



OPEN Psychometric properties of the Arabic version of the Eco guilt and Eco grief scales

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The purpose of this study is to validate the Eco Guilt (EGuiQ-11) and Eco Grief (EGriQ-6) scales for the Lebanese population. Conducted in September 2023, this cross-sectional study utilized a snowball sampling method. A total of 763 adult participants provided consent and completed an online survey that included the following scales: the EGuiQ-11, the EGriQ-6, the Arabic Climate Change Anxiety Scale (CCAS), and the Depression Anxiety Stress Scales-8 (DASS-8). The Exploratory Factor Analysis (EFA) of the EGuiQ-11 revealed a good fit for a unidimensional model. Both the EFA and Confirmatory Factor Analysis (CFA) indicated excellent reliability, with a Cronbach's alpha of 0.92 and a McDonald's omega of 0.92. For the EGriQ-6, EFA and CFA results also supported a unidimensional structure with excellent reliability, reflected in an alpha coefficient of 0.83 and an omega coefficient of 0.84. No significant gender differences were observed in EGuiQ-11 ($t(761) = 0.862, p = .389$) and EGriQ-6 ($t(761) = 0.401, p = .689$) scores. Additionally, higher levels of Eco Guilt and Eco Grief were strongly linked to greater psychological distress and increased climate anxiety. These findings make it possible for researchers to use these scales, which assess environmental emotions, in future studies with Arabic-speaking populations in Lebanon. They also highlight the potential impact of environmental changes on mental health.

Keywords Eco grief, Eco guilt, Climate anxiety, Psychological distress, Lebanon

In recent history, the impact of climate change has been hard to ignore. Earthquakes, hurricanes, floods and increasing records of the highest heat levels in human history are remarkably intrusive consequences of ecological shifts that have contributed to worsening mental health¹. A scoping review found that these events were associated with psychological distress, poor well-being and increased hospitalizations in psychiatric units². Another systematic review highlighted the importance of the long-term and short-term effects of climate change and psychological health, which could also be explicit or implicit³. As a result, an increase in research about psychological variables relating to the environmental and ecological changes has been witnessed, including the concepts of Eco guilt and Eco grief³.

In the past, tools were developed to measure emotions related to climate change such as the Climate Change Worry Scale (CCWS), a scale containing 10 items designed to determine worry related to the environment⁴, and the Climate Change Anxiety Questionnaire, a 22-item scale measuring aspects related to ecological anxiety⁵. Both scales focus on negative emotions related to the environment, but do not assess the psychological consequences of these emotions. For that reason, the Eco guilt (EGuiQ) and Eco grief (EGriQ) scales were designed and validated by Ágoston et al. as measures of the psychological outcomes of negative emotional responses (i.e., grief and guilt) to climate change⁶. Both scales showed good psychometric qualities⁶.

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Eco guilt refers to a person's perceived inability to meet personal or societal standards related to the environment. Subsequently, individuals contemplate environmentally polluting activities that they do, which produces a feeling of guilt. The individual experiences remorse regarding implicit or explicit actions that do not abide by environmental norms⁷. Previous research shows that individuals' guilt could stem from their belief that their personal or country's ecological footprint is significantly higher than the norm⁸. Eco grief represents another psychological concept related to the environment. It is experienced when the person observes or expects ecological repercussions that have resulted from important environmental change, which impacts mental health⁹. The mass death of species, the destruction of ecosystems and landscapes can produce Eco grief⁹. Eco grief is related to a feeling of loss regarding one's identity, as the environment is a prominent element of who a person is and produces attachment emotions and behaviors¹⁰. On the other hand, Eco grief can produce prosocial behavior including personal and collective change, and advocacy related to environmental behavior¹¹.

Agoston et al.⁶ were the first to develop scales to assess Eco guilt and Eco grief, named EGuiQ and EGriQ respectively. Participants were recruited using purposive interviewing of individuals whose lives might have been affected by ecological changes⁶. Subsequently, a snowball sampling technique was adopted when recruited participants would recommend further affected interviewees⁶. In the original study, females exhibited higher scores of both Eco guilt and Eco grief⁶. As for age, no association was found with Eco grief while a negative association was found with Eco guilt ($p < .01$)⁶. The one-factor structured EGuiQ consists of 11 items while the EGriQ includes 6 items and fits a single-factor structure as well⁶. Recently, both scales were validated in a German version and demonstrated good psychometric properties¹². The German EGuiQ-11 exhibited a unidimensional structure, and the German EGriQ showed a two-dimensional structure in contrast with the original version of the scale¹². To the best of our knowledge, no other studies validating the EGuiQ-11 and the EGriQ-6 exist at the moment.

In Lebanon, attention given to ecological concern is majorly lacking and focuses on specific ecosystems, as opposed to eliciting personal and public action to preserve the environment and prevent or mitigate the effects of environmental change^{13–15}. Except for a few very recent studies on the topic showing negative impact of climate change on mental health (e.g.¹⁶), many of the studies investigating the status of Lebanese ecological systems and the environment are incredibly outdated^{17–19}. This gap in the literature is likely to cause ambiguity about the current ecological situation in Lebanon. Adding to that, action regarding environmental concerns is heavily contingent on governmental awareness and call for action from the relevant ministries, which is relatively non-existent due to the country being plagued by political, economic and societal uncertainty. These factors have caused ecological impact to become an unexplored element in local psychological health. For these reasons, the aim of the study is to validate the EGuiQ-11 and the EGriQ-6 scales for the Lebanese Arabic-speaking population. We hypothesize that both scales will show a unidimensional factor structure invariant across gender as well as a good internal consistency reliability, and will have a significant positive relationship with psychological distress and climate anxiety measures.

Methods

Sample and procedure

This study had a cross-sectional design. A snowball sampling technique was used to recruit participants. Noting that the snowball sampling was chosen for this study to efficiently access a hard-to-reach population, as participants can refer others who meet the study's criteria, helping researchers build a sample quickly and effectively.

The data was collected during September 2023 through an online questionnaire on Google Forms. It was distributed through social media platforms and messaging applications. The participants eligible for the study needed to be older than 18 years. Exclusion criteria included the following: (1) refusal to participate in the study, and (2) being unable to read and understand the Arabic language. At the beginning of the questionnaire, participants have been presented with the relevant information about the study, including anonymity, confidentiality, and contact details of the research team. Then, it was made clear that by proceeding with the study, the respondent is providing informed consent to participate. The data was stored safely with the principal investigator (SH), protected by a username and password and adhering with all privacy regulations.

Ethics approval and consent to participate

Ethics approval for this study was obtained from the ethics committee of the School of Pharmacy at the Lebanese International University (Reference # 2023RC-021-LIUSOP). Written informed consent was obtained from all subjects; the online submission of the soft copy was considered equivalent to receiving a written informed consent. All methods were performed in accordance with the relevant guidelines and regulations.

Measures

The Eco guilt scale (EGuiQ-11)

This tool by Agoston et al. assesses the degree of guilt a person experiences due to the perceived harmful ecological actions committed by them or their country. It consists of 11 items that are reported on a scale from 1, reflecting the highest level of agreement, to 4, indicating the lowest degree of agreement⁶. Higher scores reflect higher ecological guilt ($\alpha = 0.89$)⁶.

The Eco grief scale (EGriQ-6)

The EGriQ-6 by Agoston et al. is a measure that evaluates to what extent individuals feel grief about the negative consequences witnessed in the environment. There are 6 statements that participants rate on a Likert-type scale from 1 (strongly agree) to 4 (strongly disagree)⁶. The internal consistency of the scale is good ($\alpha = 0.77$)⁶.

The climate change anxiety scale (CCAS)

This instrument estimated to what extent an individual might exhibit fear and worry about the future of the ecological situation. It includes 13 items such as “My concerns about climate change make it hard for me to have fun with my family or friends.” and “I try to reduce my behaviors that contribute to climate change”⁵. The items are scored from 1 (never) to 5 (almost always) ($\alpha = 0.87$)⁵. The Arabic version of the scale was recently validated in a Lebanese sample ($\alpha = 0.96$)²⁰.

The depression anxiety stress scales-8 (DASS-8)

This scale, validated in Arabic, includes 8 items evaluating the level of depression, anxiety and stress²¹. The items are divided as follows: 3 items for depression, 3 items for anxiety and 2 items for stress. The participants score the statements on a Likert scale of 4 levels, 0 being “did not apply to me at all, and 3 indicating “applied to me very much or most of the time”. The higher the scores, the higher the severity of psychological distress. This scale showed excellent reliability ($\alpha = .90$)²¹.

Demographics

Participants were asked to provide their demographic details consisting of age, sex, marital status, highest level of education and socioeconomic status, calculated via the household crowding index by dividing the number of persons by the number of rooms in the house except the kitchen and bathrooms²².

Minimal sample size calculation

The needed sample for the EGuiQ-11 was 55 to 100 participants in order to conduct the Exploratory Factor Analysis (EFA), which is based on 5 to 10 participants for the scale's items²³. Meanwhile, the sample needed for the confirmatory factor analysis (CFA) was 33 to 220 participants according to the suggested minimum sample of a previous study, which was from 3 to 20 times the number of the scale's variables²⁴. As for the EGriQ-6, the minimum samples needed were 30 to 60 and 18 to 160 participants for EFA and CFA respectively.

Translation procedure

According to Beaton guidelines²⁵, and before their use in the current study, the EGuiQ-11 and the EGriQ-6 scales were translated and adapted to the Arabic language and context (English items of both scales can be found in Table S1 in the Supplementary material and Arabic items of both scales can be found in Table S2 in the Related files). To this end, it was translated to the Arabic language with the purpose of achieving semantic equivalence between measures in their original and Arabic versions following international norms and recommendations²⁶. For this, the forward and backward translation method was applied. The English version was translated to Arabic by a Lebanese translator who was completely unrelated to the study. Afterwards, a Lebanese psychologist with a full working proficiency in English, translated the Arabic version back to English. The translation team ensured that any specific and/or literal translation was balanced. The initial and translated English versions were compared to detect/eliminate any inconsistencies and guarantee the accuracy of the translation. The translation committee was composed of two psychiatrists and one psychologist, in addition to the research team and the two translators²⁷. An adaptation of the measure to our specific context was performed. It sought to determine any misunderstanding of the items wording as well as the ease of items interpretation. This procedure was done to ensure the conceptual equivalence of the original and Arabic scales in both contexts²⁸. After the translation and adaptation of the scale, a pilot study was done on 30 patients to ensure all questions were well understood. No changes were made after the pilot study.

Data analysis

A CFA was conducted on the total sample to confirm the one-dimensionality of both scales. Maximum Likelihood was used as the method of estimation. The following fit indices were calculated to check the adequacy of the model: the Steiger-Lind root mean square error of approximation (RMSEA), the Tucker-Lewis Index (TLI) and the comparative fit index (CFI). Values ≤ 0.05 for SRMR, ≤ 0.08 for RMSEA, and 0.90 for CFI and TLI indicate good fit of the model to the data²⁹. At first, multivariate normality was not verified (Bollen-Stine bootstrap $p = .008$). Subsequently, non-parametric bootstrapping procedure was performed. Correlation between residuals was inserted in case of high modification indices. The average variance extracted (AVE) was used to assess evidence of convergent validity, with values of ≥ 0.50 considered adequate³⁰.

Gender invariance

A multi-group CFA using the total sample was performed to evaluate gender invariance of the EGuiQ-11 and the EGriQ-6 scores³¹. We assessed measurement invariance at the configural, metric, and scalar levels³². As per international recommendations³³, we accepted $\Delta CFI \leq 0.010$ and $\Delta RMSEA \leq 0.015$ or $\Delta SRMR \leq 0.010$ as evidence of invariance³⁴.

The Cronbach's α and McDonald's ω coefficients were used to examine reliability, with values greater than 0.70 reflecting adequate composite reliability. The EGuiQ-11 and the EGriQ-6 scores were considered normally distributed according to their skewness and kurtosis values varying between ± 1 ³⁵. Then, we used the Student t test to compare two means. In addition, we used the Pearson test to correlate those scores with psychological distress and climate anxiety scores. Based on Cohen³⁶, correlation coefficient values ≤ 0.10 were considered weak, ~ 0.30 were considered moderate, and ~ 0.50 were considered strong correlations.

Results

Seven hundred sixty-three adults filled the survey, with a mean age of 28.46 ± 11.09 years and 63.4% females. Other details about the sample are provided in Table 1.

Concurrent validity

Higher EGuiQ-11 scores were significantly associated with higher psychological distress ($r=.30; p<.001$) and higher climate anxiety ($r=.56; p<.001$). In addition, higher EGriQ-6 scores were significantly associated with more psychological distress ($r=.26; p<.001$) and higher climate anxiety ($r=.43; p<.001$). Higher EGuiQ-11 scores were significantly and positively associated with higher EGriQ-6 scores ($r=.70; p<.001$).

Confirmatory factor analysis (CFA) of the EGuiQ-11

The unidimensional model was tested via a CFA. Results indicated that the fit of the scale was modest: RMSEA=0.102 (90% CI 0.093, 0.111), SRMR=0.039, CFI=0.939, TLI=0.923. When adding correlations between residuals of items 8–10 and 9–11, the indices improved: RMSEA=0.086 (90% CI 0.077, 0.096), SRMR=0.033, CFI=0.958, TLI=0.945. The AVE value was adequate as well (=0.58) (Fig. 1). The reliability was excellent as shown via the alpha coefficient (=0.94) and the omega coefficient (=0.94).

Confirmatory factor analysis (CFA) of the EGriQ-6

CFA indicated that the fit of the factor-structure of the scale was modest: RMSEA = 0.097 (90% CI 0.078, 0.119), SRMR = 0.024, CFI = 0.974, TLI = 0.957. The AVE value was adequate as well (=0.58). The reliability was excellent as shown via the alpha coefficient (=0.90) and the omega coefficient (=0.90) (Fig. 2). Table 2 shows the loading factors obtained from CFA for the both scales.

Gender invariance of the EGuiQ-11 and the EGriQ-6

We were able to show the invariance across gender at the configural, metric, and scalar levels for both the EGuiQ-11 and the EGriQ-6 scales (Table 3). No statistically significant difference between males and females was found in terms of EGuiQ-11 scores ($M=23.05, SD=7.24$ vs. $M=23.42, SD=7.38, t(761) = -0.67, p=.505$) and EGriQ-6 scores ($M=13.37, SD=4.24$ vs. $M=13.74, SD=4.31, t(761) = -1.15, p=.250$).

Discussion

In the present study, one of the central aims was to validate the EGuiQ-11 scale in order to assess Eco guilt among Lebanese adults. We conducted the EFA of the scale, which confirmed that all items measured Eco guilt. Having said that, 3 items were deemed as doublets and removed. Consequently, the final validated scale consisted of 11 items. The findings indicate excellent reliability ($\alpha=0.92; \omega=0.92$) in agreement with the original scale's results ($\alpha=0.89$)⁶ and a version validated for the German-speaking population ($\alpha=0.93$)¹².

Similarly, the study aimed to validate the EGriQ-6 scale to evaluate Eco grief among Lebanese adults. As a result of the EFA of the scale, 2 items were identified as doublets and omitted from the final validated version, which was made up of 4 items. The results also showed excellent reliability ($\alpha=0.83; \omega=0.83$) in comparison with the original scale's outcome ($\alpha=0.77$)⁶ and the German validated version ($\alpha=0.82$)¹². In both the original⁶ and the German¹² validated versions, EFA showed good fit for a single-factor solution. Meanwhile, the current findings show that the EFA for Eco grief indicated a unidimensional model, similar to the original scale⁶. This might be an indicator of the homogeneity of the Eco grief measure, as it assesses general grief related to the environment. Overall, the current results indicate that the validated EGuiQ-11 and the EGriQ-6 scales into Arabic are accurate means of assessment of the mentioned concepts within the Lebanese Arabic-speaking adult population.

Having said that, the RMSEA values were suboptimal for the EGuiQ-11 and the EGriQ-6 in our study (Table 3). The content of the items could be ambiguous for some participants given that ecological awareness in Lebanon is limited. Findings have shown that ecological activities in educational institutions are often followed without critically evaluating the reasons behind such incentives³⁷. Ecological awareness could be predominantly constricted by limited local ecological knowledge, which can differ from one subculture to another³⁸. Moreover, Lebanese individuals' awareness of the ecological situation is challenged by political and security instability³⁹, shifting their attention to basic human needs. These cultural and socio-political reasons can also aid in explaining

Variable	N (%)
Gender	
Male	279 (36.6%)
Female	484 (63.4%)
Marital status	
Single	511 (67.0%)
Married	252 (33.0%)
Education	
Secondary or less	149 (19.5%)
University	614 (80.5%)
	Mean ± SD
Age (years)	28.57 ± 11.08
Household crowding index (persons/room)	1.15 ± 0.52

Table 1. Sociodemographic and other characteristics of the sample (N=763).

Original item number	Items	Loading factor
Model 1: EGuiQ-11		
1	I very often feel that what I do for the environment is not enough, because it cannot balance other negative behaviors	0.65
2	At times I feel some personal responsibility for the problems and unfolding impacts of climate change.	0.76
3	I blame myself for often behaving in an environmentally destructive way in situations where it could have been avoided.	0.81
4	I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.	0.80
5	I often feel like a hypocrite when it comes to environmental action.	0.77
6	I feel guilty for not paying enough attention to the issue of climate change.	0.82
7	The more I know about the human causes of climate change, the more things I feel guilty about.	0.77
8	I am constantly angry with myself because I think that I am not doing enough and that I am harming the environment by my very existence.	0.76
9	It makes me feel uneasy that I am part of a system that is amplifying climate change.	0.78
10	I often blame myself for the fact that my needs and my work are not really important, but they contribute to the destruction of the environment.	0.75
11	I feel guilty when I do something polluting that I had stopped doing before.	0.72
Model 2: EGriQ-6		
1	I feel some sense of loss because of climate change impacts that are becoming apparent in my local area.	0.68
2	Watching videos of the destruction of the environment makes me cry.	0.64
3	It makes me sad that I don't see many of the plants and animals I used to see often.	0.82
4	It is frightening that climate change is causing the destruction of natural areas at such a dramatic rate that they will never be the same again.	0.85
5	The wildlife around me has changed in a disturbing way.	0.82
6	I am not comforted by the thought that nature can regenerate itself to some extent, because what we have destroyed will never return.	0.80

Table 2. Standardized estimates of factor loadings from the Confirmatory Factor Analysis of the EGuiQ-11 and the EGriQ-6.

the gender invariance found in our study in terms of Eco Guilt and Eco Grief scores. The original study hypothesized that females, being more environmentally conscious, would score higher on Eco guilt and Eco grief scales⁶. This hypothesis was later confirmed; however, gender was deemed to be a minimally influential factor when it comes to Eco guilt and Eco grief⁶. Similar results were found in the study validating the EGuiQ-11 and the EGriQ-6 scales for the German population, with females scoring slightly higher than males¹². Environmental awareness and action are heavily dependent on a country's economic power and governmental policies, which is the case in Lebanon⁴⁰. In fact, some major environmental issues in Lebanon are caused by the lack of economic measures⁴¹, potentially affecting knowledge and call for action regarding environmental concerns. It is fair to assume that the absence of economic resources and current governmental strategies, such as national awareness campaigns, might affect the overall Lebanese population's stance on pro-environmental beliefs and behaviors irrespective of gender. As a result, this could contribute to the absence of significant gender differences in Eco guilt and Eco grief scores in the present sample.

In line with the initial study by Ágoston et al.⁶, we found that the correlation between Eco guilt and Eco grief was positive and significant ($r = .70$; $p < .001$), indicating that feelings of guilt regarding environmental actions and experiencing grief as a result of observing negative environmental outcomes are interrelated. Eco guilt is characterized by being blaming oneself for failing in one's individual responsibility towards the environment, being critical of others' actions impacting the environment negatively and feeling chronic guilt about one's current and previous actions⁴². Meanwhile, Eco grief involves feelings of sadness and distress towards the loss of species and expecting more losses in the future⁴². This prompts prospective research regarding Eco guilt and Eco grief scores within the Lebanese population to examine the possibility of a significant relationship. According to Abraham Maslow, humans have needs that exist in a hierarchical system, and one must be achieved before elevating to the next category⁴³. The first category consists of basic physiological needs including food, water, shelter, and breathable air, which can be compromised in the case of ecological disasters such as floods, wildfires and deforestation⁴⁴. As a consequence, a deficiency in or absence of the components essential for achieving physiological needs may cause psychopathology, psychological distress resulting from variables such as Eco guilt and Eco grief, and hinder humans from reaching higher-order needs. Andrew and Smith previously introduced the term "Emotional Geography" stating that humans are emotionally impacted by their environments⁴⁵. Based on the theory of Emotional Geography, humans experience grief when observing the ecological disasters occurring due to their behaviors and feel guilty⁴⁵. Similarly, a model of moral emotions defines guilt as the product of less than favorable moral evaluation of oneself⁴⁶. As a result, grief caused by loss of ecological resources might exacerbate feelings of moral guilt⁴⁷.

Adding to the current findings, Eco guilt showed a positive association with psychological distress ($r = .30$; $p < .001$) and climate anxiety ($r = .56$; $p < .001$). In general, feelings and intensity of guilt are positively correlated with depression (95%-CI = 26.2–48.7)⁴⁸. Moreover, ecological anxiety was related to ecological emotions⁴⁹, which could possibly include Eco guilt. In a similar study, Eco guilt had a positive relationship with climate anxiety

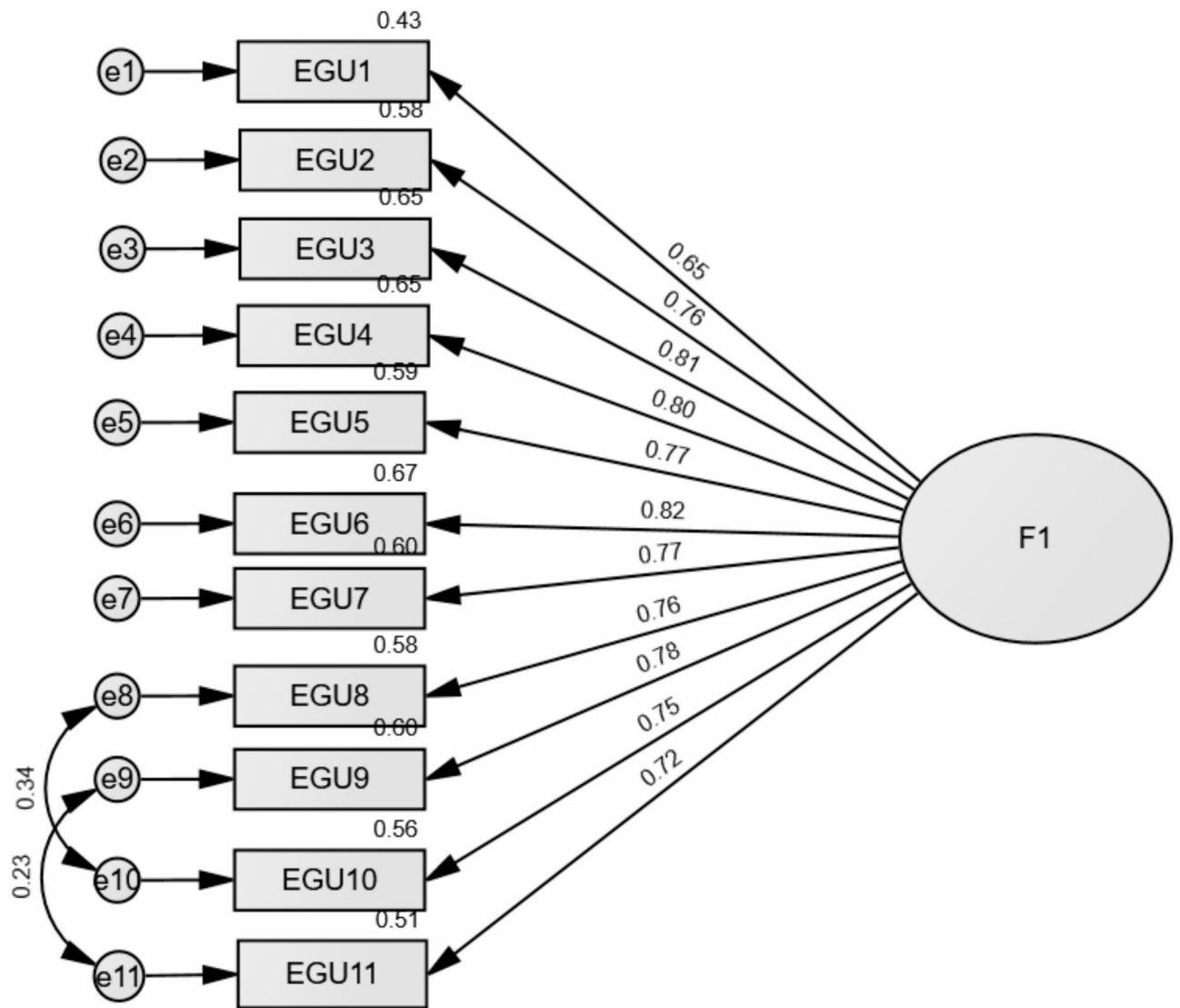


Fig. 1. Standardized Estimates of Factor Loadings from the Confirmatory Factor Analysis of the EGuiQ-11.

($p < .01$)¹². It can be hypothesized that ecological emotions such as guilt can be rooted in moral distress, which is also connected to overall psychological distress⁵⁰. Also, Eco grief had a positive correlation with psychological distress ($r = .26$; $p < .001$) and climate anxiety ($r = .43$; $p < .001$). First, it was suggested that Eco grief is a normative reaction to environmental change that can affect mental health⁹. In the past, different factors were associated with Eco grief such as anxiety and distress related to climate⁵¹. Likewise, it has been established that Eco grief and ecological anxiety are closely related⁵². Therefore, the results of our study are in accordance with previous research. A model previously suggested that depression is a stage of grieving when witnessing detrimental ecological events, where the individual experiences upset and distress⁵³, which could explain this study's results.

Some limitations should be noted. First, the EGuiQ-11 and EGriQ-6 scales have only been validated once to another population, apart from the original study making the scales. This means that the literature does not offer significant content to compare previous validations with the current validation of the scale for the Lebanese population. Second, the data was collected from a self-administered online questionnaire, which increases the probability of response bias. Furthermore, the use of an online questionnaire also limits the ability for participants who do not have Internet access to take part in the study. A snowball sampling method was used in this study, making the sample less representative. In addition, the sample's mean age (28.46 years) and the gender distribution (63.4% females) may not accurately reflect the population of Lebanese adults, limiting the study's external validity. Also, adult participants from the general population who were included in this study could have intellectual, developmental or learning disabilities that affect the quality of responses. Future studies need to consider these conditions as exclusion criteria. Lastly, only two professionals conducted the translation process for the EGuiQ-11 and EGriQ-6 scales due to lack of funds.

In this study, the EGuiQ-11 for Eco guilt and EGriQ-6 for Eco grief scales were validated for the Arabic-speaking Lebanese population. No gender variance was found for both scales. In addition, higher Eco guilt

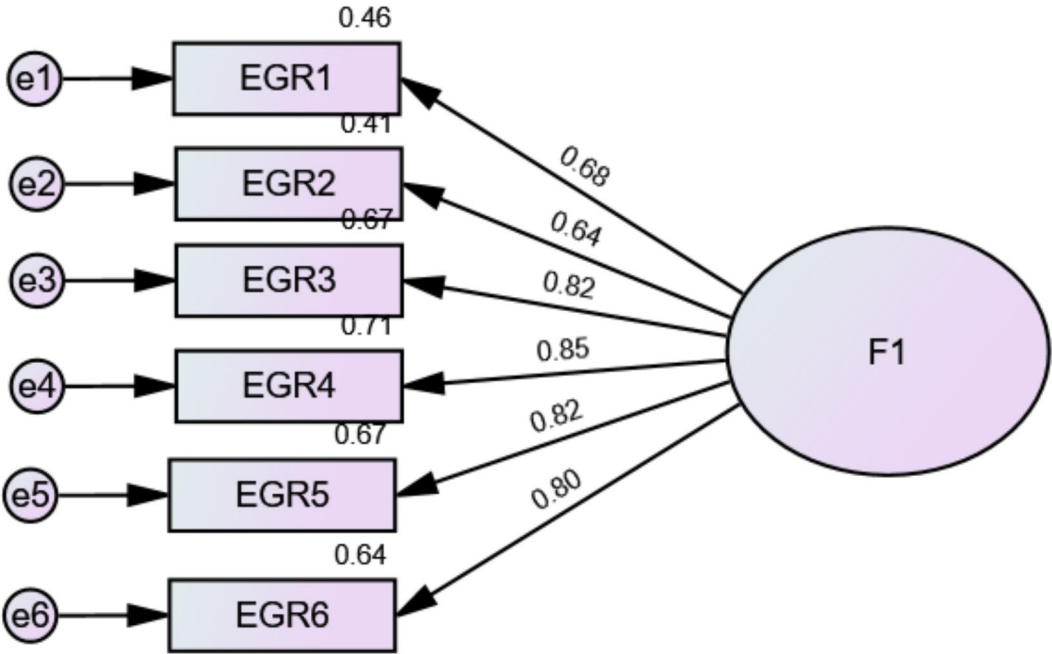


Fig. 2. Standardized Estimates of Factor Loadings from the Confirmatory Factor Analysis of the EGriQ-6.

Model	CFI	RMSEA	SRMR	Model Comparison	ΔCFI	ΔRMSEA	ΔSRMR
Model 1: EGuiQ-11							
Males	0.938	0.104	0.046				
Females	0.955	0.091	0.035				
Configural	0.949	0.068	0.046				
Metric	0.948	0.065	0.049	Configural vs. metric	0.001	0.003	0.003
Scalar	0.947	0.062	0.049	Metric vs. scalar	0.001	0.003	<0.001
Model 2: EGriQ-6							
Males	0.963	0.114	0.040				
Females	0.969	0.110	0.029				
Configural	0.967	0.079	0.040				
Metric	0.964	0.073	0.048	Configural vs. metric	0.003	0.006	0.008
Scalar	0.960	0.069	0.048	Metric vs. scalar	0.004	0.004	<0.001

Table 3. Measurement invariance of the EGuiQ-11 and the EGriQ-6 scales across gender in the total sample. CFI=Comparative fit index; RMSEA=Steiger-Lind root mean square error of approximation; SRMR=Standardized root mean square residual.

levels were significantly associated with more depression, anxiety and stress, as well as higher climate anxiety. Similar results were found for Eco grief scores as it had a positive correlation with psychological distress and climate anxiety. These results enable researchers to use scales assessing emotions related to the environment for future studies in Lebanon. It also clarifies the association between the possible effects of environmental change on mental health.

Practical implications

The current findings call attention to a topic that is not well-researched in Lebanon. It also provides a validation for reliable scales assessing emotions related to the environment, the EGuiQ-11 for Eco guilt and EGriQ-6 for Eco grief. Moreover, it highlights the importance of investigating ecologically-related emotions in the clinical setting as it might have an impact on psychological distress. This reinforces the value of evaluating the psychological outcomes of climate change and utilizing it in guiding prosocial behavior to address ecological concerns, which can potentially improve the general population's mental well-being.

Future directions

The current findings show the importance of creating interventions that resonate with people. It is essential to invite citizens to critically think about the ecological situation in Lebanon instead of merely participating in

environmentally-friendly behavior. The government must put policies in action by making awareness campaigns that educate the Lebanese people, showing them how environmental changes impacts their psychological and physical health. These policies accompanied by awareness campaigns and call for action could generate habitual behavior that can actually make a change. Scientists in the mental health field should be employed by governmental agencies to research the tremendous significance of ecological changes on human behavior, thoughts and emotions as a first step towards ecological awareness.

Data availability

All data generated or analyzed during this study are not publicly available due the restrictions from the ethics committee, but are available upon a reasonable request from the corresponding author.

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References

- Palinkas, L. A. & Wong, M. Global climate change and mental health. *Curr. Opin. Psychol.* **32**, 12–16 (2020).
- Charlson, F. et al. Climate Change and Mental Health: a scoping review. *Int. J. Environ. Res. Public Health.* **18** (9), 4486 (2021).
- Cianconi, P., Betrò, S. & Janiri, L. The Impact of Climate Change on Mental Health: a systematic descriptive review. *Front. Psychiatry.* **11**, 74 (2020).
- Stewart, A. E. Psychometric properties of the climate change worry scale. *Int. J. Environ. Res. Public Health.* **18** (2), 494 (2021).
- Clayton, S. & Karazsia, B. T. Development and validation of a measure of climate change anxiety. *J. Environ. Psychol.* **69**, 101434 (2020).
- Ágoston, C. et al. The psychological consequences of the ecological crisis: three new questionnaires to assess eco-anxiety, eco-guilt, and ecological grief. *Clim. Risk Manage.* **37**, 100441 (2022).
- Mallett, R. K. Eco-guilt motivates eco-friendly behavior. *Ecopsychology* **4** (3), 223–231 (2012).
- Mallett, R. K., Melchiori, K. J. & Strickroth, T. Self-confrontation via a Carbon Footprint Calculator increases guilt and support for a Proenvironmental Group. *Ecopsychology* **5** (1), 9–16 (2013).
- Cunsolo, A. & Ellis, N. R. Ecological grief as a mental health response to climate change-related loss. *Nat. Clim. Change.* **8** (4), 275–281 (2018).
- Engstrom, S. Recognising the Role Eco-grief Plays in Responding to Environmental Degradation. (2019).
- Bright, M. L. & Eames, C. From apathy through anxiety to action: emotions as motivators for youth climate strike leaders. *Australian J. Environ. Educ.* **38** (1), 13–25 (2022).
- Zeier, P. & Wessa, M. Measuring Eco-Emotions-A German version of questionnaires on eco-guilt, ecological grief, and eco-anxiety. (2023).
- Badreddine, A., Abboud-Abi Saab, M., Gianni, F., Ballesteros, E. & Mangialajo, L. First assessment of the ecological status in the Levant Basin: application of the CARLIT index along the Lebanese coastline. *Ecol. Ind.* **85**, 37–47 (2018).
- Darwish, T. et al. Sustaining the ecological functions of the Litani River Basin, Lebanon. *Int. J. River Basin Manage.* **21** (1), 37–51 (2023).
- Ghoussein, Y. et al. Biology and ecology of *Pontederia crassipes* in a Mediterranean river in Lebanon. *Aquat. Bot.* **188** (103681), 103681–103611 (2023).
- Fekih-Romdhane, F. The relationship between climate change anxiety and psychotic experiences is mediated by death anxiety. *Int. J. Soc. Psychiatry* **70**(3), 574–581 <https://doi.org/10.1177/00207640231221102> (2024).
- Taslakian, M. J., Hardy, J. T. & American Univ BDOB. Sewage nutrient enrichment and phytoplankton ecology along the central coast of Lebanon. *Mar. Biol.* **38** (4), 315–325 (1976).
- Boydak, M. Regeneration of Lebanon cedar (*Cedrus libani* A. Rich.) on karstic lands in Turkey. In., vol. 178. Amsterdam: Elsevier B.V.; 231–243. (2003).
- Talhouk, S. N., Zurayk, R. & Khuri, S. Conservation of the coniferous forests of Lebanon: past, present and future prospects. *Oryx* **35** (3), 206–215 (2001).
- Fekih-Romdhane, F. et al. Translation and validation to the Arabic language version of the climate change anxiety scale (CCAS). *BMC Psychiatry* **24**(1), 507. <https://doi.org/10.1186/s12888-024-05956-0>.
- Ali, A. M. et al. Psychometric evaluation of the depression anxiety stress scale 8-items (DASS-8)/DASS-12/DASS-21 among family caregivers of patients with dementia. *Front. Public Health.* **10**, 1012311–1012311 (2022).
- Melki, I. S., Beydoun, H. A., Khogali, M., Tamim, H. & Yunis, K. A. National Collaborative Perinatal neonatal N: Household crowding index: a correlate of socioeconomic status and inter-pregnancy spacing in an urban setting. *J. Epidemiol. Community Health.* **58** (6), 476–480 (2004).
- Andrew, L. & Comrey, H. B. L. *A First Course in Factor Analysis* (Taylor and Francis, 2013).
- Mundfrom, D. J., Shaw, D. G. & Ke, T. L. Minimum sample size recommendations for conducting factor analyses. *Int. J. Test.* **5** (2), 159–168 (2005).
- Guillemin, F., Bombardier, C. & Beaton, D. Recommendations for the cross-cultural adaptation of health status measures. *J. Clin. Epidemiol.* **46** (12), 1417–1432 (1993).
- Van Widenfelt, B. M. et al. Translation and cross-cultural adaptation of assessment instruments used in psychological research with children and families. *Clin. Child. Family Psychol. Rev.* **8**(2). (2005).
- Fenn, J., Tan, C-S. & George, S. Development, validation and translation of psychological tests. *BJPsych Adv.* **26** (5), 306–315 (2020).
- Ambuehl, B. & Inauen, J. Contextualized measurement scale adaptation: a 4-Step tutorial for health psychology research. *Int. J. Environ. Res. Public Health.* **19** (19), 12775 (2022).
- Hu, L. & Bentler, P. M. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* **6** (1), 1–55 (1999).
- Malhotra, N., Hall, J., Shaw, M. & Oppenheim, P. *Essentials of Marketing Research: An Applied Orientation (Custom Edition)* 2 edn (Pearson Education Australia, 2010).
- Sokolov, B. *Sensitivity of Goodness of Fit Indices to Lack of Measurement Invariance with Categorical Indicators and Many Groups* (Federal Reserve Bank of St Louis, 2019).
- Vandenberg, R. J. & Lance, C. E. A review and synthesis of the Measurement Invariance Literature: suggestions, practices, and recommendations for Organizational Research. *Organizational Res. Methods.* **3** (1), 4–70 (2000).
- Cheung, G. W. & Rensvold, R. B. Evaluating goodness-of-fit indexes for Testing Measurement Invariance. *Struct. Equ. Model.* **9** (2), 233–255 (2002).
- Fekih-Romdhane, F. et al. Translation and validation of the mindful eating behaviour scale in the Arabic language. *BMC Psychiatry* **23**(1), 120. <https://doi.org/10.1186/s12888-023-04614-1>

35. Hair, J. Jr., Sarstedt, M., Ringle, C. M., Gudergan, S. P. & ADVANCED ISSUES IN PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING. In: *Advanced Issues in Partial Least Squares Structural Equation Modeling* (SAGE, Incorporated, 2017).
36. Cohen, J. A power primer. *Tutorials Quant. Methods Psychol.* **3** (2), 79–79 (2007).
37. Ghosn-Chelala, M. & Akar, B. Citizenship education for environmental sustainability in Lebanon: public school teachers' understandings and approaches. *Environ. Educ. Res.* **27** (3), 366–381 (2021).
38. Baydoun, S. et al. An Initial Assessment of Community Values, rules, and traditional ecological knowledge of Mount Hermon, Lebanon: key perspectives towards Biocultural Conservation. *Hum. Ecol.* **2024**:1–16.
39. Naoufal, N. Peace and environmental education for climate change: challenges and practices in Lebanon. *J. Peace Educ.* **11** (3), 279–296 (2014).
40. Djoundourian, S. Environmental movement in Lebanon. *Environ. Dev. Sustain.* **11** (2), 427–438 (2009).
41. Massoud, M. A., Mokbel, M. & Alawieh, S. Reframing environmental problems: lessons from the solid waste crisis in Lebanon. *J. Mater. Cycles Waste Manage.* **21** (6), 1311–1320 (2019).
42. Ágoston, C. et al. Identifying types of eco-anxiety, eco-guilt, eco-grief, and eco-coping in a climate-sensitive population: a qualitative study. *Int. J. Environ. Res. Public Health.* **19** (4), 2461 (2022).
43. Poston, B. J. T. Maslow's hierarchy of needs. *41*(8):347–353. (2009).
44. Wissing, R., Jones, D. & Klas, A. The crucial role of private domestic gardens in achieving sustainable cities: a model linking the person, Maslow's Hierarchy and Millennium Ecosystem Assessment to sustainably meeting ecological and human needs. In: *2018: 8th State of Australian Cities National Conference*, 28–30 November 2017, Adelaide, Australia.
45. Anderson, K. & Smith, S. J. Emotional geographies. *Trans. Inst. Br. Geogr.* **26** (1), 7–10 (2001).
46. Tangney, J. P. & Dearing, R. L. *Shame and guilt*: Guilford Press; (2003).
47. Haidt, J. The moral emotions. *Handb. Affect. Sci.* **11** (2003), 852–870 (2003).
48. Luck, T. & Luck-Sikorski, C. Feelings of guilt in the general adult population: prevalence, intensity and association with depression. *Psychol. Health Med.* **26** (9), 1143–1153 (2021).
49. Kurth, C. & Pihkala, P. Eco-anxiety: what it is and why it matters. *Front. Psychol.* **13**, 981814–981814 (2022).
50. Banwell, N. & Eggert, N. Rethinking ecoanxiety through environmental moral distress: an ethics reflection. *J. Clim. Change Health* **2023**, 100283.
51. Pihkala, P. Eco-anxiety and Environmental Education. *Sustain. (Basel Switzerland)*. **12** (23), 10149 (2020).
52. Ojala, M., Cunsolo, A., Ogunbode, C. A. & Middleton, J. Anxiety, worry, and grief in a time of Environmental and Climate Crisis: a narrative review. *Annu. Rev. Environ. Resour.* **46** (1), 35–58 (2021).
53. Running, S. W. *The 5 Stages of Climate Grief* (In.: ScholarWorks at University of Montana, 2007).

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Author contributions

FFR and SH designed the study; EA drafted the manuscript; SH carried out the analysis and interpreted the results; FS, MD and SEK collected the data. DM, KI and SO reviewed the paper for intellectual content; all authors reviewed the final manuscript and gave their consent.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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