promoting sustainable eating habits in alignment with environmental values, and on the other, potentially contributing to disordered and unflexible eating patterns driven by excessive preoccupation with food sustainability. Examining this intersection is essential for both advancing sustainable behavior change and addressing potential psychological risks associated with eco-concerns and climate change worry. Considering the potential links between ecological concerns and disordered eating [47, 49, 52], the current study aims to examine through network analysis the complex interplay between eating-related eco-concerns, climate change worry, psychological distress, disordered eating and sustainable eating behaviors in a general population sample to shed light on the dual role that eco-concerns can play in eating behaviors.

Materials and methods

Participation was entirely voluntary, with the option to withdraw at any time without justification or consequences. The project received approval from the Bologna University Bioethics Committee and the Department of Psychology Ethics Committee (Ethics Committee approval number 0155312 on 06/08/2023). Informed consent was obtained from all participants before data collection.

Procedures

Participants were recruited online through a QR code linking to a Qualtrics survey. To maintain confidentiality and anonymity, IP addresses were not collected. The QR code was distributed via major social media platforms, social networks, and a snowballing approach through researchers' contacts. No compensation was provided for participation. Eligibility required participants to be adults aged 18 or older. An ad hoc survey was used to collect socio-demographic information and assess experiences with extreme climate events and nature.

Measures

An ad hoc survey to collect socio-demographic information including gender, nationality, educational level (highest degree obtained), job status (unemployed/employed) and income level (difficulty in making ends meet), body mass index (BMI), dietary habits was administered. The survey also included questions exploring motivations associated with dietary choices (health reasons, weight management, ethical or moral reasons, environmental concerns, taste preferences, medical reasons, and religious or spiritual values), and presence of past experiences with climate-related events.

The Eating-Related Eco-Concern Scale (EREC) [47] is a 10-item self-report measure assessing the degree to which individuals worry about their food choices and their impact on the changing climate, (e.g. "I avoid eating any animal products due to my concerns about climate change"). Items were based on the authors clinical observations and the scale is based on the Climate Change Worry Scale [50], with 5-point Likert scale with the anchors 1 = "Never", 2 = "Rarely", 3 = "Sometimes", 4 = "Often", and 5 = "Always" as well as on literature review on eco-friendly eating and sustainable eating. The scale is unidimensional. A total score is calculated as a sum of the items, with higher scores indicating greater eating-related eco-concern. The Italian version of the EREC was used [52], with a Cronbach alpha in the current sample equal to 0.87.

The climate change worry scale (CCWS)

The Climate Change Worry Scale (CCWS) [50] a 10-item scale measures worry about climate change. Items are scored on a 5-point Likert scale ranging from 1 = Never to 5 = Always. The score is computed as the sum of all 10 items with higher scores indicating greater levels of climate worry. The scale has demonstrated a one-factor structure that was invariant across gender, and good internal consistency (Cronbach's α = 0.95) and test–retest reliability (r = .91) in the original study [50]. The validated Italian version used in this study [28] also showed good validity and reliability. In the present study, reliability was α = 0.92.

The *Depression Anxiety Stress Scales – 21* (DASS-21) [36] is a shortened version of the DASS-42, developed to provide a quick and reliable assessment of an individual's emotional state, measuring levels of depression, anxiety, and stress. The tool consists of 21 total items, with each scale measured by 7 items rated on a 4-point Likert scale from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time), based on how true each statement was for the individual over the past seven days [36]. Psychometric analyses have shown that the three scales have good internal consistency and adequate convergent and discriminant validity [36]. The Italian validation study of the DASS-21 supports its utility and validity in the Italian population, with the three subscales showing internal consistency in both a general population sample and a clinical sample [6]. In the current study only the Stress subscale was used, with good reliability in the study sample (α = 0.91).

The eating disorder examination-questionnaire (EDE-Q)

The Eating Disorder Examination-Questionnaire (EDE-Q) [19] is a 28-item self-report questionnaire which assesses disordered eating over the last 28 days. The questionnaire contains four main severity subscales comprising a total of 23 items: dietary restraint (5 items concerning restraint over eating, avoidance of eating, and dietary avoidance), eating concern (5 items assessing the preoccupation with food, eating in secret, and guilt about eating), shape concern (8 items concerning the desire for a flat stomach, the importance of body shape, and fear of weight gain), and weight concern (5 items that assess the importance of weight, dissatisfaction with weight, and the desire to lose weight). The remaining items concern frequency data of key behavioral features of EDs. Item responses are on a 7-point Likert scale (0–6) with subscale scores being the mean of all subscale items. Higher scores indicate a greater intensity of disordered eating. A global score is calculated as the mean of the four subscales scores. The EDE-Q has consistently shown good psychometric properties including high internal consistency, test–retest reliability, and good discriminant validity across several studies [1, 3, 37, 40, 41]. In this study the Italian version [9] was used with excellent Cronbach's α for global scores (0.95). The global score was the only score that was used.

The eating habits questionnaire (EHQ)

The Eating Habits Questionnaire (EHQ) [23] is a self-reported tool comprising 21 items designed to gauge thoughts, actions, and emotions associated with an intense emphasis on healthy eating. It consists of three consistent subscales: knowledge of healthy eating which contains items regarding diet superiority (5 items), problems associated with healthy eating such as avoidance

and social difficulties (12 items) and feeling positively about healthy eating (4 items), such as a sense of control when consuming nutritious foods. Respondents use a 4-point scale to rate their responses, ranging from "false, not at all true" to "very true." Higher scores on the EHQ indicate tendencies towards orthorexia nervosa. The Italian adaptation of EHQ has undergone validation and demonstrated reliability in evaluating orthorexia nervosa within a general population sample [42]. In the current study Cronbach's α was 0.89 for the total score which was used in analyses.

Sustainable and Healthy Dietary Behaviors (SHDB) [33] is a scale developed to measure consumers' dietary behavior and their sustainable behaviors related to food, creating a link between the two. The questionnaire consists of 30 items rated on a 6-point Likert scale from 1 (Never) to 6 (Always), with an additional option of 0 (I do not have the opportunity to do this); these are divided into 5 subscales calculated as means of subscale item responses: Food Choice (14 items) examines dietary decisions, Storing and Preservation (3 items) focuses on food storage habits, Cooking (6 items) addresses food preparation methods, Consumption (2 items) explores how food is used, and Disposal (5 items) investigates waste management practices. Each category includes sample items illustrating specific behaviors. The questionnaire has so far been validated only in the Japanese population, where it showed adequate internal consistency (Cronbach's $\alpha = 0.92$) [33]. The questionnaire was translated into Italian using the Back-Translation method. This method involves an initial translation of the items from the original language into Italian by at least two researchers who must agree on the final version. This version is then reviewed by a bilingual individual who, through a re-translation into the original language, confirms the comparability between the two versions [4]. Cronbach alpha in the current sample for the Food Choice subscale which was used in the analyses was good (0.87).

Statistical analyses

Descriptive analyses were performed to report sociodemographic characteristics (age, education, marital and employment status).

Network Estimation

The network analysis was conducted using R software. Network models were estimated using the *Gaussian graphical stepwise model selection (ggmModSelect)* algorithm for the *estimateNetwork* function from the *bootnet* R package [18]. This algorithm uses a regularized estimation to search across models to recover a network that will be applied in a stepwise model search. Through a step-up and step-down approach, the algorithm then tests all possible combinations including and excluding each edge present in the network. The model with the lowest criterion is selected for each interaction, until it comes to the best possible information criterion [30]. This process uses Bayesian information criterion (BIC), which is obtained from the estimation of the maximum likelihood of sparsity. Correlations among nodes in *ggmModSelect* networks represent partial correlations while accounting for other symptoms present in the network.

Network accuracy

The accuracy and stability of the estimated network were assessed using nonparametric bootstrapping techniques, performed using the *bootstrap* function of the *bootnet* R package. Edge-weight accuracy was evaluated by generating 2500 bootstrap samples to obtain confidence intervals for each connection, allowing an assessment of the robustness of edge estimates. The Strength Centrality Stability Coefficient (CSC) was computed to determine the extent to which node centrality remains stable when subsets of the data are removed. Coefficients between 0.25 and 0.50 are considered acceptable, between 0.50 and 0.70 good, and above 0.70 excellent [18].

Centrality indices

The *centrality* of a node refers to how strongly it is connected to other nodes, indicating its potential influence within the network and, therefore, its potential role as target for treatments, as changes in this node may produce changes in many other nodes [5, 18]. To identify the most influential nodes in the network, strength centrality was computed for each variable. Strength centrality is defined as the sum of all edge weights connected to a given node and it indicates the relative importance of each node within the network. Nodes with higher strength centrality are considered central to the system, potentially playing a key role in the development and maintenance of psychological processes. Nodes with high strength centrality can also represent important targets for clinical interventions [5]. In order to avoid the presence of potential overlaps between nodes, which could alter centrality indices [8], the *goldbricker* algorithm from the *networktools* R package was used to control for the topological overlap of nodes [32].

Results

Participant characteristics

The final sample consists of 846 individuals between the ages of 18 and 78, with an average age of 35.91 years (± 12.15). Of these, 13.8% were men, 84.3% were female, 1.2% non-binary, and 0.7% preferred not to answer. Participants indicated the following highest level of education obtained: 0.1% reported having completed primary school, 7.7% completed middle school, 39.8% obtained a high school diploma, 23.5% earned a bachelor's degree,

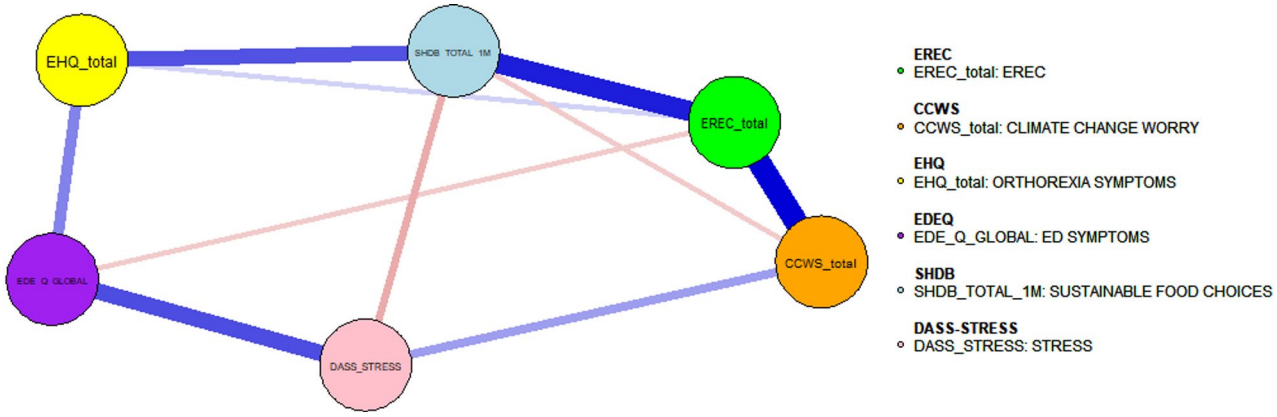

Fig. 1 Network model of ED symptomatology, EREC, Climate change worry, Orthorexia nervosa symptoms, Stress, and Sustainable and Healthy Dietary Behaviors. *CCWS* Climate Change Worry Scale, *DASS* Depression Anxiety Stress Scales-21, *ED* Eating Disorders, *EDE_Q* Eating Disorder Examination-Questionnaire, *EHQ* Eating Habits Questionnaire, *EREC* Eating-Related Eco-Concern Scale, *SHDB* Sustainable and Healthy Dietary Behaviors

Table 1 Individual edge weights table

	EREC_total	CCWS_total	EHQ_total	EDE_Q_GLOBAL	SHDB_TOTAL	DASS_STRESS
EREC_total	0	0.55	0.1	−0.11	0.48	0
CCWS_total	0.55	0	0	0	−0.11	0.21
EHQ_total	0.1	0	0	0.27	0.37	0
EDE_Q_GLOBAL	−0.11	0	0.27	0	0	0.38
SHDB_TOTAL_1M	0.48	−0.11	0.37	0	0	−0.18
DASS_STRESS	0	0.21	0	0.38	−0.18	0

23.4% earned a master's degree, and 5.6% have other qualifications. In terms of income level, defined as difficulty in making ends meet, 6.7% reported significant difficulty making ends meet, 27.5% reported some difficulty, 31.8% reported no difficulty, 23.2% managed to save money every month, and 7.3% preferred not to answer. In terms of nationality, the majority of the sample (97.7%) reported being Italian, while 2.3% reported other nationalities (Bulgarian, Romanian, Albanian, French, Greek, Polish, Russian, Brazilian). Regarding relationship status, 22.8% of the sample identified as single, 23.8% were in a relationship, 19.6% were cohabiting, 25.2% were married, and 8.7% fell into other categories (separated, divorced, widowed, other). Lastly, 66.5% of the sample were at the moment of data collection employed, while 33.5% were not employed (of whom 20.7% were university students).

Network analysis with ED symptomatology, eating-related eco-concern, climate change worry, orthorexia nervosa symptoms, stress, and sustainable and healthy dietary behaviors

A graphical representation of the obtained network structure can be observed in Fig. 1. In the network, each variable is represented as a node (i.e., a circle), and associations between them are depicted as edges (i.e., lines) that reflect partial correlations adjusted for all other variables in the model. Blue lines indicate positive associations, red lines negative ones, and thicker lines correspond to stronger relationships [5, 18].

Positive connections between nodes are represented using blue lines, while negative connections are represented using red lines. Thicker lines represent stronger correlations.

When examining the relationships between variables in the network (See Fig. 1), several positive associations emerged. EREC showed strong positive connections with both CCWS (edge weight = 0.55) and SHDB (edge weight = 0.48). SHDB was also positively associated with EHQ (edge weight = 0.37), CCWS and DASS-21-Stress (edge weight = 0.21). A smaller positive association was found between EREC and EHQ (edge weight = 0.10).

Negative associations instead emerged between EREC and EDEQ (edge weight=−0.11), SHDB and DASS-21-Stress (edge weight=−0.18), and CCWS and SHDB (edge weight=−0.11).

A full summary of all edge weights is presented in Table 1. In network analysis, edge weights represent the strength of association between two variables, after controlling for all other variables in the network. Higher absolute values indicate stronger relationships, whether positive or negative [18]. Figure 2 illustrates the results of the bootstrapped edge weight difference test, which shows whether specific connections in the network are significantly stronger or weaker than others. Statistically significant differences ($p < .05$) are represented in black.

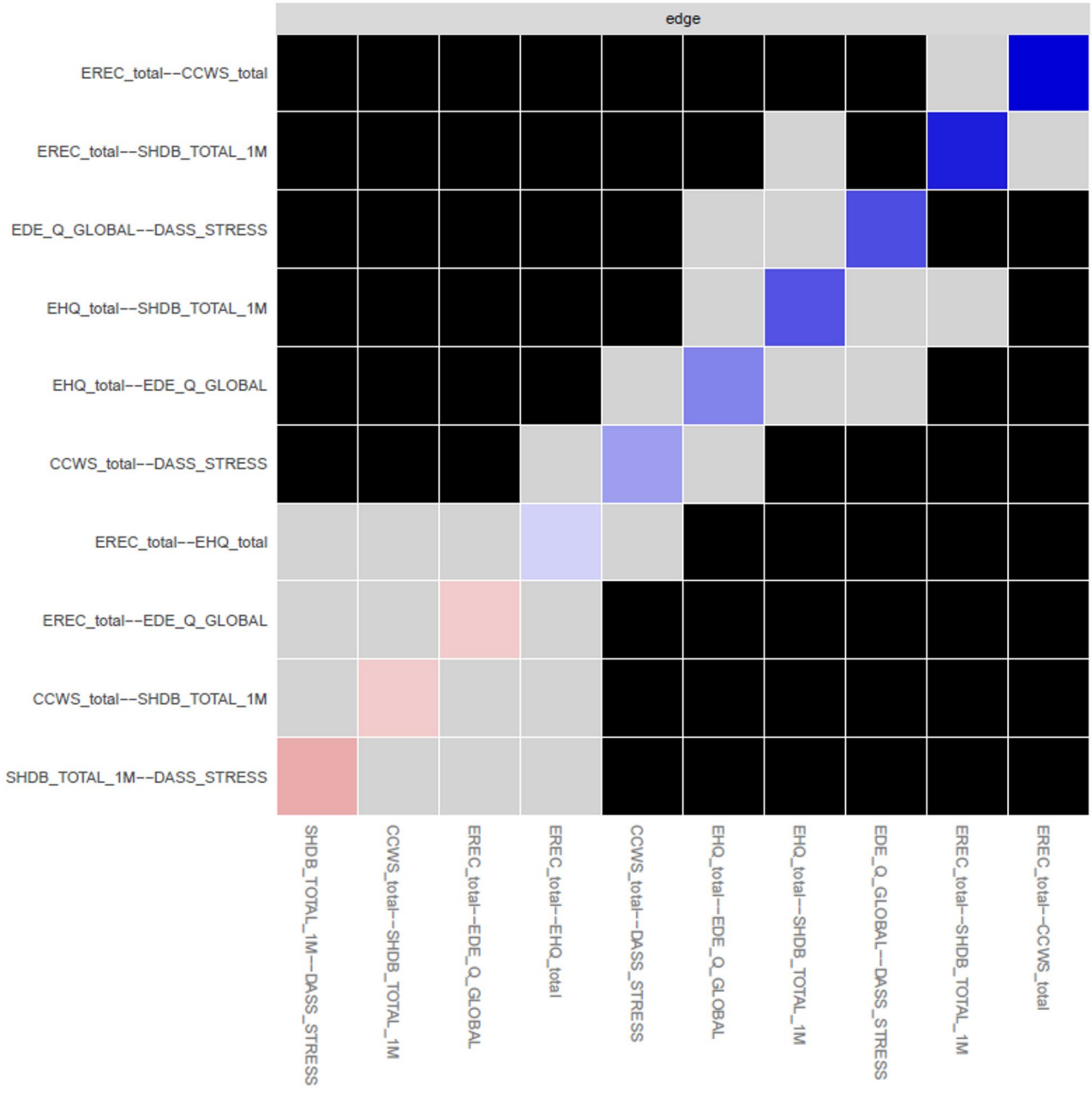

Fig. 2 Bootstrapped edge weights differences. *CCWS* Climate Change Worry Scale, *DASS* Depression Anxiety Stress Scales-21, *EDE_Q* Eating Disorder Examination-Questionnaire, *EHQ* Eating Habits Questionnaire, *EREC* Eating-Related Eco-Concern Scale, *SHDB* Sustainable and Healthy Dietary Behaviors. Significant differences ($p < .05$) are represented in black

CCWS Climate Change Worry Scale, *DASS* Depression Anxiety Stress Scales-21, *EDE_Q* Eating Disorder Examination-Questionnaire, *EHQ* Eating Habits Questionnaire, *EREC* Eating-Related Eco-Concern Scale, *SHDB* Sustainable and Healthy Dietary Behaviors.

Bootstrap analyses were also performed to assess the stability of node centrality, revealing a CSC of 0.52. This value falls within the acceptable-to-good range [18], indicating that centrality estimates can be interpreted with reasonable confidence. A CSC above 0.50 suggests that the most central nodes in the network remain stable even when subsets of the data are removed, supporting the robustness of the findings. A graphical representation of the bootstrapped stability estimate is shown in Fig. 3.

When looking at strength centrality (see Fig. 4), EREC and SHDB exhibited the highest strength centrality among nodes (respectively 1.47 and 1.03), indicating their strong connection with the other variables in the network.

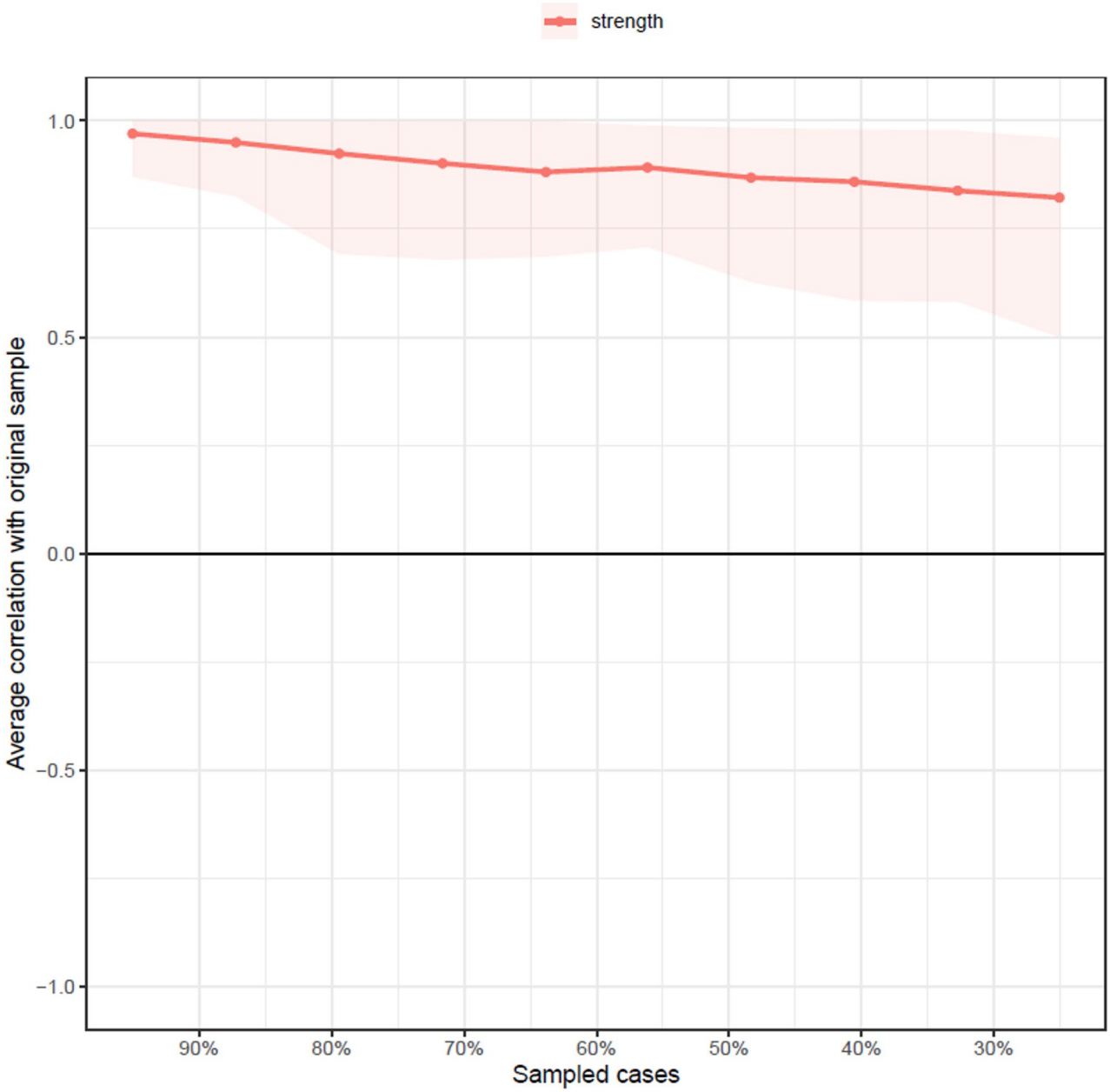

Fig. 3 Graphical representation of bootstrapped strength centrality stability

Finally, the bootstrapped difference test (see Fig. 5) was performed to check whether the strength values of different nodes in the network are truly different from each other, rather than those differences happening by chance. These results help identify which nodes are more central or important within the network. Significant differences ($p < .05$) are represented in black. [5, 18]. This test confirmed significant differences in strength values from other nodes for EREC, meaning it plays a distinct role in the network, and partially for SHDB, which showed a significant difference against DASS-Stress only, suggesting its influence is different mainly from that specific node.

Discussion

The findings of this study reveal a complex network of relationships among eco-concern and climate worry, sustainable food choice behaviors, psychological distress, orthorexia nervosa and ED symptoms. These results provide valuable insights into how individuals' concerns about climate change and sustainability shape both their mental health and eating behaviors. Additionally, they build on existing research that has explored the psychological implications of related constructs of eco-anxiety and climate anxiety [12, 44] and its impact on health behaviors, particularly related to eating [48, 52].

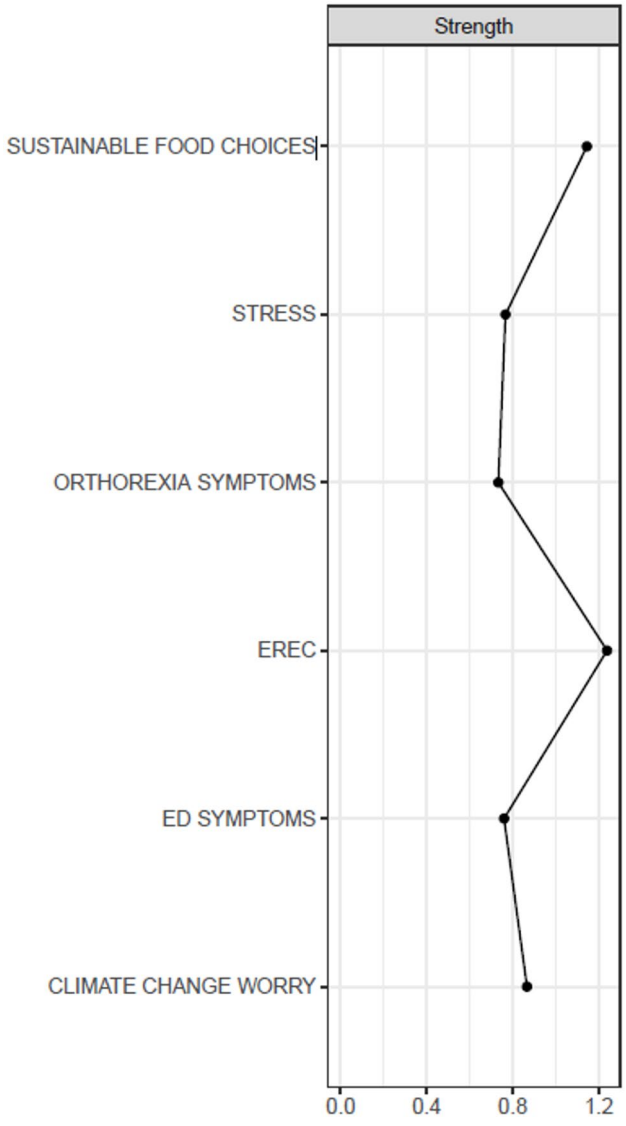

Fig. 4 Strength centrality plot. *ED* Eating Disorders, *EREC* Eating-Related Eco-Concern

Eco-related eating concern (EREC) as a central node and risk of orthorexia nervosa

The study found that eating-related eco-concern (EREC) held a central position in the network, while being strongly connected with climate change worries (CCWS) and sustainable healthy dietary behaviors (SHDB). These findings support previous research in which eco-anxiety was found to strongly correlate and possibly motivate individuals to adopt more sustainable eating behaviors [31, 55]. The significant positive association between EREC and sustainable food choices indicates that individuals who experience ecological concerns related to food are likely to engage in pro-environmental dietary behaviors, such as choosing plant-based diets or minimizing consumption of animal-based products. This aligns with the idea that climate change concerns, while potentially distressing, can also act as a driver for pro-environmental actions [24, 26, 38, 55]. Although the strong centrality of EREC within the network may be due to its strong association with the SHDB and CCWS nodes, it also underscores its significant influence on other variables, even those of a potentially psychopathological nature. Indeed previous studies on climate change worry had found significant correlations with anxiety and depression, indicating its possible negative impact on mental health [12, 14].

Indeed, as suggested by authors [48], concerns about climate change could drive a range of maladaptive eating behaviors, including the adoption of new dietary choices motivated by environmental considerations. However, when such behaviors are undertaken with an exaggerated sense of personal responsibility, they may lead to restrictive and dysfunctional eating patterns aimed at reducing one's carbon footprint [49]. In this context, sustainable dietary choices within the present study's network may serve as a gateway to orthorexia nervosa symptoms for a subset of vulnerable individuals. Indeed, research has already identified a link between lacto-vegetarianism and an increased risk of developing orthorexia nervosa [16, 43]. On the other hand, as causality cannot be implied, the significant links may indicate that some individuals with disordered eating might seek socially acceptable justifications for restricting their food intake. In line with the current study findings, a recent review highlights an association between vegetarian diets, which represent an increasingly popular choice due to ecological and sustainability concerns [39], and orthorexia-related eating behaviors [7].

Interestingly, the negative association between EREC and EDE-Q may suggest that on the other hand, for some individuals, adopting sustainable eating behaviors due to climate change concerns could act as a protective factor specifically against eating disorders. This is in line with findings from the literature [47, 52], who noted a lack of significant overlap between diagnostically defined ED symptomatology and eating-related ecological concern.

Sustainable food choices, psychological distress and climate change worry

Sustainable food choices (SHDB) were not only strongly associated with EREC, but they also exhibited a moderate connection with psychological distress, particularly DASS-21-Stress. The result highlights the complex and sometimes conflicting nature of these behaviors, where individuals may strive for environmental sustainability while also managing psychological distress [25]. This result also suggests that individuals experiencing higher levels of psychological distress, such as anxiety or stress, may find it more challenging to maintain sustainable eating behaviors. This finding is in line with the work of several authors [15, 17] who identified the psychological

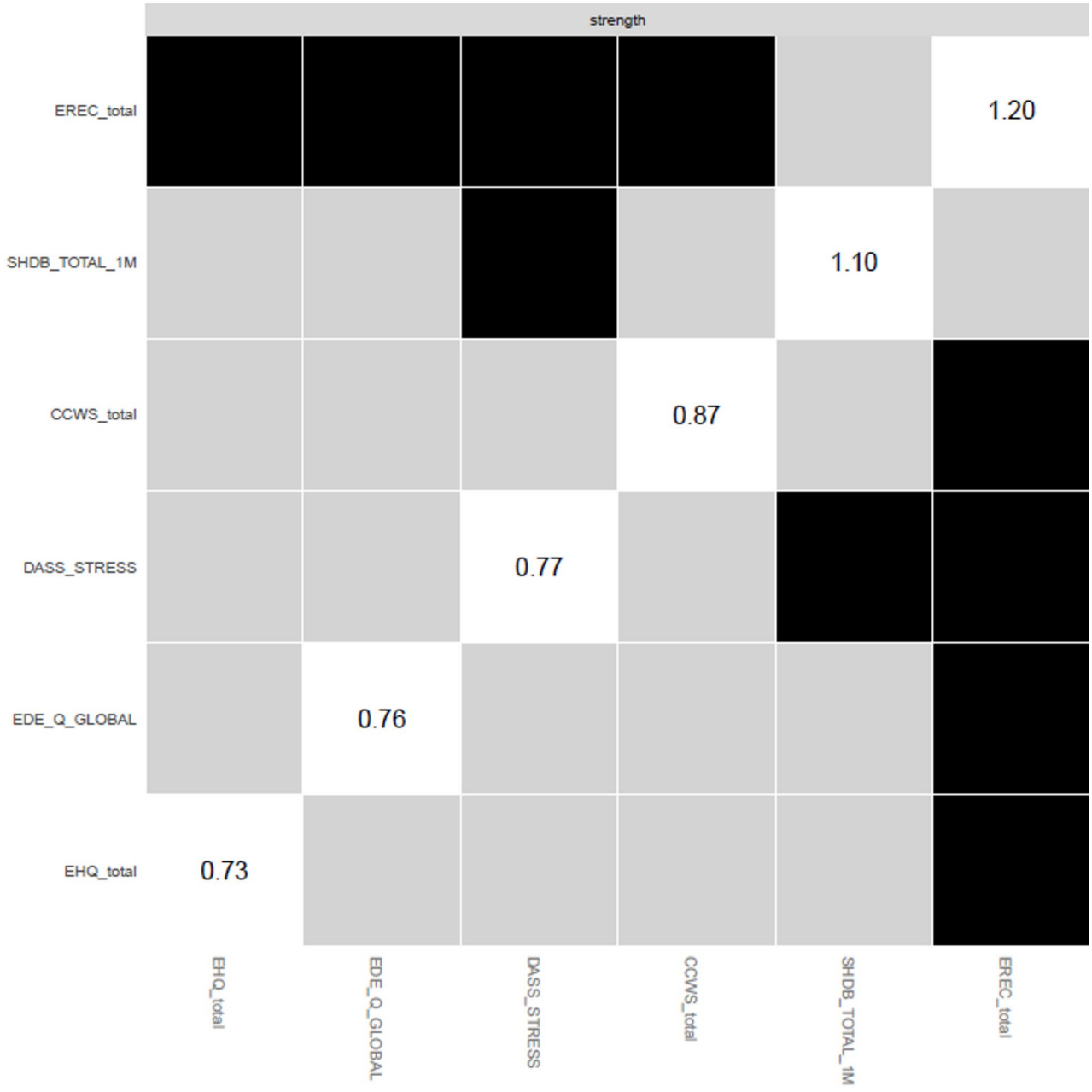

Fig. 5 Strength centrality differences. Significant differences ($p < .05$) are represented in black. *CCWS* Climate Change Worry Scale, *DASS* Depression Anxiety Stress Scales-21, *EDE_Q* Eating Disorder Examination-Questionnaire, *EHQ* Eating Habits Questionnaire, *EREC* Eating-Related Eco-Concern Scale, *SHDB* Sustainable and Healthy Dietary Behaviors

toll of climate-related stress and its potential to influence behaviors and mental health as also underscored in the literature [13]. Eco-anxiety, when not managed effectively, may exacerbate mental health difficulties, complicating efforts to adopt sustainable dietary behaviors.

Similarly, a negative association was found between climate change worries (CCWS) and SHDB food choices, suggesting that general heightened concerns about climate change may impede sustainable dietary behaviors, while, as discussed above, specific ecological concerns over food choice may motivate such behaviors. This is contrary to most findings where CCWS generally correlates significantly with pro-environmental behaviors. However, climate change worry has also been found to correlate with psychopathological symptoms of stress, depression, and anxiety, which if excessive may indeed constitute an obstacle to adaptive behaviors [35, 45, 50].

The correlations between EREC scores and both climate change concerns and orthorexia nervosa symptoms, when mediated by sustainable dietary behaviors, further

illustrate the complex interplay between environmental worries, eating behaviors, and mental health [11, 12]. It is worthy of note that although sustainable eating behaviors may have a positive environmental impact, they can also be psychologically taxing, especially when they become overly restrictive or perfectionistic [12].The results suggest that as individuals become more concerned about the ecological impact of their food choices, they may increase their focus on reducing personal carbon footprints through food, which could contribute to both pro-environmental behaviors and psychological distress. Conversly, those who already suffer from psychological distress may find food restriction justified by ecological motivations as a coping mechanism. Such dysfunctional behaviors should be considered within the context of increased ED risk [48].

Limitations

This study has several limitations that should be acknowledged. First, while we assessed eating disorder symptomatology, we relied on a global score rather than examining specific symptoms, which may have limited our ability to capture nuanced patterns. Similarly, we did not include measures of anxiety and depression symptoms as indicators of psychological distress, which could have provided further insight into the psychological factors influencing eating behaviors. Lastly, while we examined orthorexia risk, we considered it as a single global measure rather than analyzing its distinct components, potentially overlooking important variations within the construct. Future research should address these limitations by employing longitudinal designs and incorporating a more detailed assessment of disordered eating and psychological distress.

Implications

The findings of this study underscore the need for tailored interventions that address both ecological concerns and climate-related worries and sustainable behavior change. Clinicians working with individuals who experience distress about the climate and ecological crisis may need to help them balance environmental motivations with psychological well-being, recognizing that eco-concerns can both foster sustainable behaviors and contribute to psychological distress and disordered eating. Other authors [24, 26], suggested that understanding the psychological mechanisms behind eco-anxiety is essential for both promoting pro-environmental behaviors and mitigating potential negative mental health outcomes.

Future research should thus explore the temporal dynamics of these relationships, particularly how eco-concerns and sustainable eating behaviors evolve over time, especially in the face of increasingly frequent and severe climate events. Additionally, longitudinal studies could investigate how interventions aimed at reducing eco-concerns might influence both psychological distress and eating behaviors. By further elucidating the dual role of ecological concerns and eco-anxiety in promoting sustainability and potentially contributing to maladaptive eating patterns, future research can inform strategies for supporting both environmental and psychological health.

From a clinical perspective, these findings emphasize the need to consider climate-related factors of distress when assessing and treating eating disorders, particularly orthorexia nervosa. Clinicians should also recognize the moral dimension of dietary choices in practice, as suggested by the link between EREC scores and feelings of moral superiority-an important aspect of orthorexia nervosa [10]. Additionally, the findings highlight the growing need to address eco-anxiety and environmental concerns in mental health promotion and prevention efforts. Despite the increasing relevance of these issues in clinical settings, there remains a lack of guidance for clinicians on how to effectively address and manage ecological concerns in therapeutic contexts [53].

Recent studies indicate that fostering compassion for both the planet and oneself can alleviate ecological concern while promoting healthier coping strategies, especially relevant in contexts like orthorexia nervosa. Grounded in Compassion-Focused Therapy (CFT), self-compassion serves as an effective mechanism for regulating threat-based emotions—such as guilt, shame, and self-criticism [21], which can manifest in responses to climate anxiety and disordered eating. Empirical findings [2] demonstrate that self-compassion mediates the link between empathy for nature, compassion for others, and pro-environmental behavior, underscoring its dual role in ecological engagement and emotional resilience, while another study found that self-compassion and compassion from others moderated the relation between nature connection, climate anxiety, and well-being [46]. Gerber [20] argues that self-compassion enhances emotional regulation in the face of environmental threat, helping individuals avoid overwhelm and engage constructively. Compassion-based interventions have also been shown to reduce self-criticism and foster emotional resilience [22], which may be particularly relevant for individuals experiencing moral distress or perfectionistic standards related to their ecological impact. Future research may benefit from examining how compassion practices can be tailored to address the intersection of climate-related emotions and disordered eating patterns.

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Author contributions
Lucia Tecuta was responsible for Concepualization, Data curation, Methodology, Formal analysis, writing the original draft. Valentina Gardini contributed to formal analysis and methodology and writing the original draft. Elena Tomba contributed to the Conceptualization, Funding acquisition, Project administration, Resources and Supervision. All authors contributed to writing and editing the final manuscript.

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Data availability
The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

Declarations

Ethics approval and consent to participate
Ethics approval was obtained before commencing data collection from the Bologna University Bioethics Committee and the Department of Psychology Ethics Committee (Ethics Committee approval number 0155312 on 06/08/2023). Informed consent was obtained from all participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Aardoom JJ, Dingemans AE, Op't Landt S, M. C. T., Van Furth EF. Norms and discriminative validity of the eating disorder examination questionnaire (EDE-Q). Eat Behav. 2012;13(4):305–9. https://doi.org/10.1016/j.eatbeh.2012.09.002.
2. Ballarotto G, Ghezzi V, Velotti P. Feeling the nature to foster sustainability: the mediating role of (self) compassion. Sustainability. 2025;17(1):351. https://doi.org/10.3390/su17010351.
3. Bardone-Cone AM, Boyd CA. Psychometric properties of eating disorder instruments in black and white young women: internal consistency, Temporal stability, and validity. Psychol Assess. 2007;19(3):356–62. https://doi.org/10.1037/1040-3590.19.3.356.
4. Behling O, Law KS. Translating questionnaires and other research instruments. SAGE Publications, Inc; 2000. https://doi.org/10.4135/9781412986373.
5. Borsboom D, Cramer AOJ. Network analysis: an integrative approach to the structure of psychopathology. Ann Rev Clin Psychol. 2013;9(9):91–121. https://doi.org/10.1146/annurev-clinpsy-050212-185608.
6. Bottesi G, Ghisi M, Altoè G, Conforti E, Melli G, Sica C. The Italian version of the depression anxiety stress Scales-21: factor structure and psychometric properties on community and clinical samples. Compr Psychiatr. 2015;60:170–81. https://doi.org/10.1016/j.comppsych.2015.04.005.
7. Brytek-Matera A. Vegetarian diet and orthorexia nervosa: A review of the literature. *Eating and weight Disorders - Studies on anorexia*. Bulimia Obes. 2021;26(1):1–11. https://doi.org/10.1007/s40519-019-00816-3.
8. Burger J, Isvoranu A-M, Lunansky G, Haslbeck JMB, Epskamp S, Hoekstra RHA, Fried EI, Borsboom D, Blanken TF. Reporting standards for psychological network analyses in cross-sectional data. Psychol Methods. 2023;28(4):806–24. https://doi.org/10.1037/met0000471.
9. Calugi S, Milanese C, Sartirana M, Ghoch E, Sartori M, Geccherle F, Coppini E, Franchini A, C., Grave D, R. The eating disorder examination questionnaire: reliability and validity of the Italian version. Eat Weight Disorders: EWD. 2017;22(3):509–14. https://doi.org/10.1007/s40519-016-0276-6.
10. Cheshire A, Berry M, Fixsen A. What are the key features of orthorexia nervosa and influences on its development? A qualitative investigation. Appetite. 2020;155:104798. https://doi.org/10.1016/j.appet.2020.104798.
11. Cianconi P, Hanife B, Grillo F, Betro' S, Lesmana CBJ, Janiri L. Eco-emotions and psychoterratic syndromes: reshaping mental health assessment under climate change. Yale J Biol Med. 2023;96(2):211–26. https://doi.org/10.59249/EARX2427.
12. Clayton S, Karazsia BT. Development and validation of a measure of climate change anxiety. J Environ Psychol. 2020;69:101434. https://doi.org/10.1016/j.jenvp.2020.101434.
13. Clayton S, Manning C, Krygsman K, Speiser M. Mental health and our changing climate: Impacts, implications, and guidance. American Psychological Association and ecoAmerica; 2017. https://scholar.google.com/scholar_lookup?hl=en%26publication_year=2017%26author=S.+W.+W.+Clayton%26author=C.+Manning%26author=K.+Krygsman%26author=M.+Speiser%26title=Mental+health+and+our+changing+climate%3A+Impacts%2C+implications%2C+and+guidance.
14. Coffey Y, Bhullar N, Durkin J, Islam MS, Usher K. Understanding eco-anxiety: A systematic scoping review of current literature and identified knowledge gaps. J Clim Change Health. 2021;3:100047. https://doi.org/10.1016/j.joclim.2021.100047.
15. Cunsolo Willox A, Harper SL, Ford JD, Edge VL, Landman K, Houle K, Blake S, Wolfrey C. Climate change and mental health: an exploratory case study from Rigolet, Nunatsiavut, Canada. Clim Change. 2013;121(2):255–70. https://doi.org/10.1007/s10584-013-0875-4.
16. Dittfeld A, Gwizdek K, Jagielski P, Brzęk J, Ziora K. A study on the relationship between orthorexia and vegetarianism using the BOT (Bratman test for Orthorexia). Psychiatr Pol. 2017;51(6):1133–44. https://doi.org/10.12740/PP/75739.
17. Ellis NR, Albrecht GA. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian wheatbelt. Soc Sci Med. 2017;175:161–8. https://doi.org/10.1016/j.socscimed.2017.01.009.
18. Epskamp S, Borsboom D, Fried EI. Estimating psychological networks and their accuracy: A tutorial paper. Behav Res Methods. 2018;50(1):195–212. https://doi.org/10.3758/s13428-017-0862-1.
19. Fairburn CG, Beglin SJ. Assessment of eating disorders: interview or self-report questionnaire? Int J Eat Disord. 1994;16(4):363–70.
20. Gerber Z. Self-compassion as a tool for sustained and effective climate activism. Integr Environ Assess Manag. 2023;19(1):7–8. https://doi.org/10.1002/ieam.4695.
21. Gilbert P. Compassion focused therapy: distinctive features. Routledge; 2010.
22. Gilbert P, Choden. Mindful compassion: how the science of compassion can help you understand your emotions, live in the present, and connect deeply with others. Constable & Robinson; 2013.
23. Gleaves DH, Graham EC, Ambwani S. Measuring orthorexia: development of the eating habits questionnaire. Int J Educational Psychol Assess. 2013;12(2):1–18.
24. Heeren A, Mouguiama-Daouda C, McNally RJ. A network approach to climate change anxiety and its key related features. J Anxiety Disord. 2023;93:102625. https://doi.org/10.1016/j.janxdis.2022.102625.
25. Helm SV, Pollitt A, Barnett MA, Curran MA, Craig ZR. Differentiating environmental concern in the context of psychological adaption to climate change. Glob Environ Change. 2018;48:158–67. https://doi.org/10.1016/j.gloenvcha.2017.11.012.
26. Hogg TL, Stanley SK, O'Brien LV, Wilson MS, Watsford CR. The Hogg Eco-Anxiety scale: development and validation of a multidimensional scale. Glob Environ Change. 2021;71:102391. https://doi.org/10.1016/j.gloenvcha.2021.102391.
27. Hyrnik J, Janas-Kozik M, Stochel M, Jelonek I, Siwiec A, Rybakowski JK. The assessment of orthorexia nervosa among 1899 Polish adolescents using the ORTO-15 questionnaire. Int J Psychiatry Clin Pract. 2016;20(3):199–203. https://doi.org/10.1080/13651501.2016.1197271.

28. Innocenti M, Santarelli G, Lombardi GS, Ciabini L, Zjalic D, Di Russo M, Cadeddu C. How can climate change anxiety induce both pro-environmental behaviours and eco-paralysis? The mediating role of general self-efficacy. Int J Environ Res Public Health. 2023;20(4). https://doi.org/10.3390/ijerph20043085.
29. IPCC. (2023). *Climate change 2023: Synthesis report. Contribution of working groups I, II and III to the sixth assessment report of the Intergovernmental Panel on Climate Change [Core writing team, Lee, H. And Romero, J, editors]*. 33–115. https://doi.org/10.59327/IPCC/AR6-9789291691647
30. Isvoranu A-M, Epskamp S, Waldorp L, Borsboom D. Network psychometrics with R: A guide for behavioral and social scientists. Taylor & Francis; 2022.
31. Jain N, Jain P. (2022). Eco-anxiety and environmental concern as predictors of eco-activism. *IOP Conference Series: Earth and Environmental Science*, *1084*(1), 012007. https://doi.org/10.1088/1755-1315/1084/1/012007
32. Jones P. (2025). *networktools: Tools for Identifying Important Nodes in Networks* (Versione 1.6.0) [Software]. https://cran.r-project.org/web/packages/networktools/index.html
33. Kawasaki Y, Nagao-Sato S, Yoshii E, Akamatsu R. Integrated consumers' sustainable and healthy dietary behavior patterns: associations between demographics, psychological factors, and meal Preparation habits among Japanese adults. Appetite. 2023;180:106353. https://doi.org/10.1016/j.appet.2022.106353.
34. Kurth C, Pihkala P. Eco-anxiety: what it is and why it matters. Front Psychol. 2022;13. https://doi.org/10.3389/fpsyg.2022.981814.
35. Larionow P, Gawrych M, Mackiewicz J, Michalak M, Mudło-Głagolska K, Preece DA, Stewart AE. The climate change worry scale (CCWS) and its links with demographics and mental health outcomes in a Polish sample. Healthcare. 2024;12(11). https://doi.org/10.3390/healthcare12111128.
36. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. Behav Res Ther. 1995;33(3):335–43. https://doi.org/10.1016/0005-7967(94)00075-U.
37. Luce KH, Crowther JH. The reliability of the eating disorder Examination-Self-Report questionnaire version (EDE-Q). Int J Eat Disord. 1999;25(3):349–51. https://doi.org/10.1002/(sici)1098-108x(199904)25:3%3C349::aid-eat15%3E3.0.co;2-m.
38. Mathers-Jones J, Todd J. Ecological anxiety and pro-environmental behaviour: the role of attention. J Anxiety Disord. 2023;98:102745. https://doi.org/10.1016/j.janxdis.2023.102745.
39. Mayrhofer R, Roberts LM, Hackl JM, Frischholz K. Psychological differences and similarities between vegans, prospective vegans, and vegetarians. Motivation, knowledge, vegan literacy – and cheese. Front Psychol. 2024;15. https://doi.org/10.3389/fpsyg.2024.1163869.
40. Mond JM, Hay PJ, Rodgers B, Owen C, Beumont PJV. Validity of the eating disorder examination questionnaire (EDE-Q) in screening for eating disorders in community samples. Behav Res Ther. 2004;42(5):551–67. https://doi.org/10.1016/S0005-7967(03)00161-X.
41. Mond JM, Myers TC, Crosby RD, Hay PJ, Rodgers B, Morgan JF, Lacey JH, Mitchell JE. Screening for eating disorders in primary care: EDE-Q versus SCOFF. Behav Res Ther. 2008;46(5):612–22. https://doi.org/10.1016/j.brat.2008.02.003.
42. Novara C, Pardini S, Pastore M, Mulatti C. Ortoressia nervosa: un'indagine Del Costrutto e Delle Caratteristiche Psicometriche Della versione Italiana Dell'Eating habits Questionnaire- 21(EHQ-21). [Orthorexia nervosa: an investigation of the construct and psychometric properties of the Italian version of the eating habits Questionnaire-21 (EHQ-21)]. Psicoterapia Cognitiva E Comportamentale. 2017;23(3):291–316.
43. Parra-Fernández ML, Manzaneque-Cañadillas M, Onieva-Zafra MD, Fernández-Martínez E, Fernández-Muñoz JJ, Prado-Laguna MDC, Brytek-Matera A. Pathological preoccupation with healthy eating (orthorexia nervosa) in a Spanish sample with vegetarian, vegan, and non-vegetarian dietary patterns. Nutrients. 2020;12(12):3907. https://doi.org/10.3390/nu12123907.
44. Pihkala P. Eco-anxiety and environmental education. Sustainability. 2020;12(23). https://doi.org/10.3390/su122310149.
45. Plohl N, Mlakar I, Musil B, Smrke U. Measuring young individuals' responses to climate change: validation of the Slovenian versions of the climate anxiety scale and the climate change worry scale. Front Psychol. 2023;14. https://doi.org/10.3389/fpsyg.2023.1297782.
46. Prata A, Matos M. Compassion towards nature and well-being: the role of climate change anxiety and pro-environmental behaviors. Sustainability. 2025;17(10). https://doi.org/10.3390/su17104349.
47. Qi B, Presseller EK, Cooper GE, Kapadia A, Dumain AS, Jayawickreme SM, Bulik-Sullivan EC, van Furth EF, Thornton LM, Bulik CM, Munn-Chernoff MA. Development and validation of an Eating-Related Eco-Concern questionnaire. Nutrients. 2022;14(21). https://doi.org/10.3390/nu14214517.
48. Rodgers RF, Paxton SJ, Nagata JM, Becker AE. The impact of climate change on eating disorders: an urgent call for research. Int J Eat Disord. 2023;56(5):909–13. https://doi.org/10.1002/eat.23876.
49. Runfola CD, Safer DL. The role of eco-anxiety in the presentation of bulimia nervosa: A case report. J Eat Disorders. 2024;12(1):164. https://doi.org/10.1186/s40337-024-01118-5.
50. Stewart AE. Psychometric properties of the climate change worry scale. Int J Environ Res Public Health. 2021;18(2). https://doi.org/10.3390/ijerph18020494.
51. Tchonkouang RD, Onyeaka H, Nkoutchou H. Assessing the vulnerability of food supply chains to climate change-induced disruptions. Sci Total Environ. 2024;920:171047. https://doi.org/10.1016/j.scitotenv.2024.171047.
52. Tecuta L, Casu G, Tomba E. Validation of the Italian version of the Eating-Related Eco-Concern questionnaire: insights into its relationship with orthorexia nervosa. Front Psychol. 2024;15. https://doi.org/10.3389/fpsyg.2024.1441561.
53. Trost K, Ertl V, König J, Rosner R, Comtesse H. Climate change-related concerns in psychotherapy: therapists' experiences and views on addressing this topic in therapy. BMC Psychol. 2024;12(1):192. https://doi.org/10.1186/s40359-024-01677-x.
54. UN General Assembly. (2015, ottobre 21). *Transforming our world: The 2030 Agenda for Sustainable Development, A/RES/70/1*. https://www.refworld.org/legal/resolution/unga/2015/en/111816
55. Verplanken B, Marks E, Dobromir AI. On the nature of eco-anxiety: how constructive or unconstructive is habitual worry about global warming? J Environ Psychol. 2020;72:101528. https://doi.org/10.1016/j.jenvp.2020.101528.

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