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Development and validation of the climate change health protection behaviors scale for adolescents: a methodological study

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ABSTRACT

This study aimed to develop and validate the Climate Change Health Protection Behaviors Scale for adolescents. A total of 1036 adolescents were recruited from middle and high schools. The development of the assessment scale was carried out in three steps: item generation, content validity evaluation, and psychometric evaluation. Psychometric testing was conducted to determine the relationship between the resulting factors and the Healthy Lifestyle Belief Scale and Climate Change Awareness Scale. A 28-item scale was developed, consisting of four factors that account for 65.0% of the variance. The Cronbach's alpha value was 0.874. Additionally, a positive correlation was observed between the Climate Change Health Protection Behaviors Scale and both the Climate Change Awareness Scale and the Healthy Lifestyle Belief Scale for adolescents. These results suggest that the Climate Change Health Protection Behaviors Scale is a reliable and valid tool for evaluating health protection behaviors related to climate change in adolescents.

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KEYWORDS
Climate change; health protection; adolescents; scale development

Introduction

Direct impacts of climate change include heat waves, floods, storms, and extreme weather events (Bell et al. 2018). Climate change can have both direct and indirect impacts on health (Wang et al. 2016). Indirect impacts include changes in infectious diseases, water availability, and food supply (Helldén et al. 2021). Diseases are highly sensitive to changes in climate elements. Climate change and diseases such as diarrhea and malaria have a global impact on malnutrition, which disproportionately affects children and adolescents (Chevance et al. 2023). Environmental degradation poses challenges for children and adolescents living in both urban and rural areas, leading to long-term malnutrition and diarrhea due to inadequate access to water and food (Ojala 2023). In regions where extreme weather events occur, such as extreme heat, flooding, and drought, adolescents may be at risk for mental health effects, such as depression and post-traumatic stress disorder (Rother et al. 2022). Adolescents may be the most affected group and experience psychological problems as a consequence of climate change (Veijonaho et al. 2024).

Given that adolescence is a period during which individuals should be learning about climate change in school and that the younger generation will become future leaders of society, it can be argued that it is important to ascertain whether this age group is aware of prevention behaviors against adverse health conditions that may occur due to climate change (Ojala 2023). To effectively reach this subgroup, health professionals must possess a deeper understanding of the

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aforementioned factors. From middle childhood to late adolescence, many young people may experience negative emotions such as anxiety, sadness, anger, helplessness, and pessimism related to climate change issues and the global future (Veijonaho et al. 2024). The utilization of problem-focused coping strategies by adolescents in response to these emotions is associated with an increased likelihood of experiencing negative affect in daily life (Wullenkord and Ojala 2023). Adolescents may be more likely to be concerned about climate change (Ojala 2021). Therefore, it is important to make an accurate assessment and intervene to address the negative effects of global climate change on adolescent health (Ojala et al. 2021).

The significance of researching the impact of climate change on adolescent health and health protection behaviors is growing due to the rising occurrence of extreme weather events, such as extreme heat, flooding, and drought in Turkey (Hacısalihoğlu and Balcı 2023). Academics from various fields and disciplines have conducted numerous studies on the relationship between climate change and the health protection behaviors of adolescents (Wang et al. 2016; Helldén et al. 2021). Several studies have also examined the main factors that affect health-promoting behaviors among adolescents (Almutairi et al. 2018; Tabrizi et al. 2024). Ojala conducted studies among Swedish adolescents to explore their concerns, hopes, developmental effects, and coping mechanisms related to climate change and crisis (Ojala et al. 2021; Ojala 2023). Bakouei et al. (2018) also conducted a study to determine the status and predictors of health-promoting behaviors among adolescents in Iran and Saudi Arabia.

The literature review reveals measurement tools related to climate change awareness in adolescents (Ataklı and Kuran 2021; Gönen et al. 2023), climate change attitude behavior (Christensen and Knezek 2015), and climate change risk and problem perception (Chevance et al. 2023). A scale was developed to assess climate change awareness among adolescents in Turkey. The sub-dimensions of this scale were climate change awareness, perception of the problem, information on the causes of climate change, climate change concern, expectations from behaviours and policies (Ataklı and Kuran 2021). Another scale was developed to measure the emotional reactions of secondary school students in Turkey towards the environment and climate change. The sub-dimensions of this scale were reasons of climate change, recklessness act to climate change (Gönen et al. 2023). In the United States, a scale was developed to test the climate change awareness of high school students (Christensen and Knezek 2015). However, these measurement tools do not include items related to evaluating health behaviors that may arise due to climate change. The purpose of this study is to create the Climate Change Health Protection Behavior Assessment Scale (CCHPB) for adolescents. Currently, there is no measurement tool available that directly evaluates behaviors aimed at protecting against the negative effects of climate change on health in this context.

Material and methods

Design

This is a methodological study aimed at developing the CCHPB and evaluating its psychometric properties (Streiner et al. 2015). The process of this methodological study consists of three stages: item development, content validity, and evaluation of psychometric properties (DeVellis and Thorpe 2021) (Figure 1).

Participants

The study was conducted in a city center in the Western Black Sea Region of Turkey, which is known for frequent hot weather and floods due to climate change (Halis et al. 2022). To ensure unbiased data, adolescents were randomly selected from two middle schools and two high schools in the city center. A total of 1074 students, including all 7th and 8th graders in middle schools and high school students,

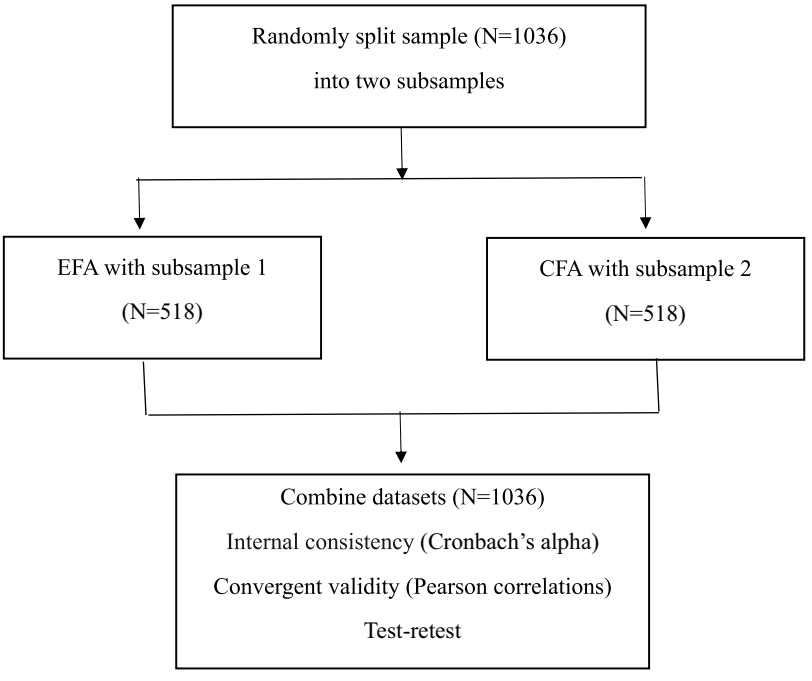

Figure 1. Data analysis plan.

were invited to participate in the study. Due to the students' unavailability during the data collection process, 38 students were unable to be contacted. Out of the total number, 1036 adolescents participated, resulting in a participation rate of 96.4%. The scale utilized in this study was developed and validated using two different randomized samples. To establish the construct validity of the scale, the total sample was randomly divided into two subsamples. The first subsample, comprising 518 adolescents, underwent exploratory factor analysis (EFA), while the second subsample, also consisting of 518 adolescents, underwent confirmatory factor analysis (CFA) (Figure 1).

The study involved adolescents with an average age of 14.88 ± 1.72 years (11–18), of whom 56.9% were female. The majority of the adolescents were in 9th grade. The mothers of the adolescents had an average age of 41.07 ± 5.69 (29–60) and mostly (58.4%) had a primary school education. The fathers had an average age of 44.29 ± 5.89 (32–67) and mostly (39.8%) had a high school education. The family income status was mostly (51.2%) reported as income equal to expenditure (Table 1).

Data collection

After receiving approval from the ethics committee and the institution, the researchers informed the school administration and teachers about the study's purpose. The data collection forms were administered to adolescents who had obtained consent from their parents through face-to-face interviews and who had volunteered to participate in the study. The researchers collected data using the "Introductory Information Form," "Climate Change Awareness Scale," and "Healthy Lifestyle Belief Scale for Adolescents."

Introductory Information Form

This form examines the adolescents' age, class, parental education level, family income level and whether they have received any education on global climate before.

Table 1. Participant characteristics ($N = 1036$).

Characteristics	n	%
Gender		
Female	590	56.9
Male	446	43.1
Age	**Mean ± SD=** 14.88 ± 1.72	**Min-Max=**11–18
Grade		
7th	74	7.1
8th	86	8.3
9th	382	36.9
10th	180	17.4
11th	197	19.0
12th	117	11.3
Age of mother	**Mean ± SD=** 41.07 ± 5.69	**Min-Max=**29–60
Mother education status		
Primary school	605	58.4
High school	295	28.5
University	98	9.5
Graduate	38	3.6
Age of father	**Mean ± SD=**44.29 ± 5.89	**Min-Max=**32–67
Father education status		
Primary school	393	37.9
High school	412	39.8
University	179	17.2
Graduate	52	5.1
Family income		
Income is more than expenses	280	27.0
Income equals expenses	530	51.2
Income is less than expenses	2226	21.8

Climate Change Awareness Scale

The Climate Change Awareness Scale, developed by Gönen et al. (2023), evaluates adolescents' awareness of climate change. The scale consists of 17 items and has a Cronbach's alpha value of 0.88. It is divided into two sub-dimensions: Awareness towards the reasons for climate change, which includes 12 items (1–12), and Reckless Acts towards climate change, which includes 5 items (13–17). The scale includes reverse items. As the score on the scale increases, adolescents' awareness of climate change also increases.

Healthy Lifestyle Belief Scale for Adolescents (HLBA)

The Healthy Lifestyle Belief Scale for Adolescents was developed by Melnyk and Small (2003), and validated for Turkish population by Akdeniz Kudubeş and Bektas (2020). It is a five-point Likert-type scale that emphasizes beliefs related to maintaining a healthy lifestyle, including physical activity and nutrition. The scale comprises 16 items, categorized into three sub-dimensions: health beliefs, physical activity, and nutrition. The scale comprises three sub-dimensions: health belief (items 4, 5, 6, 11, 12, 13, and 16), physical activity (items 2, 7, 9, 14, and 15), and nutrition (items 1, 3, 8, and 10). The total score ranges from 16 to 80, with higher scores indicating stronger beliefs in a healthy lifestyle among adolescents. The scale has a Cronbach's alpha coefficient of 0.90.

Scale development

Stage 1: item generation

Three approaches are commonly used in item drafting: deductive, inductive, or a combination of both. In this study, we utilized the deductive method, which is the most recommended approach in

the literature for developing measurement instruments (McKim 2023). The research team conducted a literature search for articles related to the construct under investigation using the keywords "climate change" and "health behavior". During our search, we came across The Climate Change and Health Behaviors Feedback Loops Model, which we focused on for the question items (Chevance et al. 2023). The first author drafted the items in line with the model, and the other authors jointly evaluated them for extraction. We conducted a conceptual analysis of the items to create the first draft and evaluated thematically corresponding items. The resulting structure determined the scope, leading to the creation of a draft consisting of 44 items.

Stage 2: content validity

The item list for the content validation process of the CCHPB was finalized using a two-stage Delphi methodology (Spranger et al. 2022). The draft form items were presented to 12 field experts in pediatric nursing, public health nursing, child psychiatry, and child development, as well as 10 adolescents, to obtain their opinions. During the quantitative stage, experts rated the 44 draft items on a five-point Likert-type scale to accurately reflect the scope. Only items with a quantitative value of 80% or higher were retained in the draft (Spranger et al. 2022). At the end of this phase, 38 items remained for further analysis. During the qualitative phase, we further examined the appropriateness of the items obtained in the quantitative phase. We evaluated adolescents' understanding of the items through focus group discussions. If an item was deemed inappropriate or incomprehensible, we removed it based on the opinions of the adolescents.

A total of 20 adolescents were included in the pilot study. The researchers conducted personal interviews with the adolescents and obtained the responses via direct interaction. The adolescents were requested to complete the forms and provide commentary on any words or sentences that they perceived to be challenging to comprehend. The 20 adolescents included in the pilot study were excluded from the analyses conducted as part of the larger study. Subsequently, the researchers conducted a second review of the ambiguous words and items identified in the pilot study, The final form was determined by the researchers based on their subjective judgments following the interviews with the experts.

Phase 3: psychometric evaluation

Data analysis was performed using SPSS for Windows 22.0 and AMOS 16.0 software. A 95% confidence interval was utilized, and a significance level of $p < 0.05$ was accepted. Descriptive statistics were presented as numbers, percentages, means, and standard deviations. The normal distribution of the data was verified by calculating the skewness and kurtosis between −1.5 and 1.5, as well as the floor and ceiling effects. Responses were evaluated based on whether they fell within the upper or lower 15% category. Exploratory factor analysis (EFA) was conducted after achieving normality in the data, using half of the sample (Subsample 1, $N = 518$). The adequacy of the sample for the analysis was assessed using Kaiser-Meyer-Olkin (KMO) ≥0.70 (Kaiser 1970) and Bartlett's test of sphericity with $p < 0.05$ (Marsh et al. 2020). To determine the potential factor structure of the scale, we conducted principal component analysis with varimax rotation on the data from subsample 1. We then verified the resulting structure from EFA by conducting CFA on another random sample (Subsample 2, $N = 518$) (Figure 1). During CFA, we examined fit indices to determine if the structure was supported, following the method outlined by Marsh et al. (2020).

The internal consistency of the CCHPB was assessed using Cronbach's alpha coefficients and corrected item-subscale correlations. Furthermore, the substantial disparity (i.e. discrimination) in the total score between the 27% lower and upper groups was analyzed. Convergent validity was evaluated by calculating the Pearson correlation coefficients between the CCHPB and CCA and HLBA. Also we examined the Pearson correlation coefficients between the test-retest measurements of CCHPB ($N = 1036$, Figure 1).

Ethics

To conduct the research, ethical approval was first obtained from the social and humanities ethics committee of a university (Protocol no: 2023-SBB-0496, Date: 17 August 2023). Permission was also obtained from the provincial directorate of national education for data collection in middle and high schools (Number: 82939087, Date: 5 September 2023). An informed consent form was presented to the parents of the adolescents, explaining the purpose and scope of the study and the confidentiality of the data. Adolescents were included in the study only if their written informed consent was obtained.

Results

Structural validity

During the initial stage of EFA, the Kaiser-Meyer-Olkin (KMO) measure was 0.794, and Bartlett's test of sphericity was significant ($\chi 2 = 4738.362$, $p < 0.001$). This indicates that further analysis is possible. A varimax rotation analysis was performed on all 36 items to determine the factor structure of the CCHPB. Eight items with factor loadings < 0.40 and placed in more than one factor were removed from the scale. The subsequent analysis only included the remaining 28 items. The eigenvalue explained 65. A 28-item scale consisting of four factors with an eigenvalue > 1 emerged, explaining 59.4% of the variance. Factor 1 pertains to obtaining accurate information about global climate change to protect health (items 1–5), while Factor 2 relates to health behaviors to be implemented when faced with situations caused by climate change (items 6–15). Factor 3 includes health behaviors to be performed after the situations caused by climate change have passed (items 16–22), while Factor 4 includes health behaviors to mitigate climate change (items 23–28), as shown in Table 2.

The study aimed to test the accuracy of the four-factor structure, which comprised of 28 items and emerged from EFA, by conducting CFA on a different sample (subsample 2, $N = 518$). The model fit indices were within acceptable standards: ($\chi 2/sd = 2.749$, CFI = 0.916, NFI = 0.904, IFI = 0.937, RMSEA = 0.050, SRMR = 0.048), and all item coefficients were significant ($p < 0.001$). CFA confirmed the four-factor structure of the scale (Figure 2).

Internal consistency

Internal consistency of the CCHPB was assessed using Cronbach's alpha coefficients for the total scale and each subscale, as well as item-subscale correlations. The Cronbach's alpha values for the CCHPB were 0.874, 0.697, 0.756, 0.756, 0.762, and 0.770 for the total and factors 1, 2, 3, and 4, respectively. Mean item total scores ranged from 0.402 to 0.728. These findings indicate good internal consistency for the total and factors of the CCHPB (Table 3).

The item-total correlations of CCHPB items were found to be above 20%. A significant difference was observed in the total score between the lower and upper 27% groups ($p < 0.001$) on the scale. In this instance, the notable discrepancy between the lower and upper groups provides compelling evidence for the item's discriminatory capacity (Table 3).

Convergent validity

The study tested the convergent validity of the CCHPB by calculating inter-scale correlation coefficients and correlations with the HLBA. Positive correlations were found between the total score of the CCHPB and its four sub-factors ($p < 0.001$). Specifically, the correlation values between the total score of CCHPB and subfactors 1, 2, 3, and 4 were 0.705, 0.943, 0.925, and 0.880, respectively. Additionally, significant correlation values were found between the four sub-factors ($p < 0.001$). Significant positive correlations were found between the total and sub-factors of the

Table 2. Results of the exploratory factor analysis for subsample 1 ($N = 518$).

Items	Factors				Kaiser – Meyer – Olkin measure	Bartlett's test of sphericity	Eigenvalue	Explained variance
	1	2	3	4				
ı1				0.773	0.794	4738,362	3.721	65.594
ı2				0.704		p < 0.001		
ı3				0.664				
ı4				0.567				
ı5				0.702				
ı6			0.682					
ı7			0.677					
ı8			0.735					
ı9			0.706					
ı10			0.501					
ı11			0.660					
ı12			0.595					
ı13			0.834					
ı14			0.749					
ı15			0.614					
ı16		0.702						
ı17		0.755						
ı18		0.738						
ı19		0.720						
ı20		0.712						
ı21		0.772						
ı22		0.777						
ı23	0.741							
ı24	0.666							
ı25	0.703							
ı26	0.785							
ı27	0.640							
ı28	0.492							

CCHPB and the HLBA ($p < 0.001$). The total score of the CCHPB and its subfactors 1, 2, 3, and 4 exhibited correlations of 0.593, 0.455, 0.495, 0.547, and 0.594, respectively, with CCA. Similarly, the total score of the CCHPB and its subfactors 1, 2, 3, and 4 exhibited correlations of 0.589, 0.650, 0.472, and 0.538, respectively, with the HLBA. Test-retest correlation values of CCHPB were between 0.629 and 0.839 (Table 4). At the end of all these data, the scale was finalized (Table 5).

Discusion

The aim of this study was to develop and assess the psychometric properties and factorial structure of the Climate Change Health Protection Behavior Assessment Scale for Adolescents. The scale is designed to evaluate the health protection behaviors of adolescents in situations that may arise as a result of climate change. Climate changes, such as hot weather, flooding, haze, and air pollution, can directly impact the health of adolescents and increase the risk of disease (Chevance et al. 2023). Research conducted in Madrid, Spain, and China with children and adolescents found that rapid fluctuations in temperature and humidity levels significantly increased the transmission of respiratory and infectious diseases (Wang et al. 2016; Helldén et al. 2021). Qualitative studies conducted in Australia and the USA have shown that drought and higher temperatures negatively affect the mental health of adolescents (Younan et al. 2018). Furthermore, haze weather can damage the respiratory tract, alveolar epithelial cells, and lead to various health issues, including asthma, rhinitis, bronchitis, pneumonia, weakened immunity, and metabolic diseases in adolescents (Chevance et al. 2023). Tao et al. (2022) found that adolescents have a lower understanding of the harms caused by hazy weather compared to adults and are less likely to adopt health protection behaviors during such weather. Studies conducted in Sweden, Canada, and Australia have also focused on how adolescents can cope with climate change by addressing their climate-related

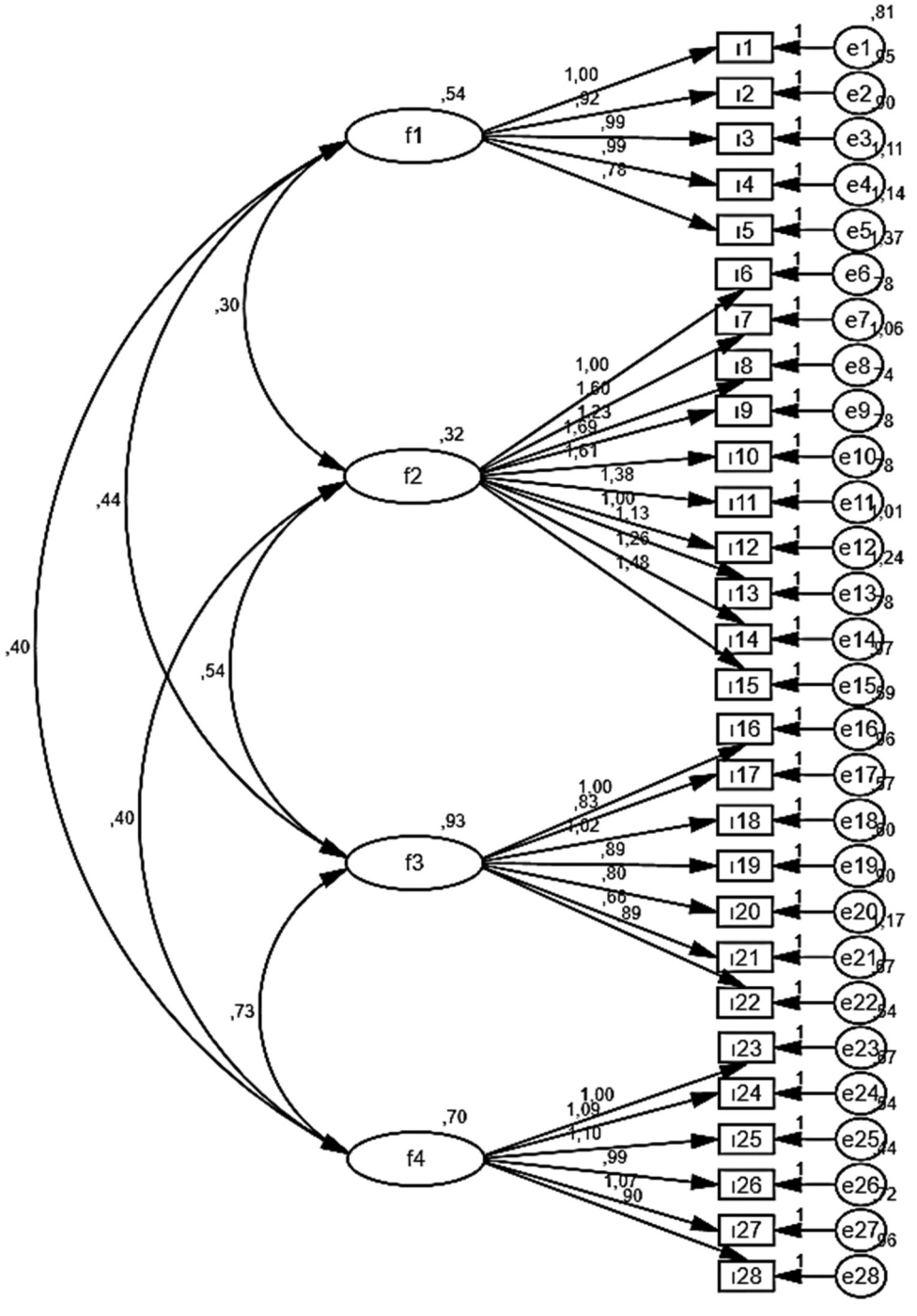

Figure 2. The standardized factor loadings according to the confirmatory factor analysis (subsample 2, $N = 518$).

problems (MacDonald et al. 2015). To contextualize the impact of climate change within the UN Sustainable Development Goals, it is crucial to conduct a comprehensive, interdisciplinary investigation of child and adolescent health across various sectors (Alfvén et al. 2019). In Turkey, adverse weather conditions are increasing gradually due to climate change. Currently, there is no available

Table 3. Reliability analysis results ($N = 1036$).

Items	Mean	SD	t (Lower 27%-Upper 27%)	Corrected Item-Total Correlation	Cronbach's Alpha (Factor)	Cronbach's Alpha (Total)
ı1	2.793	1.165	12.258*	0.432	0.697	0.874
ı2	2.528	1.189	15.598*	0.429		
ı3	2.514	1.195	7.345*	0.402		
ı4	3.251	1.284	9.664*	0.434		
ı5	3.699	1.214	17.270*	0.448		
ı6	2.940	1.303	12.060*	0.429	0.756	
ı7	3.290	1.271	12.631*	0.675		
ı8	2.751	1.247	10.543*	0.527		
ı9	3.353	1.288	10.118*	0.694		
ı10	3.349	1.274	9.345*	0.681		
ı11	3.832	1.184	10.874*	0.646		
ı12	2.587	1.156	7.328*	0.473		
ı13	3.139	1.287	10.958*	0.501		
ı14	4.258	1.140	12.219*	0.610		
ı15	3.580	1.297	10.480*	0.619		
ı16	3.479	1.235	9.958*	0.728	0.762	
ı17	2.902	1.266	11.858*	0.609		
ı18	3.332	1.241	12.219*	0.752		
ı19	3.853	1.160	11.239*	0.696		
ı20	2.979	1.228	8.470*	0.615		
ı21	3.374	1.257	9.299*	0.494		
ı22	4.125	1.189	12.594*	0.680		
ı23	4.195	1.116	11.394*	0.650	0.770	
ı24	3.720	1.230	9.390*	0.637		
ı25	3.758	1.176	10.491*	0.684		
ı26	4.269	1.063	9.293*	0.675		
ı27	3.444	1.237	13.400*	0.731		
ı28	3.737	1.238	13.303*	0.559		

t= t test, *p < 0.001.

measurement tool to assess these conditions (Hacısalihoğlu and Balcı 2023). The CCHPB is a reliable and valid five-point Likert-type scale with 28 items. It has a four-factor structure that explains 65% of the variance.

One of the most important stages in scale development is creating the item draft (DeVellis and Thorpe 2021). Researchers encountered The Climate Change and Health Behaviors Feedback Loops Model while searching the literature using relevant keywords during this stage. This model was used as a source for preparing the survey items. The model emphasizes that climate change can alter health behaviors and that health behaviors can have different effects on the consequences of climate change (Chevance et al. 2023). The model suggests that climate change can be directly and indirectly related to health behaviors. The harmful effects of heatwaves are direct (Mukherjee and Mishra 2021), while the impact of extreme weather events on stress, anxiety, and sleep disorders can be considered indirect (Cruz et al. 2020). The effects of health behaviors on climate change are evaluated in terms of both positive and negative impacts, as well as mitigation and adaptation (Ebi et al. 2020). At this point, emphasis is placed on topics such as nutrition, physical activity, clean water usage, and waste management (Chevance et al. 2023). When developing CCHPB, at least one item was created for the topics mentioned above. The scale's content validity was established by consulting field experts and adolescents (DeVellis and Thorpe 2021).

CCHPB, EFA, and DFA exhibited a four-factor structure. The first factor evaluates the acquisition of accurate knowledge about global climate change to protect health and assesses adolescents' knowledge-seeking behavior regarding health protection behaviors related to climate change. The second factor evaluates health behaviors to be applied when faced with situations caused by climate change and assesses adaptive behaviors to negative situations caused by climate change. The third factor evaluates adaptive behaviors after the negative impacts of climate change have passed, while the fourth factor assesses health behaviors aimed at reducing climate change. Health

Table 4. Inter-scale correlation and correlations among CCHPB, CCA, and HLBA.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
CCHPB-Total (1)	95.042	12.348	1											
CCHPB- factor 1 (2)	14.786	2.070	0.705**	1										
CCHPB- factor 2 (3)	33.083	4.224	0.943**	0.592**	1									
CCHPB- factor 3 (4)	24.045	3.350	0.925**	0.496**	0.856**	1								
CCHPB- factor 4 (5)	23.125	2.509	0.880**	0.538**	0.738**	0.788**	1							
CCA (6)	48.39	4.929	0.593**	0.455**	0.495**	0.547**	0.594**	1						
HLBA (7)	59.933	7.065	0.589**	0.650**	0.472**	0.491**	0.538**	0.479**	1					
CCHPB-Total (8)	96.203	13.493	0.799**	0.713**	0.679**	0.776**	0.839**	0.672**	0.815**	1				
CCHPB- factor 1 (9)	13.380	2.704	0.716**	0.729**	0.756**	0.766**	0.635**	0.657**	0.932**	0.622**	1			
CCHPB- factor 2 (10)	31.382	4.562	0.711**	0.758**	0.741**	0.645**	0.629**	0.603**	0.916**	0.427**	0.866**	1		
CCHPB- factor 3 (11)	23.234	3.583	0.749**	0.749**	0.781**	0.779**	0.632**	0.641**	0.894**	0.569**	0.768**	0.828**	1	
CCHPB- factor 4 (12)	24.593	2.663	0.714**	0.737**	0.743**	0.776**	0.654**	0.616**	0.636**	0.528**	0.454**	0.657**	0.614**	1

**Correlation is significant at the 0.01 level, CCHPB: Climate Change Health Protection Behaviors Scale for adolescents, CCA: Climate Change Awareness Scale, HLBA: Healthy Lifestyle Belief Scale for Adolescents.

Note: The values represented by the digits 1, 2, 3, 4, 5 are test measurements, while the digits 8, 9, 10, 11, and 12 represent retest measurements.

Table 5. The climate change health protection behaviors scale for adolescents.

Dear participant, Climate change can be caused by environmental (air pollution, radiation), climate-related (temperature increases, weather disasters), and ecological (nutrient deficiencies, allergens, infectious diseases, emerging infectious diseases) factors. Below, we ask you to rate your health behaviors in relation to situations that may occur as a result of climate change. Please check the most appropriate box based on the frequency with which you make the following statements.	Strongly Agree (5)	Mostly Agree (4)	Moderately Agree (3)	Partly Agree (2)	Disagree (1)
Often the right information to protect health from global climate change,					
1. I follow it frequently.					
2. I learn by asking health professionals (such as doctors, nurses).					
3. I learn from books.					
4. I learn from school.					
5. I learn from television/internet.					
When I encounter situations related to climate change,					
6. I seek shelter indoors.					
7. I eat more fruits and vegetables.					
8. I eat more foods that strengthen my immune system (pickles, yogurt, kefir).					
9. I eat less spicy and hot foods.					
10. I increase my fluid intake.					
11. I pay more attention to preparing food according to hygiene rules.					
12. I reduce my exercise time.					
13. I increase my sleep time.					
14. I pay more attention to personal hygiene (e.g. hands, face, whole body).					
15. I use protective equipment (such as masks, gloves, goggles, hats).					
After climate change-related events have passed,					
16. I eat more fruits and vegetables.					
17. I eat less spicy and hot foods.					
18. I consume more foods that strengthen my immune system (such as pickles, yogurt, kefir).					
19. I pay more attention to preparing food according to hygiene rules.					
20. I increase my exercise time.					
21. I increase my sleep time.					
22. I pay more attention to my personal hygiene (such as hands, face, whole body).					
To mitigate climate change,					
23. I prefer walking or cycling instead of public transportation.					
24. I prefer to use stairs instead of elevators.					
25. I separate waste such as paper, glass, household waste and ensure that it is disposed of.					
26. I make sure that I produce less waste from the products I use (e.g. food, cleaning).					
27. I reduce the wasteful use of water.					
28. I avoid the use of harmful substances such as alcohol and cigarettes.					

protection behaviors can be evaluated at every stage regarding negative situations with the factors involved (Chevance et al. 2023).

Internal consistency analyses were conducted to assess the reliability of CCHPB. The Cronbach's alpha values for the total scale and factors 1, 2, 3, and 4 were 0.874, 0.697, 0.756, 0.762, and 0.770, respectively, indicating high reliability. This result demonstrates that CCHPB and its subscales have high internal consistency (DeVellis and Thorpe 2021).

Positive correlations were found between CCHPB and its sub-dimensions, CCA and HLBA. The relationship between CCHPB and its sub-dimensions, CC and HLBA, was examined in the psychometric evaluation. Insufficient knowledge and awareness about climate change can lead to the inability to develop preventive and protective behaviors against negative situations (Schipper 2020). As expected, an increase in awareness of climate change in the study led to an increase in health protection behaviors. Similarly, individuals with low health beliefs may have lower preventive and protective behaviors against the negative effects of climate change (Al-Delaimy et al. 2020). The study found that students with high health beliefs also had high climate change health protection behaviors.

The study employed the Climate Change Awareness Scale to assess the awareness of climate change among adolescents (Gönen et al. 2023). Additionally, the Healthy Lifestyle Belief Scale for Adolescents was used to determine their beliefs regarding healthy lifestyles (Akdeniz Kudubeş and Bektas 2020). However, these scales have not been widely associated with climate change and health protection behaviour. Therefore, a new scale was developed to measure adolescents' health protective behaviours in response to negative situations caused by climate change. Given the rising frequency of climate change events, such as elevated air temperatures, flooding, and drought, it is necessary to assess the protective behaviours of adolescents in response to potential climate change-related situations (Chevance et al. 2023). This scale offers a dependable and valid means of measuring the health-protective behaviours of adolescents who are exposed to climate change.

Strengths and limitations

The study has several strengths. As far as we know, it is the first measurement tool developed to target health protective behaviors in adolescents related to negative situations caused by climate change. This study has made a significant contribution to the field. The validity of the scale was ensured by working with two different random subsamples in EFA and DFA (Marsh et al. 2020), resulting in a logical flow of information. The reliability of the data was also increased by having a sample size above the recommended reference values for the number of items and factors (DeVellis and Thorpe 2021).

The research has some limitations in addition to its significant strengths. Due to being conducted in a single province in the Western Black Sea Region of Turkey, it cannot be generalized to all adolescents. This province frequently experiences adverse events, particularly in terms of hot weather and flooding (Halis et al. 2022). However, it is also recommended to test the validity and reliability of CCHPB in different regions and geographies. The reliability and validity of a scale are not fixed attributes but are closely tied to the population to which the scale is applied. Reliability and validity emerge as a result of the interaction between the scale itself, the participants being measured, and the context in which the measurement takes place. A scale that demonstrates good reliability and validity within one population may still require evaluation when used with another population. Currently, there is a lack of equivalence testing for scale structures across different populations and cultural backgrounds. t is recommended that future research be planned and analyzed in this direction.

Conclusion

This study is the first to develop and validate the psychometric properties of an assessment tool for evaluating health behaviors related to climate change in adolescents. The tool will be a valid and reliable addition to the literature for use in future studies examining health protective behaviors in adolescents in relation to climate change. The analysis revealed that the scale consists of 28 items and four sub-dimensions. It is recommended to re-evaluate the validity and reliability analyses of CCHPB in different age groups and cultures.

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