ORIGINAL ARTICLE

Psychometric validation of the Child Healthy Lifestyle Profile in South Korea: a cross-sectional study

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Purpose: This study aimed to validate the Child Healthy Lifestyle Profile as an instrument for screening healthy behaviors in school-aged children in South Korea. **Methods:** Self-reported questionnaires were administered to 454 students, comprising elementary-school students (n=221) and child cancer survivors (n=233). Reliability and validity were assessed using Cronbach's α, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA). **Results:** Cronbach's α, as a reliability test, was 0.87. Varimax rotation yielded nine factors with eigenvalues greater than 1 in the EFA, which explained 61.0% of the total variance. In the CFA, both convergent and discriminant validities were acceptable. Therefore, the Child Healthy Lifestyle Profile was validated as an assessment tool for Korean school-aged children. **Conclusion:** Based on the results of this study, the Child Healthy Lifestyle Profile was identified as a reliable and valid instrument for assessing healthy lifestyles in elementary-school children in South Korea.

Key words: Life style; Child; Health promotion; Surveys and questionnaires

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INTRODUCTION

Healthy lifestyles can be defined as patterns of behavior that help maintain or improve people's health and well-being [1]. The World Health Organization (WHO) also defined lifestyles as "identifiable behavioral patterns, determined by the interaction between individual personal characteristics, social interactions, and socioeconomic and environmental life conditions" [2]. Promoting a healthy lifestyle in children is desirable to improve their quality of life. The WHO [3] has pointed out that 60% of individuals' health and life quality depends on their behavior and lifestyle. Therefore, lifestyle choices and individual behaviors could influence health and improve the quality of life [4].

School-age children are at an important stage in building health-related behaviors. Although childhood is a relatively healthy period, rapid growth and development occur during the school years, and healthy behaviors (e.g., nutrition, physical activity, stress management, and health responsibility) are formed [5]. During this period, children acquire increased cognitive skills that allow them to make decisions about health behaviors they will select and pursue. They establish health behaviors under the influence of social and environmental factors, and they are assumed to have personal responsibility for self-care in the area of hygiene, nutrition, exercise, sleep, and safety [5,6]. However, children of this age may be prone to engaging in various unhealthy habits that lead to adverse health outcomes in later life [6]. It follows that nurturing healthy behaviors in elementary-school students should be considered vital for their development.

A healthy lifestyle profile has the potential to affect an individual's health status and quality of life [7]. Healthy behaviors established during childhood and adolescence play a significant role in health status and practices later in adulthood. Furthermore, lifestyle factors shape the health status of young people and their risk of developing chronic diseases such as diabetes, hypertension, and cardiac diseases in adulthood [8]. Moreover, elementary-school children are at the optimal age for actively implementing health-promoting behaviors [6]. In this stage, they develop sense of industry, or a stage of accom-

plishment, and they are eager to build skills and want to engage in tasks that they can complete. They have greater control over themselves than children at younger ages and begin to acquire the ability to use their thoughts to select actions, such as health behaviors [5,6].

With the development of medical technology, the success rate of treatment for childhood cancer has improved and the number of childhood cancer survivors (CCSs) is increasing rapidly, exceeding 80% of children diagnosed with childhood cancer. CCSs are also in the process of growth and development, and care for them should focus on reducing health risks and maintaining and promoting health [9]. To date, the emphasis has been on identifying health problems in this population, such as their abnormal health status and potential complication of cancer. Pediatric cancer patients who are undergoing treatment have different stages and characteristics of disease and treatment, and there may be limitations in using the same tools as with general school-aged children. However, CCSs have comprehensive health-related needs and, ultimately, the goal of improving the quality of life is similar to the goal for elementary school-aged children.

The healthy behavior of school-aged children can be assessed using valid instruments. The Health-Promoting Lifestyle Profile (HPLP) scale is one of the first (and most commonly used) questionnaires for assessing health-promoting behaviors. It has 52 items and comprises six subscales: nutrition, physical activity, health responsibility, stress management, interpersonal relationships, and spiritual growth. The HPLP has been used in both young people and adults [10,11]. The Adolescent Lifestyle Profile (ALP) was developed by Hendricks et al. [12] based on the HPLP. The Adolescent Lifestyle Profile-Revised 2 (ALP-R2) consists of 44 items, including the positive life perspective dimension added by previous studies for psychometric validation by Hendricks. A limited number of psychometric validation studies on the ALP-R2 have been conducted in other countries to explore how adolescents engage in healthy behaviors [13-16].

Monitoring healthy behaviors among elementary-school children is essential to enable children to improve their health. However, adolescents are the target population of the ALP-R2. For these reasons, there is an urgent need to develop a simple, valid, and reliable instrument that school nurses could use to assess the healthy behaviors of school-aged children. However, a limited number of psychometrically sound instruments that assess the health practices of school-aged children have been described in the literature [1]. Furthermore, extant tools to measure the healthy lifestyle of school-aged children do not comprehensively consider all aspects of health-promoting lifestyles and have not yet been validated. Especially for school-aged CCSs, no studies have validated tools

developed to assess a healthy lifestyle [9]. In addition to developing a new tool, validating existing tools would be worthwhile. Therefore, an instrument for the assessment of school-aged children, including CCSs, is required. Since the ALP-R2 was developed and validated for adolescents in a Western context, validating the Child Healthy Lifestyle Profile (CHLP), which was developed in this study on the basis of the ALP-R2 with the aim of targeting elementary-school children, will make a valuable contribution.

This study aimed to validate the CHLP for screening healthy behaviors among elementary-school students in South Korea. This study aimed to 1) Test the validity and reliability of the CHLP, 2) Examine the differences between healthy behaviors measured using the CHLP according to several demographic variables.

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METHODS

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Ethics statement: This study was approved by the Institutional Review Board (IRB) of Sahmyook University (No. 2021109HR). Informed consent was obtained from all participants.

1. Design

This was a cross-sectional study. The psychometric evaluation of the CHLP was conducted according to the cross-cultural validation process for translating and adapting instruments [17,18]. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [19].

2. Validation Process

The reliability and validity of the adapted CHLP tool were verified through the following procedure:

1) Step 1: conceptual framework and initial items

The conceptual framework (Table 1) of the CHLP was constructed using the ALP-R2 tool developed by Gaete et al. [13]. The ALP-R2 tool consists of total 44 items with seven sub-dimensions, including health responsibility (7 items), physical activity (6 items), nutrition (7 items), positive life perspective (6 items), interpersonal relations (6 items), stress management (6 items), and spiritual health (6 items). Permission to translate and change the tool's name after modifying it to remove questions unsuitable for elementary-school students was obtained from the tool developer.

2) Step 2: translation procedures and content validity

Table 1. Conceptual Framework Comparing the Child Healthy Lifestyle Profile and Adolescent Lifestyle Profile-Revised 2 Items

Child healthy lifestyle profile (CHLP, 31 items)		Adolescent lifestyle profile-revised 2 (ALP-R2, 44 items)	
Health responsibility (4)	1. I go to my school nurse or a doctor if I am not feeling well.	Health responsibility (7)	1. See my school nurse or my doctor if I am not feeling well.
	2. I read articles (or books) about health.		2. Read articles about health topics.
	3. I ask questions to understand what a doctor or nurse said.		3. Ask questions of the doctor or nurse to understand their instructions.
	-		4. Attend programs about preventing health problems and improving my health.
	4. I ask school teachers (homeroom teachers, school nurses, counselors, etc.) for help when needed.		5. Seek guidance from the school counselor when needed.
	-		6. Ask questions of the doctor or nurse about improving my health.
	-		7. Avoid behaviors that damage my health.
Physical activity (4)	1. I spend active time (sports, play) with my family.	Physical activity (6)	1. Spend time with my family being active.
	2. I do vigorous exercise about three times a week for more than 20 minutes (running, jumping rope, cycling, swimming, etc.).		2. Engage in vigorous physical activity for 20 minutes or more, three days a week.
	-		3. Participate in recreational activities or sports.
	-		4. Walk or do something active during my free time.
	3. I play sports with my friends (running, soccer, etc.).		5. Play active games with my friends.
	4. I exercise until my heart beats faster and I sweat.		6. Exercise until my heart beats fast and I perspire.
Nutrition (4)	1. I avoid sweets or other foods high in sugar.	Nutrition (7)	1. Avoid sweets or other foods high in sugar.
	-		2. Choose low-fat milk or low-fat dairy products.
	2. I eat breakfast.		3. Eat breakfast.
	3. I eat a variety of foods (meat/fish, milk/cheese, rice/bread, fruits, vegetables, etc.).		4. Eat two to four servings of fruit each day.
	-		5. Eat three to five servings of vegetables each day.
	-		6. Eat a variety of meats (chicken, fish, beef, pork).
	4. I drink more than 6 cups of water every day.		7. Drink six or more glasses of water each day.
Positive life perspective (5)	-	Positive life perspective (6)	1. Am excited about the future.
	1. I think that I am a happy person.		2. Am happy with who I am.
	2. I work toward important goals in my life.		3. Work toward important goals in my life.
	3. I look forward to each new day.		4. Look forward to each new day.
	4. I set goals that I can achieve.		5. Set goals that I can achieve.
	5. I feel good about myself when I do something well.		6. Feel good about myself when I do something well.

Table 1. Conceptual Framework Comparing the Child Healthy Lifestyle Profile and Adolescent Lifestyle Profile-Revised 2 Items (Continued)

Child healthy lifestyle profile (CHLP, 31 items)		Adolescent lifestyle profile-revised 2 (ALP-R2, 44 items)	
Interpersonal relations (6)	1. I spend time talking with my family.	Interpersonal relations (6)	1. Spend time talking to members of my family.
	2. I congratulate my friends when they do something well.		2. Congratulate others when they do something well.
	3. I try to understand other people's perspectives.		3. Try to be sensitive to the feelings of others.
	4. I play with close friends.		4. Spend time with close friends.
	5. When I argue with a friend, I solve it by talking rather than fighting.		5. Settle conflicts through discussion rather than fighting.
	6. I try to help others.		6. Make a special effort to be helpful to others.
Stress management (5)	1. I sleep 6-8 hours at night.	Stress management (6)	1. Get 6-8 hours of sleep at night.
	2. I have time to relax every day.		2. Take time to relax each day.
	-		3. Accept things in my life that I cannot change.
	3. I take time to do what I like.		4. Take time for myself to do something I like.
	4. I think about pleasant things before going to sleep.		5. Try to think pleasant thoughts as I fall asleep.
	5. I talk with my parents or close friends during difficult times.		6. Discuss my problems with someone close to me to try and solve them.
Spiritual health (3)	-	Spiritual health (6)	1. Talk with others about my spiritual beliefs.
	-		2. Feel that there is a higher power guiding my life.
	-		3. Attend a group that shares my spiritual beliefs.
	1. I go to a church, a cathedral, or a temple.		4. Engage in activities to help me grow spiritually.
	2. I pray when I need to.		5. Spend time in prayer or meditation.
	3. I want to do things that make God happy.		6. Use my spiritual beliefs as a guide for what I do.

Forward translation: The 44 ALP-R2 items were first translated from English to Korean by bilingual independent translators who had worked in the intensive care unit of a general hospital. The translation focused on conveying the original meaning while using culturally appropriate Korean expressions.

Review of the translated items and the first round of content validity testing: The researchers reviewed the translated text's expressions and vocabulary and the clarity of the translation. Of the 44 translated items, the researchers selected 34 items suitable for elementary-school students and modified some sentences to make them easier to understand. The initial 34 items were tested with eight healthy elementary-school students and their parents, who were asked to express their opinions on individual items freely. The words in each sentence were modified to make them easier to understand according to elementary-school students' level of understanding based on the item content validity index (I-CVI) being > 0.8.

The second round of content validity testing: The revised tool was subjected to content validity testing by eight healthy elementary-school students with their parents and eight experts in clinical pediatrics (four nursing professors, one social worker, one pediatrician, and two nurses working at general hospitals) to reflect the opinions of elementary-school students accurately. Thirteen of the 44 original items were deleted based on feedback from the two rounds of content validity testing, resulting in a total of 31 valid items (health responsibility, 4 items; physical activity, 4 items; nutrition, 4 items; positive life perspective, 5 items; interpersonal relations, 6 items; stress management, 5 items; and spiritual health, 3 items). The I-CVI of these 31 items was above .82.

Back-translation: Two bilingual middle school students and a nurse living in the United States reverse-translated the 31 revised items. Then, to consider cultural aspects of the scale, four people (one bilingual nurse and three nursing professors) re-examined the agreement. In total, 31 items were obtained and the consistency showed 88% to 100%.

3) Step 3: psychometric evaluation

The CHLP, consisted of 31 items that employs 4-point Likert scale: 1 (never) to 4 (always). The CHLP consists of seven sub-factors: health responsibility (4 items), physical activity (4 items), nutrition (4 items), positive life perspective (5 items), interpersonal relationships (6 items), stress management (5 items), and spiritual health (3 items). Scores can range from 31 to 124, and the higher the score, the healthier lifestyle.

3. Participants

Participants were students from N Elementary School in Gangwon Province. The study was conducted with the students' and parents' consent after explaining the purpose and process and obtaining permission from the school principal. After obtaining the school principal's approval for the purpose and method of this study, a school letter was sent with the cooperation of the school nurse and teachers. Written consent was obtained from parents and children for the research purpose and detailed survey methods included in the school letter. The survey was conducted face-to-face in the classroom using a printed questionnaire with the cooperation of the schoolteacher.

The survey was also conducted among CCSs. The purpose of this study was explained to the president and manager of the Korea Pediatric Cancer Foundation, and approval was obtained for the survey. Parents of CCSs registered as Korea Pediatric Cancer Foundation members were notified online, and written consent from CCSs and their parents who agreed to participate in the survey was obtained. The CCS survey was conducted using Google Forms.

Inclusion criteria for both CCS and elementary-school students (6-13 years old) were those who were (1) school age children, (2) able to understand the questionnaire contents. For CCS, those who completed treatment for childhood cancer. The exclusion criterion was severe psychiatric or cognitive conditions that hindered participation in the questionnaire survey. The reason why two groups of school-age children were selected as the study participants was because confirmatory factor analysis (CFA) was performed after performing exploratory factor analysis (EFA). The target group for CFA must be a different sample from the EFA sample [18].

The sample size to determine tool validity is approximately 10 times the number of items in the tool, as this helps ensure the stability of analyses such as factor analysis [16]. Thus, 470 participants were initially recruited for the total sample, anticipating a dropout rate of 10% to 20%. The final data analysis included more than 200 samples for each group: 221 in the elementary-school student group and 233 in the CCS group. Considering that the CHLP has 31 items, this study's sample size was sufficient for the number of participants needed to verify the validity of the CHLP through both EFA and CFA.

4. Data Collection

For CCSs, study participants were recruited through cooperation with the Korea Pediatric Cancer Foundation. For CCS, data collection was conducted online using a Google Forms questionnaire from August 25 to November 30. Before survey, a trained investigator individually explained purpose of the study, survey method, and contents to CCS with their parents on the phone. And then, a Google Forms questionnaire with written consent was sent to CCS. For elementary-school student, permission for data collection was obtained from the principal of the elementary school. After explaining the purpose of the study with the cooperation of classroom teachers and health teachers, the survey was conducted after obtaining written consent from parents and children. It took about 15 minutes to respond to the questionnaire. Students who completed the survey were provided a small gift of approximately 10 US dollars.

Ultimately, 470 questionnaires were collected (response rate, 96.6%), of which 454 were analyzed after excluding 16 questionnaires with missing values for the main question.

5. Data Analysis

Data in this study were analyzed using SPSS for Windows (version 24.0; IBM Corp., Armonk, NY, USA). Participants' general characteristics were presented as frequency, percent, mean, and standard deviation. An item analysis used the mean inter-item correlations to evaluate how well each item correlated with the total score, enabling the investigators to decide which items to retain [20].

The Kaiser-Meyer-Olkin test (0.831) and the Bartlett sphericity test (x^2=2,127.99, $p < .001$) were conducted to confirm the suitability of the EFA, and the communality of the factors and the values of factor loading were confirmed. Factor extraction was performed using principal component analysis and the varimax method, which recognizes the correlations between factors.

The normality of the CHLP data was checked before conducting CFA to verify construct validity. The following parameters were investigated: the correlation between item means, central tendency, kurtosis, the Kolmogorov-Smirnov test, and the Shapiro-Wilk test [21,22].

In CFA, the model fit was checked using the x^2 statistic (x^2/degrees of freedom), standardized root mean square residual (SRMR), the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root

mean square error of approximation (RMSEA) [22,23]. The GFI, AGFI, and CFI scores ranged from 0 to 1, with a score exceeding 0.9 indicating a good fit [23]. The RMSEA estimates the closeness-of-fit compared to a saturated model. RMSEA values of 0.08, 0.05, and 0 indicate adequate, close, and exact fit, respectively [24].

To verify the measurement instrument's validity, the model's fit based on the conceptual framework was confirmed, and we investigated convergent and discriminant validity. CFA was performed to confirm the factor validity and conformity of the factors that comprised the CHLP, discrimination factors, and the degree of correlation between items belonging to the factors. To confirm convergent validity, each factor's average variance extracted (AVE) was calculated to determine whether it was 0.05 or greater. For discriminant validity, we investigated how each factor differed from the others, using the criterion of AVE $>r^2$.

Finally, the reliability of all the tools and factors was analyzed using Cronbach's α.

RESULTS

1. Demographic Characteristics of Participants and Differences in CHLP between Groups

The total number of participants was 454 children, compris-ing 221 elementary-school students and 233 CCSs. The demographic characteristics are presented in Table 2 and Supplement 1. The elementary-school students ranged in age from 9 to 13 years, with a median age of 11.0 years and a mean (standard deviation) age of 11.05 (0.84) years. Meanwhile, the CCSs were 6 to 13 years of age, with a median age of 10.0 years and a mean (standard deviation) age of 10.40 (2.07) years. In the elementary-school age group, there was a significant difference in CHLP according to participants' perceived health status ($p<.001$), with the highest scores found for participants who perceived themselves as "very healthy", followed in descending order by those with self-perceptions as "healthy" and "not healthy".

There was no significant difference in the mean values of the total CHLP between the groups. However, the mean scores of four factors (health responsibility [$p<.001$], physical activity [$p<.001$], nutrition [$p<.001$], and interpersonal relations [$p=.038$]) were significantly different.

2. Validity

1) Content validity

The I-CVI was above .80, except for two items that had values of .76 and .78. The research team reviewed these two items and agreed that they sufficiently reflected the characteristics of the CHLP and decided to include them. This resulted in 31

Table 2. Demographic Characteristics and Differences in the Child Healthy Lifestyle Profile Between the Two Groups (N=454)

Characteristics	Categories	Elementary-school students (n=221)				Childhood cancer survivors (n=233)			
		n (%)	M±SD	t or F	p	n (%)	M±SD	t or F	p
Sex	Male	115 (52.0)	3.04±0.38	0.37	.714	109 (46.8)	2.97±0.32	-0.13	.896
	Female	106 (48.0)	3.02±0.36			124 (53.2)	2.98±0.40		
Child age (year)		-	11.05±0.84			-	10.40±2.07		
Birth order	First child	78 (35.3)	3.02±0.36	1.21	.306	95 (40.8)	2.99±0.37	0.04	.990
	Second child	80 (36.2)	3.08±0.36			82 (35.2)	2.97±0.36		
	>Third child	30 (13.6)	2.93±0.42			20 (8.6)	2.98±0.37		
	Only child	33 (14.9)	3.02±0.36			36 (15.5)	2.97±0.35		
Perceived health status	Very healthy[a]	70 (31.7)	3.27±0.32	21.94	<.001	18 (7.7)	2.94±0.23	0.16	.926
	Healthy[b]	82 (37.1)	3.00±0.35		(a>b>d)	84 (36.1)	2.97±0.41		
	Moderate[c]	57 (25.8)	2.85±0.31			93 (39.9)	2.98±0.35		
	Not healthy[d]	12 (5.4)	2.71±0.24			38 (16.3)	3.01±0.35		
Type of cancer diagnosed (multiple-choice)	Leukemia	-	-	-	-	134 (57.5)	2.96±0.36	-	-
	Lymphoma	-	-			29 (12.4)	3.02±0.30		
	Brain tumor	-	-			13 (5.6)	2.89±0.34		
	Others	-	-			77 (33)	3.04±0.38		
Last treatment	Less than 12 months ago	-	-	-	-	22 (9.4)	2.87±0.26	1.75	.157
	1-5 years ago	-	-			76 (32.6)	2.99±0.30		
	More than 5 years ago	-	-			58 (24.9)	3.05±0.40		
	Treatment in progress	-	-			77 (33.0)	2.94±0.41		

M, mean; SD, standard deviation.

items ratable on a 4-point Likert scale.

2) Item properties

The mean inter-item correlation was above .30, except for seven of the 31 total items (Table 3, Supplement 2). However, the effect of these items on overall reliability was minimal; thus, the construct validity was tested using factor analysis.

3) Construct validity by exploratory factor analysis

Nine factors were extracted from the results of the EFA (Table 3, Supplement 2). The items of three factors ("positive life perspectives" [factor 1], "health responsibility" [factor 3], and "spiritual health" [factor 4]) were identified in the same way as in the conceptual framework. The values of factor loading were above .50. All items corresponding to "physical activity" (factor 6) and "stress management" (factor 7) were consistent with the conceptual framework. Still, two items had a factor loading value of less than .30. Factors 2 and 5 were related to "interpersonal relationships". Factors 8 and 9 were extracted as items related to "nutrition". The four items included in factors 8 and 9 had factor loading values of .50 or higher.

The communality of each item was 0.4, and the cumulative variance explained by the nine factors was more than 61%, indicating appropriate construct validity in the EFA results.

4) Construct validity by confirmatory factor analysis

The model fit was as follows: x^2 statistic (x^2/degrees of freedom)=3.00; GFI=0.79, AFGI=0.75, CFI=0.81, RMSEA=0.74, and SRMR=0.08. The purpose of this study was to confirm the structural validity (convergent and discriminant validity) of the sub-factors; thus, CFA was performed.

For convergent validity, the estimate of standardized regression weights was set at .50 or higher. The AVE ranged from .778 to .949, and the construct reliability (CR) ranged from .918 to .986. Theoretically, if the AVE is .50 or more and the CR is .70 or more, the convergent validity is reasonable. Therefore, the convergent validity of the CHLP was confirmed (Table 4).

Discriminant validity relates to how sub-factors differ from each other. It compares the sub-factor AVE value and the square of the correlation between each sub-factor and the other sub-factors. Discriminant validity (AVE $> r^2$) among all factors was confirmed (Supplement 3).

5) Reliability

Cronbach's α for both groups and the total sample ranged from .50 to .89 (Table 5).

DISCUSSION

This study aimed to validate the psychometric properties of the CHLP for screening healthy behaviors among elementary-school students in South Korea. This study has several strengths. The construct validity of the CHLP was verified using two methods: EFA for elementary-school students and CFA for CCSs. Previous studies on the cultural validation of translated tools [13,14,25] used EFA or CFA to identify the suitability of factors related to the conceptual framework. However, several studies have discussed the validation of healthy behavior measurements using the Adolescent Lifestyle Profile Scale [7,15]. These studies have stated that using two methods—EFA and CFA—is considered an effective approach to prove the suitability of the conceptual framework of the tool. Second, as a result of comparing the validity and reliability between elementary-school students and CCSs, seven sub-factors of the CHLP were shown to be consistent with the conceptual framework, and the reliability was also similar between the two groups. These results mean that the health behaviors pursued by CCSs can also be evaluated with the same items as those used with general elementary-school students, rather than being considered as distinctive subjects during the disease process for whom measurements must be made with other tools. The CHLP tool can, therefore, be applied to all children regardless of disease status.

The CHLP validated in this study was based on the ALP-R2 conceptual framework, composed of seven sub-factors (health responsibility, physical activity, nutrition, positive life perspective, interpersonal relations, stress management, and spiritual health). The questions in the CHLP tool begin with "I" for easy understanding by elementary-school students and have been revised after some items were corrected or deleted. The primary purpose of this study was to verify the reliability and validity of the tool. Consequently, when considering CFA and EFA results, the discussion focused on convergence and discriminant validity between sub-factors rather than data normality and model fit. This study established the CHLP, which consists of 31 items rated on a 4-point Likert scale that supports the conceptual framework, including seven sub-factors. The seven sub-factors showed good internal reliability, reliable convergent and discriminant validity, and desirable correlations with other sub-factors. Other research groups [13-16] have assessed conceptual structures based on the seven sub-factors of the ALP-R2. In Chile, Portugal, and Turkey [13,15,16], the seven sub-factors were found to be acceptable, with a desirable model fit. However, in a US study [14], only five sub-factors (positive life perspective, nutrition and health responsibility, spiritual health, interpersonal relations, and physical activity) were accepted by the principal CFA with

Table 3. Results of Item and Exploratory Factor Analysis among Elementary-School Students (I)

No	Items	MIIC	Alpha if item deleted	Factors									Comm.
				1	2	3	4	5	6	7	8	9	
1	I look forward to each new day.	.586	.854	.712	.168	.135	.062	.084	.148	.161	-.022	.063	.617
2	I feel good about myself when I do something well.	.511	.858	.696	.188	-.073	.063	.109	.071	.159	.081	-.072	.580
3	I think that I am a happy person.	.569	.856	.671	.181	.193	-.063	.263	-.006	.163	-.057	.179	.656
4	I work toward important goals in my life.	.568	.856	.656	.247	.103	.059	.027	.161	-.019	.211	.062	.580
5	I set goals that I can achieve.	.540	.856	.495	.115	.171	.086	.146	.216	.032	.356	-.388	.641
6	I think about pleasant things before going to sleep.	.439	.859	.453	.341	.188	.041	-.215	.057	.393	-.101	-.048	.575
7	I spend active time (sports, play) with my family.	.534	.856	.419	.075	.256	.126	.335	.267	-.131	.166	.111	.503
8	I try to understand other people's perspectives.	.434	.859	.179	.786	.163	.071	-.010	.021	-.017	.010	-.045	.684
9	I congratulate my friends when they do something well.	.402	.860	.040	.734	-.094	.065	.208	.127	.256	.028	.123	.694
10	I try to help others.	.476	.858	.223	.662	.215	.005	.070	.002	.035	.115	.058	.558
11	When I argue with a friend, I solve it by talking rather than fighting.	.448	.859	.265	.580	.154	-.037	.208	-.064	.039	.105	-.113	.504
12	I go to my school nurse or a doctor if I am not feeling well.	.368	.861	-.042	.055	.706	.071	.129	.069	.068	.194	.088	.580
13	I ask school teachers (homeroom teachers, school nurses, counselors, etc.) for help when needed.	.508	.857	.240	.224	.613	-.032	.181	.073	.051	.065	.020	.530
14	I read articles (or books) about health.	.321	.862	.141	.034	.536	.062	.129	.054	-.103	.148	-.494	.608
15	I ask questions to understand what a doctor or nurse said.	.473	.858	.286	.209	.524	.131	-.109	.226	.084	-.052	.019	.490
16	I want to do things that make God happy.	.218	.866	.116	.055	.087	.840	-.066	.009	-.118	-.045	-.010	.749
17	I pray when I need to.	.234	.866	.061	.042	.005	.824	.038	-.048	.131	.062	-.088	.717
18	I go to a church, a cathedral, or a temple.	.112	.871	-.073	-.006	.058	.780	.036	.027	-.104	-.004	.117	.644
19	I play with close friends.	.368	.861	.066	.352	-.017	.005	.733	.116	-.032	.041	-.071	.687
20	I spend time talking with my family.	.520	.857	.373	-.047	.251	.001	.606	.014	.248	.162	.010	.659
21	I talk with my parents or close friends during difficult times.	.568	.855	.349	.206	.364	.013	.515	-.003	.297	-.087	-.024	.659
22	I exercise until my heart beats faster, and I sweat.	.328	.862	.121	.062	.033	.041	-.091	.814	.073	.177	-.074	.733
23	I do vigorous exercise about three times a week for more than 20 minutes (running, jumping rope, cycling, swimming, etc.).	.272	.863	.112	-.021	.153	-.083	.079	.787	.020	-.124	.171	.715
24	I play sports with my friends (running, soccer, etc.).	.440	.859	.164	.047	.109	.029	.466	.634	.013	.062	-.117	.678
25	I have time to relax every day.	.259	.863	.110	.057	.090	-.103	.124	.041	.772	-.056	.112	.663
26	I sleep 6-8 hours at night.	.333	.861	.146	.210	-.088	.066	.011	.048	.626	.344	-.062	.594
27	I take time to do what I like.	.333	.861	.430	-.048	.175	-.119	.072	-.004	.450	-.087	.073	.453
28	I eat a variety of foods (meat/fish, milk/cheese, rice/bread, fruits, vegetables, etc.).	.256	.863	-.049	.088	.150	-.108	.393	-.042	.065	.608	.147	.596
29	I avoid sweets or other foods high in sugar.	.364	.861	.060	.144	.365	.201	-.103	.007	.132	.573	-.056	.558
30	I drink more than six cups of water every day.	.266	.863	.349	.002	-.016	-.117	.010	.240	-.180	.501	.150	.464
31	I eat breakfast.	.303	.863	.256	.048	.140	.078	.014	.085	.071	.220	.741	.704

Comm., Communalities; MIIC, mean inter-item correlation.

Table 4. Results of Normality, Convergent, and Discriminant Validity in the Childhood Cancer Survivor Group (*N*=236)

Factors	Items	M±SD	S.E.	SE	C.R.	*p*	AVE	CR
Health responsibility	1. I go to my school nurse or a doctor if I am not feeling well.	3.27±0.68	0.64	-	-	-	0.87	0.95
	2. I read articles (or books) about health.	2.36±0.78	0.33	0.14	4.18	<.001		
	3. I ask questions to understand what a doctor or nurse said.	2.78±0.73	0.16	0.13	2.15	.031		
	4. I ask school teachers (homeroom teachers, school nurses, counselors, etc.) for help when needed.	3.10±0.73	0.81	0.21	6.54	<.001		
Physical activity	5. I spend active time (sports, play) with my family.	3.05±0.72	0.56	-	-	-	0.93	0.98
	6. I do vigorous exercise about three times a week for more than 20 minutes (running, jumping rope, cycling, swimming, etc.).	2.85±0.98	0.83	0.24	8.46	<.001		
	7. I play sports with my friends (running, soccer, etc.).	2.54±0.94	0.71	0.21	7.82	<.001		
	8. I exercise until my heart beats faster and I sweat.	2.62±0.92	0.81	0.22	8.38	<.001		
Nutrition	9. I avoid sweets or other foods high in sugar.	2.48±0.79	0.24	-	-	-	0.78	0.92
	10. I eat breakfast.	3.17±0.76	0.31	0.47	2.58	.010		
	11. I eat a variety of foods (meat/fish, milk/cheese, rice/bread, fruits, vegetables, etc.).	2.72±0.87	0.77	1.12	3.09	.002		
	12. I drink more than six cups of water every day.	2.85±0.83	0.33	0.54	2.65	.008		
Positive life perspective	13. I think that I am a happy person.	3.20±0.63	0.58	-	-	-	0.95	0.99
	14. I work toward important goals in my life.	3.07±0.69	0.78	0.18	8.43	<.001		
	15. I look forward to each new day.	3.14±0.66	0.78	0.17	8.46	<.001		
	16. I set goals that I can achieve.	2.89±0.68	0.61	0.16	7.20	<.001		
	17. I feel good about myself when I do something well.	3.63±0.52	0.52	0.12	6.40	<.001		
Interpersonal relationships	18. I spend time talking with my family.	3.21±0.73	0.53	-	-	-	0.92	0.98
	19. I congratulate my friends when they do something well.	3.25±0.60	0.73	0.16	7.29	<.001		
	20. I try to understand other people's perspectives.	3.12±0.63	0.64	0.16	6.81	<.001		
	21. I play with close friends.	3.24±0.73	0.48	0.16	5.66	<.001		
	22. When I argue with a friend, I solve it by talking rather than fighting.	3.21±0.66	0.55	0.15	6.18	<.001		
	23. I try to help others.	3.23±0.61	0.56	0.14	6.23	<.001		
Stress management	24. I sleep 6-8 hours at night.	3.49±0.69	0.58	-	-	-	0.93	0.98
	25. I have time to relax every day.	3.36±0.69	0.61	0.15	7.12	<.001		
	26. I take time to do what I like.	3.42±0.58	0.67	0.13	7.58	<.001		
	27. I think about pleasant things before going to sleep.	3.03±0.72	0.66	0.16	7.48	<.001		
	28. I talk with my parents or close friends during difficult times.	3.27±0.67	0.62	0.14	7.21	<.001		
Spiritual health	29. I go to a church, a cathedral, or a temple.	2.12±1.12	0.86	-	-	-	0.95	0.98
	30. I pray when I need to.	2.32±1.08	0.83	0.06	15.19	<.001		
	31. I want to do things that make God happy.	2.20±1.02	0.90	0.06	16.42	<.001		

AVE, average variance extracted; CR, construct reliability; C.R., critical ratio; SD, standard deviation; SE, standard error; S.E., standardized estimate.

Table 5. Reliability (Cronbach's α) of the Child Healthy Lifestyle Profile for Both Groups

Factors	Total (n=454)	Elementary-school students (n=221)	Childhood cancer survivors (n=233)
Total (31 items)	0.87	0.86	0.88
Health responsibility (4 items)	0.60	0.63	0.55
Physical activity (4 items)	0.77	0.70	0.82
Nutrition (4 items)	0.50	0.50	0.51
Positive life perspective (5 items)	0.78	0.79	0.78
Interpersonal relationships (6 items)	0.74	0.74	0.74
Stress management (5 items)	0.71	0.67	0.76
Spiritual health (3 items)	0.83	0.76	0.89

varimax rotation. The conceptual structure of the CHLP revised for two groups of Korean elementary-school students needs validation in other cultures.

In the health responsibility sub-factor, which consisted of seven ALP-R2 items, three items were deleted and reworked into four other items in the CHLP. The results of this study indicated that this sub-factor satisfied the criteria for conceptual agreement between the included items, convergence, and discriminant validity. Health responsibility was a factor that showed low mean scores in both elementary-school students and CCSs in the present study. The EFA results for American adolescents analyzed health responsibility and nutrition as one factor [14]. Younger students were found to have high health responsibility scores when assisted by their parents [26]. Health responsibility focuses on being accountable for one's health through education and seeking assistance from others [12]. In Korean culture, encouraging elementary-school children to take responsibility for their health should be a critical health-related behavior.

The physical activity sub-factor consists of six ALP-R2 items. Two of these items were deleted and reworked into four CHLP items. This factor met the conceptual agreement criteria, convergence, and discriminant validity between the included items. Healthy behaviors focus on adherence to regular exercise patterns [12]. Previous studies on adolescent healthy behavior measurement tools [7,13-15,25] showed that physical activity was a crucial measurement factor for healthy behavior in adolescents, showing desirable validity and reliability. In a study by Lim [9], who developed a health-related needs assessment tool for Korean CCSs, exercise was a question related to health-related physical demands. However, it was not classified as a sub-factor. The results of the present study showed that the validity and reliability of physical activity were adequate. However, the average physical activity score was low for both groups of adolescents. Physical

activity is a factor that requires regular management to promote healthy adolescent behavior.

In the nutrition sub-factor, consisting of seven items in the ALP-R2, three were deleted and reworked into CHLP items. This factor was shown to be two factors in the EFA, which were combined into a single factor, analyzed in CFA, and met the convergence and discriminant validity criteria. In the nutrition sub-factor, the mean score of the CCS group was significantly lower than that of the elementary-school student group. It has been reported that the intake of sterile or sterilized food during hospitalization affects eating habits after treatment, inducing a tendency to avoid fresh vegetables, water, and fruits [27]. This result implies difficulties in maintaining healthy lifestyles among CCSs, and this sub-factor will be an index that can be used meaningfully when evaluating the nutritional management of children who are vulnerable to diseases, as well as for CCSs. Hendricks et al. [12] also suggested that nutrition is determined by good food choices and meal patterns. In studies that reported the validity and reliability of tools for health promotion targeting Australian and Taiwanese adolescents, nutrition was also shown to be a factor relevant for measuring important healthy behaviors [7,25]. When considering the characteristics of elementary-school students, who are susceptible to unhealthy food choices [1], nutrition should be considered essential for promoting healthy behavior.

In the positive life perspective sub-factor, consisting of six items in the ALP-R2, one item was deleted and reworked into five items in the CHLP. This factor met the criteria of conceptual agreement between the included items, convergence, and discriminant validity. A positive life perspective reflects behavior directed by a sense of purpose [12]. In Lim's [9] study of Korean adolescents with pediatric cancer, this factor was also treated as a sub-factor of the tool. Hence, it was shown to be an important factor related to healthy behavior in Korean

culture. This study's results showed that this factor was valid and reliable and had a high average score. This factor also showed high validity and reliability in international studies on the ALP-R2 [7,13-15].

The interpersonal relationships sub-factor has the same six items as the ALP-R2. This sub-factor was shown to be two factors in the EFA. It was combined into a single factor, analyzed in CFA, and met the convergence and discriminant validity criteria. Interpersonal relationships involve maintaining a sense of closeness or intimacy [12]. When young people have health problems, spending time with their peers and families may help them cope with stress [15]. Previous studies have analyzed this category of healthy behavior as an independent factor [7,14,15]. Furthermore, recognition of this factor can be used to build interpersonal relationships among adolescents.

The stress management sub-factor consists of six items in the ALP-R2. One item was deleted and reworked into five items in the CHLP. This factor met the criteria of conceptual agreement between the included items, convergence, and discriminant validity. The reported validation results [13,14,16] of previous studies applying the ALP-R2 are similar to those of this study. It has been confirmed that lifestyle habits, such as sleep and relaxation time, are important factors for stress management in adolescents [28]. However, most adolescents are highly dependent on electronic devices; therefore, sufficient rest and sleep are important stress-management factors to consider when fostering healthy behavior.

In the spiritual health sub-factor consisting of six ALP-R2 items, three items were deleted and reworked into three CHLP items. Spiritual health behaviors focus on the spiritual aspect of daily life [12]. This factor satisfied the criteria of conceptual agreement between the included items, convergence, and discriminant validity. The mean inter-item correlations of the three spiritual health items were in the .20. However, the reliability coefficients were high, and factor loading, convergence, and discriminant validity met the criteria.

The tool indicated similar reliability between the two groups (elementary-school students and CCSs). Therefore, the CHLP is considered to have a high level of reliability based on repeated measurements. In particular, during school age, children become more independent and autonomous in their health behaviors as they grow older [6]. Therefore, it is assumed that the tool validated in this study is more useful and appropriate for elementary-school students in their late school years. In studies that verified the reliability of the ALP-R2 (44 items) by applying the same conceptual framework in Chile and Turkey [13,15], the confirmed reliability was 0.87. This was the same as the 33 CHLP items. The sub-factors of current study also had reliability values within a range (from 0.50 to 0.89) similar to that observed in previous studies by Gaete et

al. [13] (0.49-0.87) and by Ardic and Esin [15] (0.61-0.84). However, the results of this study were obtained from Korean children, and further verification in other cultures is necessary. Moreover, to re-verify the reliability of the tool's sub-factors, a test-retest analysis is proposed in a future study.

The CHLP sub-factors that showed significant differences between the elementary-school group and the CCS group were health responsibility, physical activity, nutrition, and interpersonal relationships. The CCS group had a significantly higher health responsibility awareness than the elementary-school group, but the scores were lower for the other three factors. In contrast, there was no significant difference in the total CHLP scores between the elementary school and CCS groups. Therefore, the CHLP can be considered a useful tool to evaluate the health promotion status of all elementary-school children. Although the EFA (Table 3) and CFA (Table 4) results showed no duplicate items that did not meet the criteria, it should be kept in mind that this tool has been validated only in the Korean context, and validation in other cultures is needed.

Despite its strengths, the limitations of this study should be acknowledged. First, the elementary-school students were recruited from a single area. Therefore, further research is needed using a larger sample from various areas to verify the validity of the CHLP. Second, health responsibility, physical activity, nutrition, and interpersonal relations, which had significantly lower mean scores in the CCS group, could be viewed as factors that should be carefully considered when screening the healthy behaviors of school-age children suffering from chronic diseases. Third, since this study verified the CHLP using CFA for children with cancer, not the homogeneous school-age child group, it is necessary to conduct a further study to re-verify the CHLP in school-age children. Lastly, the survey method was not homogeneous. Because of the participants' circumstances, the survey was conducted face-to-face using printed questionnaires for elementary-school students and online using Google Forms for CCSs.

CONCLUSION

A reliable and valid instrument is vital for measuring health status and evaluating healthy lifestyle choices among school-aged children in Korea. The present study showed that the 31-item CHLP is a valid and reliable instrument for assessing healthy lifestyle choices in this population. This instrument may be useful for comprehensive early detection of lifestyle problems and can help improve children's unhealthy lifestyles. These findings indicate that the tool is practical in screening for healthy behaviors in elementary-school settings.

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Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

Shin-Jeong Kim has been an editor of *Child Health Nursing Research* since 2010. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

Data availability

Please contact the corresponding author for data availability.

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Supplement 1. Differences in the Child Healthy Lifestyle Profile between the Two Groups (*N*=454)

Mean differences between groups	Elementary-school students (n=221)	Childhood cancer survivors (n=233)		
	M±SD	M±SD	t	*p*
Factors of the Child Healthy Lifestyle Profile (4-point Likert scale)				
Total (31 items)	3.03±0.37	2.98±0.36	1.50	.129
Health responsibility (4 items)	2.67±0.56	2.88±0.48	-4.42	<.001
Physical activity (4 items)	3.09±0.63	2.77±0.72	5.16	<.001
Nutrition (4 items)	3.07±0.51	2.81±0.52	5.66	<.001
Positive life perspective (5 items)	3.21±0.59	3.18±0.47	0.53	.596
Interpersonal relations (6 items)	3.31±0.44	3.22±0.44	2.08	.038
Stress management (5 items)	3.23±0.54	3.31±0.48	-1.57	.116
Spiritual health (3 items)	2.16±0.94	2.21±0.97	-0.64	.521

M, mean; SD, standard deviation.

Supplement 2. Results of Item and Exploratory Factor Analysis among Elementary-School Students (II)

Factors	Eigenvalue	Variance explained (%)	Cumulative variance explained (%)
1. Positive life perspective (5 items)	7.132	23.008	23.008
2. Interpersonal relations (4 items)	2.281	7.359	30.367
3. Health responsibility (4 items)	1.966	6.343	36.711
4. Spiritual health (3 items)	1.651	5.327	42.038
5. Interpersonal relations (2 items)	1.409	4.545	46.583
6. Physical activity (4 items)	1.263	4.075	50.658
7. Stress management (5 items)	1.203	3.881	54.538
8. Nutrition (3 items)	1.133	3.655	58.193
9. Nutrition (1 item)	1.037	3.345	61.538

Supplement 3. Results of Discriminant Validity in the Childhood Cancer Survivor Group (*N*=236)

Discriminant validity (AVE>r^2)	Factor 1 (r/r^2)	Factor 2 (r/r^2)	Factor 3 (r/r^2)	Factor 4 (r/r^2)	Factor 5 (r/r^2)	Factor 6 (r/r^2)	Factor 7 (r/r^2)
AVE	0.87	0.93	0.78	0.95	0.92	0.93	0.95
Factor 1 (Health responsibility)	1						
Factor 2 (Physical activity)	0.19**/0.14	1					
Factor 3 (Nutrition)	0.30**/0.09	0.39**/0.15	1				
Factor 4 (Positive life perspective)	0.38**/0.14	0.32**/0.10	0.30**/0.09	1			
Factor 5 (Interpersonal relationships)	0.37**/0.14	0.40**/0.16	0.28**/0.08	0.61**/0.37	1		
Factor 6 (Stress)	0.37**/0.14	0.44**/0.19	0.24**/0.06	0.58**/0.34	0.58**/0.34	1	
Factor 7 (Spiritual health)	0.25**/0.06	0.17**/0.03	0.30**/0.09	0.25**/0.06	0.27**/0.07	0.13*/0.02	1

*p<.001; **p<.05; AVE, average variance extracted.