## RESEARCH



# Validation of a Slovenian version of the Healthy Lifestyle and Personal Control Questionnaire (HLPCQ) for use with patients in family medicine



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## Abstract

**Background** Chronic non-communicable diseases are the world's leading cause of death and disability. The emerging field of lifestyle medicine requires equipping healthcare professionals with instruments, knowledge, skills and competencies. Measuring an individual's lifestyle with a valid and reliable instrument is the first step in promoting it. The aim of the study was to validate the Slovenian adaptation of the Healthy Lifestyle and Personal Control Questionnaire (HLPCQ).

**Methods** A cross-sectional study was conducted among 666 questionnaire participants, and they were adult participants (aged 18 and above) from family medicine practices with cardiovascular diseases (CVDs) risk factors (e.g., hypertension, high cholesterol) but without a diagnosis of acute CVDs. The questionnaire included demographic data and anthropological measures and a translated English HLPCQ questionnaire. The instrument was translated using the forward-backwards translation method. The study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki. In addition to assessing the construct validity of the questionnaire, exploratory and confirmatory factor analyses were used to determine content and face validity, and internal consistency reliability.

**Results** The mean age of male participants was 41.34 ( $\pm$  13.220) years, the mean age of female participants was 40.31 ( $\pm$  11.905) years. The Cronbach's alpha was 0.852, and all questionnaire subscales had positive correlations. Sampling adequacy was confirmed by the Kaiser-Meyer-Olkin (KMO) index (0.851), and Bartlett's test of sphericity was significant ( $\chi^2$  = 4647.694, *p* < 0.001), indicating suitability for Principal Component Analysis (PCA). PCA revealed a five-factor solution, accounting for 50.67% of the total variance.

**Conclusions** The most influential factors for a healthy lifestyle were daily routine, healthy dietary choices, avoidance of harmful dietary habits, organized physical activity, and social and mental balance. The Slovenian version had high factor validity and reliability. It can be used in Slovenian Community Health Centre to assess an individual's control

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over various lifestyle dimensions. The instrument also holds potential for use in public health initiatives, supporting early identification of lifestyle-related risk factors and promoting preventive care strategies in the primary care setting. **Keywords** Lifestyle, Health behaviour, Validity, Public health, Questionnaire, HLPCQ

## Background

Economies, societies, and health systems have all been severely impacted by COVID-19 [1]. It has slowed efforts to prevent noncommunicable diseases (NCDs) in many countries. Around 74% of deaths across the globe are due to NCDs, predominantly cardiovascular diseases (CVDs), diabetes, chronic respiratory diseases and cancers [2] [3]. Modifiable behavioural risk factors contributing to these NCDs include smoking, an unhealthy diet, physical inactivity, and harmful drug use [3]. Excessive alcohol consumption further exacerbates these risks by contributing to overweight and obesity, increasing blood pressure, and causing other health issues. These factors collectively lead to elevated cholesterol levels, which is a major risk factor for NCDs [4]. Physical activity is also one of the most critical contributors for the onset of chronic NCDs [5]; therefore, measures to promote physical activity, especially among the most vulnerable groups such as populations, are paramount [6] and they continue to play an important role in public health [7]. Previous studies have also shown that lifestyle strongly influences mortality in different populations [8, 9, 10, 11, 12, 13, 14], therefore, comprehending these lifestyle elements that can be modified and their link to mortality in patients with NCDs could diminish untimely death caused by them [4]. There is still much debate about the many factors influencing personal lifestyle choices. For example, it is not easy accurately to assess the contribution of conscious, autonomous choices and socioeconomic factors, or to disentangle the influence of individuals' obesogenic environments [15]. However, as chronic diseases become more prevalent, there is a consensus that interventions are needed at both the systemic and individual levels [16, 17].

The Healthy Lifestyle and Personal Control Questionnaire (HLPCQ) aims to identify daily habits that lead to a healthy lifestyle and patient-centered care. As there is no comparable instrument in Slovenian, the aim of this study was to carry out transcultural adaptations and psychometric testing of the Slovenian adaptation of the HLPCQ.

## Methods

## Type of study

This was a cross-sectional study conducted to evaluate the validity and reliability of the Healthy Lifestyle and Personal Control Questionnaire (HLPCQ) [18] in a Slovenian population.

#### Study sample

From April to May 2023, a cross-sectional study was carried out between 809 invited participants from Slovenia. The study included adult participants (aged 18 and above) attending family medicine practices across Slovenia. Participants were included if they had one or more CVDs risk factors, such as elevated blood pressure, high cholesterol, obesity, or other metabolic risk factors. Importantly, individuals with a confirmed diagnosis of acute CVDs (e.g., myocardial infarction, stroke, or acute heart failure) were excluded. This approach allowed for the inclusion of a broader at-risk population in primary care settings, consistent with the preventive orientation of the HLPCQ. We used snowball sampling for inviting participants to complete an online questionnaire via different social networks (Facebook, Instagram, LinkedIn) and web-based email service (Gmail and Outlook).

#### Ethics and data collection procedures

The questionnaire consisted of demographic data (sex, age, marital status, number of children, smoking status, education, and employment status), anthropological measures (body weight and height) and the English version of the HLPCQ, which was used by the authors Farfaglia et al. [19] who validated the original Greek questionnaire developed by Darviri et al. [18]. The Commission approved the study for Ethical Issues in Nursing, Faculty of health sciences, University of Maribor (decision number: 02/7K-2023) and Commission of the Republic of Slovenia for Medical Ethics (decision number: 0120-217/2023/4). The study adhered to the ethical principles outlined in World Medical Association Declaration of Helsinki [20]. Participants were informed that the data collected would be solely used for research purposes. The survey was conducted anonymously, with no personally identifiable information collected; participants were informed about the anonymity and voluntary nature of the study at the beginning of the survey, and their implicit consent was obtained by proceeding with participation. The estimated time to complete the questionnaire on the 1KA platform is six minutes and eighteen seconds [21].

#### Assessment instrument

The HLPCQ assesses health-related daily activities by assessing an individual's control over daily routines, diet, physical activity, mental well-being and social interactions. Instrument consists of 26 items rated on a Likert scale with 4 points (1 = never/rarely to 4 = always). Higher

scores indicate greater health promotion [18]. The instrument was developed and validated, particularly in comparison with the Perceived Stress and Health Locus of Control scales. To participate in the development of the original questionnaire, individuals had to be literate in Greek, aged between 20 and 80 years and resident in Attica. The summary score showed positive correlations with internal health locus of control (r=0.10, p=0.003), perceived stress (r=-0.42, p<0.001), sleep quality (r=0.29, p<0.001) and health assessment (r=0.28, p<0.001) [18, 22].

## Process of validation Translation of the HLPCQ

After obtaining permission from the original author to modify the HLPCQ tool, we began translating it from the validated English version into Slovenian before conducting psychometric testing. We used the forwardbackward translation method for this endeavor [22]. This means that the first author translated the instrument from English into Slovenian with the help of an independent translator who was a nursing researcher. This step was followed by editing the translated instrument, which was then translated back into English by an independent translator (the original English instrument was not seen) [22]. Both translators were advised to use simple expressions and to avoid the use of metaphors, colloquial language, passive sentences, and hypothetical statements. This was followed by a comparison of the translated instrument in Slovenian and a back-translation into English. Both versions were compared and discussed until disagreements were resolved. No problems were observed during the back-to-back translation process. The back-to-back translation was used to achieve semantic equivalence. The meaning of each sub-word in the target culture remains the same after translation as in the English version. Question 20: "Do you practice aerobic exercise for 20 or more minutes at least 3 times per week?" was changed to: "Do you practice aerobic exercise for 30 or more minutes at least 3 times per week?". We selected a duration of 150 min of moderate-intensity aerobic exercise per week, in accordance with the recommendations of the World Health Organization (WHO) [23]. The questionnaire took about six to seven minutes to complete and the items in the English version were easy to understand.

## Content validity and statistical analysis

To achieve an appropriate level of construct validity and an adequate sample of items in the construct subscale, we calculated content validity scores [22] of the translated instrument, based on input from 10 experts in the field of prevention, i.e. nurses and doctors working in family medicine clinics. Each expert reviewed the instrument and rated the relevance of each item on a Likert 4-point scale (1 = not significant; 2 = somewhat significant; 3=quite significant; 4=very significant) [24]. We calculated the item content validity index (I-CVI): (agreed item)/(number of experts) and the scale content validity index (S-CVI): (sum of I-CVI scores)/(number of items) [22, 24, 25]. We also calculated the percentage of items on the scale for which all raters agreed on content validity (S-CVI/UA) (general agreement) [22, 24]. UA stands for the universal agreement score, which takes on a value of 1 if all the experts agree with the item, otherwise the score is 0 [24]. To calculate the S-CVI, we calculated the average scale validity index (S-CVI/Ave). Scores of I-CVI>0.78 and S-CVI/Ave>0.90 are considered good scale validity MENDELEY CITATION PLACEHOLDER 28. We also calculated kappa (k\*) using the following formula: K = (I-CVI-Pc)/(1-Pc) [22]. This was done to reduce the impact of random agreement, which we used to adjust each I-CVI. To calculate the random agreement of the experts for each item separately, the following formula was used  $Pc=[N! / A! (N-A)!]^*0.5^N [26]$ . In this formula is Pc = probability of chance agreement; N = number of experts and A=number of experts who agree that the item is relevant. Kappa values  $\geq 0.75$  are considered excellent, values between 0.60 and 0.74 good and values between 0.40 and 0.59 moderate [22, 25, 26]; Cronbach's alpha ( $\alpha$ ) was also used to assess reliability. Low values indicate that the items are not measuring consistently (approaching 0) [22, 27, 28]. The a of the items for the construct was assessed using the following criterion:  $\alpha > 0.90$  (excellent),  $\alpha > 0.80$  (good),  $\alpha > 0.70$  (acceptable),  $\alpha > 0.60$  questionable,  $\alpha > 0.50$  (poor), and  $\alpha \le 0.50$  (unacceptable) [22]. Individual items that had a correlation value between the item and the total score greater than 0.20 were judged to be satisfactory [29]. The factor structure of each of the five subscales, as they were defined in the original questionnaire, was assessed separately as suggested by Darviri et al. [18]. We analyzed the scale items' structure by carrying out a factor analysis. This involved applying the Kaiser-Meyer-Olkin (KMO) index of sampling adequacy and Bartlett's test to determine if there was sufficient covariance between the items, thus validating the PCA. In addition, varimax rotation was used in this analysis [22]. The data were presented on Microsoft Excel, and the statistical examination was conducted through the IBM SPSS 28.0 software. According to BMI (body mass index), kg = kilograms divided by m2, where m2 is the height in meters squared and kg is the weight in kilograms [30].

## Statistical analysis

We evaluated content and face validity as well as internal consistency using Cronbach's  $\alpha$ . The questionnaire's construct validity was also evaluated through a principal component analysis (PCA) and orthogonal rotation (varimax). We followed the recommendations of Polit & Beck [22] in conducting psychometric tests.

## Results

## **Content validity**

We calculated I-CVI, Pc and  $k^*$  for all 26 questionnaire items. All items with a CVI>0.78 have good content validity, in our case 15/26 items had a CVI greater than or equal to 0.80, which means they have good content validity (Table 1). The estimated S-CVI/Ave was 0.79.

## Psychometric testing based on the survey data Sample characteristics

Of 809 invited participants in this study, 666 completed the questionnaire (82% response rate).

Of the 666 participants, 23% were male, 77% female, and two identified as non-binary, while three did not disclose their gender. The average age was similar across genders (approximately 40 years). Most participants (61.4%) had children, with two being the most common number. In terms of education, 34.8% had a university degree, and 34.5% had completed secondary education.

The majority (79.1%) were employed. Regarding body weight, 40.4% had a normal weight, 31.1% were overweight, and 21.3% were obese (Table 2).

The mean scores for each subscale and the ranges observed are shown in Table 3. In addition, in terms of the possible range of scores, a good spread of calculated scores was found in our sample. The average score is based on 586 (88%) completed questionnaires with 80 (12%) containing at least one missing value preventing the calculation of the scores.

Significant associations between participant characteristics and HLPCQ subscales were observed. Females scored higher than males on "healthy dietary choices", "dietary harm avoidance," and "social and mental balance," while males had higher scores for "organized physical activity." Younger participants ( $\leq$  46 years) were more active, while older participants ( $\geq$  56 years) had higher scores for "healthy dietary choices," "dietary harm avoidance," and "daily routine." Married participants scored higher across all subscales, and having children was associated with higher scores except for "organized physical activity," where participants without children scored higher. Higher education was linked to higher scores for

 Table 1
 Content validity of the HLPCQ

No. <sup>a</sup>	Item	Nb	Ac	I-CVI <sup>d</sup>	Pc <sup>e</sup>	κ* <sup>f</sup>	κ* evaluation
1.	Are you careful about how much food you put on your plate?	10	7	0.70	0.12	0.66	Good
2.	Do you check the food labels before buying a product?	10	8	0.80	0.04	0.79	Excellent
3.	Do you calculate the calories of your meals?	10	7	0.70	0.12	0.66	Good
4.	Do you limit fat in your meals?	10	8	0.80	0.04	0.79	Excellent
5.	Do you like cooking?	10	8	0.80	0.04	0.79	Excellent
6.	Do you eat organic foods?	10	8	0.80	0.04	0.79	Excellent
7.	Do you eat whole-wheat products?	10	10	1.00	0.00	1.00	Excellent
8.	Do you avoid eating packaged- or fast-food?	10	7	0.70	0.12	0.66	Good
9.	Do you avoid soft drinks?	10	7	0.70	0.12	0.66	Good
10.	Do you avoid eating when stressed or disappointed?	10	7	0.70	0.12	0.66	Good
11.	Do you avoid binge eating when you are out with friends?	10	7	0.70	0.12	0.66	Good
12.	Do you eat your meals at the same time each day?	10	8	0.80	0.04	0.79	Excellent
13.	Are you careful about not missing a meal each day?	10	7	0.70	0.12	0.66	Good
14.	Do you eat a good breakfast?	10	7	0.70	0.12	0.66	Good
15.	Do you sleep at the same time each day?	10	8	0.80	0.04	0.79	Excellent
16.	Do you follow a scheduled program for your daily activities?	10	8	0.80	0.04	0.79	Excellent
17.	Do you eat breakfast at the same time each day?	10	7	0.70	0.12	0.66	Good
18.	Do you eat lunch at the same time each day?	10	8	0.80	0.04	0.79	Excellent
19.	Do you eat dinner at the same time each day?	10	8	0.80	0.04	0.79	Excellent
20.	Do you practice aerobic exercise for 30 or more minutes at least 3 times per week?	10	7	0.70	0.12	0.66	Good
21.	Do you exercise in an organized manner?	10	7	0.70	0.12	0.66	Good
22.	Do you share your personal problems or worries with others?	10	8	0.80	0.04	0.79	Excellent
23.	Do you concentrate on positive thoughts during difficulties?	10	10	1.00	0.00	1.00	Excellent
24.	Do you empty your brain of thoughts or the next day's program during bedtime?	10	9	0.90	0.01	0.90	Excellent
25.	Do you care about meeting and discussing with your family on a daily basis?	10	10	1.00	0.00	1.00	Excellent
26.	Do you balance your time between work, personal life, and leisure?	10	9	0.90	0.01	0.90	Excellent
	$S_{-}(1/\Delta) \rho^{g}$			0.70			

<sup>a</sup>No.=Number of questions;<sup>b</sup>N=sample size;<sup>c</sup>A=number of agreements;<sup>d</sup>I-CVI=item content validity index;<sup>e</sup>Pc=probability of chance agreement;<sup>f</sup>k\*=kappa indicating agreement on relevance;<sup>g</sup>S-CVI/Ave = average scale validity index.

**Table 2** Sociodemographic and health-related characteristics of the study participants (n = 666)

	Variable	Descriptive statistics N <sup>a</sup> (% <sup>b</sup> )
Age (Y <sup>c</sup> ; M <sup>d</sup> ± SD <sup>e</sup> )		40,55 <b>±</b> 12.19
Gender	Female	512 (77)
	Male	151 (22.7)
	Non-binary gender	3 (0.5)
Marital status	Married	228 (34.2)
	Extramarital community	299 (45.0)
	Single	113 (17.0)
	Widower	17 (2.4)
	Other	9 (1.4)
Having children	Yes	409 (61.4)
	No	229 (34.4)
	Missing	28 (4.2)
Educational level		
	No education	2 (0.3)
	Primary education	7 (1.1)
	Secondary school education	230 (34.5)
	Higher university education	232 (34.8)
	Master's degree	139 (20.9)
	PhD	22 (3.3)
	Other	9 (1.4)
	Missing	25 (3.7)
Employment		
	Yes	527 (79.1)
	No	51 (7.6)
	Retired	56 (8.4)
	Other	9 (1.4)
	Missing	23 (3.5)
Smoking status		
	Yes	170 (25.5)
	No	422 (63.4)
	Stop smoking	49 (7.4)
	Missing	25 (3.7)
Body mass index		
	Underweight	10 (1.5)
	Normal weight	269 (40.4)
	Overweight	207 (31.1)
	Obesity	142 (21.3)
	Missing	38 (5.7)

<sup>a</sup>N=sample size,<sup>b</sup>%=Per cent of participants,<sup>c</sup>Y, Years,<sup>d</sup>M=Mean,<sup>e</sup>SD=Standard deviation;

Tab	e 3	Description	of the	e five su	bscales	s and	the o	verall H	LPCQ	score	2

<sup>a</sup>SD=Standard deviation.

"daily routine" and "organized physical activity," while retired individuals scored higher on "healthy dietary choices," "dietary harm avoidance," and "daily routine" but lower on "organized physical activity." Smoking status influenced several subscales, with quitters scoring higher on "daily routine" and "organized physical activity." BMI was only associated with "organized physical activity," with underweight participants scoring the lowest across subscales (Table 4).

## Internal consistency

The Cronbach's  $\alpha$  calculated for the Slovenian version of the HLPCQ questionnaire used in this study was 0.852. The Slovenian version has acceptable internal consistency in terms of reliability. The  $\alpha$  for each subscale is between 0.59 and 0.88 (Table 5). The  $\alpha$  items for the subscales were: "healthy dietary choices" 0.68 (questionable), for "dietary harm avoidance" 0.64 (questionable), for "daily routine" 0.88 (good), for "organized physical activity" 0.63 (questionable) and for "social and mental balance" 0.59 (poor). The item-total correlations and  $\alpha$  are shown in Table 5. Questions with the lowest item-total correlation is "5. Do you like cooking?" with 0.12 and question "23. Do you share your personal problems or worries with others?" with 0.23 (Table 5).

Using the Pearson correlation coefficient, Table 6 shows that all subscales are positively correlated. This suggests that participants who follow a healthy diet and avoid harmful dietary habits also tend to maintain a structured daily routine, engage in organized physical activity, seek social support, and take care of their mental health. The strongest correlation was observed between *Healthy dietary choices* and *Dietary harm avoidance* (r=0.509, p<0.001).

#### Construct validity

The 26 items were analysed using principal component analysis (PCA) with varimax rotation, as presented in Table 7.

Sampling adequacy was confirmed by the Kaiser-Meyer-Olkin (KMO) measure (0.851), and Bartlett's test of sphericity was significant,  $\chi^2(325) = 4647.694$ , p < 0.001, indicating that the data were suitable for PCA. PCA yielded a five-factor solution with eigenvalues greater

	Healthy	dietary ch	loices	Dietary h	arm avoi	idance	Daily rou	Itine		Organize	ed physic	al activity	Social and	d mental	
	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value
Gender															
Male	14.8	3.3	< 0.001	8.8	2.7	< 0.001	19.3	5.8	0.089	4.1	1.9	0.004	12.9	2.7	< 0.001
Female	15.9	3.3		9.6	2.4		18.2	5.6		3.6	1.6		13.9	2.6	
Non-binary gender	14	/		2	/		17	/		2	/		6	/	
Age groups															
≤46	15.4	3.4	< 0.001	9.3	2.5	< 0.001	17.9	5.9	< 0.001	3.7	1.7	0.619	13.6	2.7	0.950
47–55	16	3.2		10.1	2.4		18.4	4.7		3.6	1.7		13.6	2.5	
≥56	17	3.3		10.6	2.3		21.1	4.7		3.6	1.8		13.7	2.3	
Material status															
Married	16.7	3,3	< 0.001	10,1	2.5	< 0.001	19.4	5.4	0.002	3.7	1.7	0.013	14	2.7	0.011
In relation	15.1	3.4		9.3	2.4		17.5	5.7		3.5	1.6		13.4	2.7	
Single	15.4	3.3		9.6	2.6		19.2	5.8		4.2	1.9		13.1	2.2	
Widowed	16.7	2.3		11	2.1		18.2	4.3		3.0	1.8		14.3	2.7	
Other	13.5	3.5		8.5	1.6		16.7	5.3		3.7	1.9		14.7	2.6	
Children															
Yes	16.1	3.4	< 0.001	9.9	2.4	< 0.001	18.5	5.6	0.649	3.5	1.5	< 0.001	13.9	2.6	0.002
No	15.1	3.4		9.1	2.6		18.4	5.7		4.1	1.9		13.2	2.6	
Education															
No education	17	/	0.385	14	~	0.637	<del>, -</del>	/	< 0.001	2	/	< 0.001	10	/	0.260
Primary education	15.3	2.2		8.7	2.9		17.3	4.4		2.6	0.8		12.9	1.9	
Secondary school education	15.4	3.3		9.6	2.5		17.1	5.9		3.3	3.3		13.4	2.8	
Higher university education	15.7	15.7		9.7	2.5		18.4	5.4		3.7	3.7		13.8	2.5	
Master's degree	16.2	3.6		9.7	2.5		20.4	5.1		4.3	1.9		13.8	2.5	
PhD	16.5	3.2		9.8	2.4		20.2	5.8		4.5	2.1		13.5	2.4	
Other	15.1	3.4		10	3.5		20.1	5.6		3.6	1.5		13.6	2.5	
Employment															
Yes	15.6	3.5	0.014	9.6	2.5	0.002	18.3	5.6	< 0.001	3.7	1.8	0.568	13.7	2.7	0.447
No	15.7	3.2		9.7	2.6		17	5.8		3.8	1.6		13.0	2.6	
Retired	17.1	2.9		10.9	2.1		21.2	5.0		3.5	1.7		13.7	1.8	
Other	15.4	3.5		8.7	1.8		15.4	3.9		3.7	1.2		12.8	2.9	
Smoking status															
Yes	15.5	3.5	0.380	9.3	2.6	0.024	16.4	5.6	< 0.001	3.4	1.6	0.019	13.5	2.8	0.928
No	15.8	3.3		9.9	2.4		19.2	5.5		3.8	1.8		13.6	2.6	
Stop smoking	15.5	3.5		9.3	2.5		19.5	5.1		4	1.9		13.8	2.7	
BMI															

on the HI PCO by dimension. socio-demographic and health-related characteristics Table 4 Participants'sc

	Healthy c	lietary ch	oices	Dietary h	arm avoi	idance	Daily rou	ıtine		Organize	ed physic	al activity	Social an	d mental	
													balance		
	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value	Mean	SD	<i>p</i> -value
Underweight	14.1	4.1	0.397	9.3	3.1	0.859	16.2	7.7	0.289	2.8	1.3	0.001	12.9	3.1	0.084
Normal weight	15.8	3.5		9.7	2.6		18.9	5.5		4	1.8		14	2.6	
Overweight	15.8	3.4		9.8	2.4		18.4	5.8		3.6	1.6		13.4	2.6	
Obesity	15.4	3.3		9.5	2.5		18	5.7		3.4	1.7		13.4	2.6	

**Table 4** (continued)

than 1 (Kaiser criterion), explaining 50.67% of the total variance. The scree plot showed a clear inflection point after the fifth component, supporting the retention of five components. Additional components contributed minimally to the explained variance, as shown in Fig. 1.

## Discussion

The purpose of the research was to validate the HLPCO in Slovenian and to allow further development of research on healthy lifestyles. The study included the majority of invited participants, with women being significantly overrepresented. The average age was consistent across genders, and most participants had children. In terms of education, about one-third of participants held a university degree, while a similar proportion had completed secondary education. The majority were employed, reflecting a stable socio-economic profile. Cronbach's  $\alpha$  was good, and all domains of the questionnaire showed a positive correlation. One item in the "Healthy dietary choices" subscale, "Do you like cooking? ", showed a somewhat lower item-total correlation, and the Cronbach's  $\alpha$  for the subscale slightly increased when this item was removed. This suggests that this item may not align as strongly with the other items in the subscale, possibly because it reflects a personal preference rather than a specific behavioural habit. Future studies may consider examining whether this item should be retained or revised to better capture healthy dietary behaviour. It is important to note that we modified question 20: "Do you engage in aerobic exercise for 20 minutes or more at least three times a week?" to "Do you engage in aerobic exercise for 30 minutes or more at least three times a week?". This adjustment was made in accordance with WHO recommendations [23], opting for a total duration of 150 min of moderate-intensity aerobic exercise per week. Significant associations were found between participant characteristics and HLPCQ subscales. Females, married individuals, and those with higher education generally scored higher on multiple subscales, while males, younger participants, and those without children excelled in "organized physical activity." Psychometric testing outside Greece has only been carried out in English [19], Persian [16], Indian [32] and Polish [31] [22]. The HLPCQ has been shown to have an acceptable level of reliability and structural accuracy in the Slovenian language. The internal consistency of the Slovenian version indicates excellent reliability across all subscales. Additionally, the content validity and overall reliability of the instrument confirm its suitability for use. This indicates good internal reliability, like other validations by Darviri et al. [18], English validation Farfaglia et al. [19], Persian validation Zahra et al. [16], India validation Goyal & Aleem [32] and Polish validation Czapla et al. [31]. In Slovenia, participants were invited to the study and a significant proportion completed the

## Table 5 Reliability analysis for the HLPCQ

Scale	Questions	Item-Total Correlation	Cronbach's Alpha If Item Deleted
Healthy dietary	1. Are you careful about how much food you put on your plate?	0.47	0.62
choices	2. Do you check the food labels before buying a product?	0.52	0.60
	3. Do you calculate the calories of your meals?	0.35	0.65
	4. Do you limit fat in your meals?	0.46	0.62
	5. Do you like cooking?	0.15	0.71
	6. Do you eat organic foods?	0.38	0.65
	7. Do you eat whole-wheat products?	0.42	0.64
Total Cronbach's Alpha			0.68
Dietary harm	8. Do you avoid eating packaged- or fast-food?	0.47	0.55
avoidance	9. Do you avoid soft drinks?	0.39	0.60
	10. Do you avoid eating when stressed or disappointed?	0.41	0.58
	11. Do you avoid binge eating when you are out with friends?	0.42	0.57
Total Cronbach's Alpha			0.64
Daily routine	12. Do you eat your meals at the same time each day?	0.72	0.86
	13. Are you careful about not missing a meal each day?	0.71	0.86
	14. Do you eat a good breakfast?	0.57	0.88
	15. Do you sleep at the same time each day?	0.59	0.87
	16. Do you follow a scheduled program for your daily activities?	0.57	0.87
	17. Do you eat breakfast at the same time each day?	0.73	0.86
	18. Do you eat lunch at the same time each day?	0.70	0.86
	19. Do you eat dinner at the same time each day?	0.61	0.87
Total Cronbach's Alpha			0.88
Organized physical activity	20. Do you practice aerobic exercise for 30 or more minutes at least 3 times per week?	0.47	/
	21. Do you exercise in an organized manner?	0.47	/
Total Cronbach's Alpha			0.63
Social and mental	22. Do you share your personal problems or worries with others?	0.23	0.59
balance	23. Do you concentrate on positive thoughts during difficulties?	0.43	0.49
	24. Do you empty your brain of thoughts or the next day's program dur- ing bedtime?	0.38	0.51
	25. Do you care about meeting and discussing with your family on a daily basis?	0.35	0.53
	26. Do you balance your time between work, personal life, and leisure	0.34	0.53
Total Cronbach's Alpha			0.59

Table 6 HLPCQ questionnaire item-total pearson correlation coefficients between subscales

	Healthy Dietary Choices	Dietary harm avoidance	Daily routine	Organized physical exercise	Social and mental balance
Healthy dietary choices	1	0.509**	0.370**	0.232**	0.276**
Dietary harm avoidance	0.509**	1	0.329**	0.098*	0.257**
Daily routine	0.370**	0.329**	1	0.284**	0.259**
Organized physical exercise	0.232**	0.098*	0.284**	1	0.065
Social and mental balance	0.276**	0.257**	0.259**	0.065	1

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

questionnaire, with similar participation patterns observed in Poland, Greece, and Iran [16, 18, 31]. It was found that all subscales had a significant positive correlation with each other, suggesting that people who adopt healthy eating habits also follow routines in their daily activities, exercise regularly, seek social support and take care of their mental health, as well as adopting healthy eating habits and avoiding dietary harm. The same significant positive association was found in other validations [16, 18, 19, 31, 32]. The Slovenian version of the HLPCQ

**Table 7** Principal component analysis rotated factor loadings for 26 health-related lifestyle behaviours (n = 666)

	Compo	nents			
Question(s)	1	2	3	4	5
18. Do you eat lunch at the same time each day?	0.81				
12. Do you eat your meals at the same time each day?	0.79				
17. Do you eat breakfast at the same time each day?	0.76				
19. Do you eat dinner at the same time each day?	0.75				
13. Are you careful about not missing a meal each day?	0.73				
15. Do you sleep at the same time each day?	0.69				
16. Do you follow a scheduled program for your daily activities?	0.60				0.37
14. Do you eat a good breakfast?	0.57				
11. Do you avoid binge eating when you are out with friends?		0.71			
1. Are you careful about how much food you put on your plate?		0.66			
4. Do you limit fat in your meals?		0.57			
3. Do you calculate the calories of your meals?		0.56			0.38
10. Do you avoid eating when stressed or disappointed?		0.56			
6. Do you eat organic foods?			0.698		
9. Do you avoid soft drinks?			0.65		
8. Do you avoid eating packaged- or fast-food?			0.63		
2. Do you check the food labels before buying a product?		0.40	0.52		
7. Do you eat whole-wheat products?			0.47		0.36
5. Do you like cooking?			0.44	0.31	
23. Do you concentrate on positive thoughts during difficulties?				0.69	
24. Do you empty your brain of thoughts or the next day's program during bedtime?				0.65	
25. Do you care about meeting and discussing with your family on a daily basis?				0.61	
26. Do you balance your time between work, personal life, and leisure				0.56	
22. Do you share your personal problems or worries with others?				0.42	
20. Do you practice aerobic exercise for 30 or more minutes at least 3 times per week?					0.77
21. Do you exercise in an organized manner?					0.72

Only loadings  $\geq |0.30|$  are shown.

has good factorial validity and can be used in clinical practice and research. In the Persian validation by Zahra et al. [16], only the overall  $\alpha$  was calculated and not by subscales, so we could not compare it with our results. We found that the original Greek validation, English, Polish, Indian and our Slovenian validations have in common that the subscale *"daily routine"* has the highest  $\alpha$ , and English validation has magnitude of the highest  $\alpha$ subscale "social and mental balance". The overall order varies between all validations, but the numbers are very similar and very close. The outlier was found in the subscale "Social and mental balance" with the lowest  $\alpha$ , likely reflecting cultural differences between Slovenians and populations in other countries where the HLPCQ has been validated. Similarly, the 14-item Resilience Scale (RS-14-SL) highlights the importance of cultural and contextual adaptation to ensure accurate assessment of psychological resilience. Both tools validated in Slovenian language, underscore the need for culturally sensitive measures to capture the nuances of well-being and health management across diverse populations [33]. The factor analysis revealed low loading values for three items: eating whole-wheat products, enjoying cooking, and sharing personal problems. These results may reflect cultural norms in Slovenia, where cooking is still primarily viewed as a woman's responsibility, potentially leading to biased responses to the latter question. Also, in a questionnaire of the Slovenian population, the results indicate a low consumption of whole grain products, which may also predict biased responses [34]. Low factor loadings were also calculated in the Indian validation version of the questionnaire [32]. In previous years, Slovenia has made important progress in the development of mental health care [35]. Data suggest a response bias in the low factor loading of the item related to sharing personal concerns or worries with others. Hence, we conclude that this difference in the order of the subscales order is due to different lifestyles in different countries. This difference in order suggest that the Slovenian population has a daily routine and also prefers healthy eating habits and choices, avoiding processed foods, sugary drinks and overeating. Our findings suggest that older individuals tend to spend more time selecting and preparing healthy meals, avoiding unhealthy diets, and maintaining regular daily routines. Married participants generally demonstrate healthier lifestyles and higher scores across all subscales, as do those with at least one child. In the Greek validation by authors Darviri et al. [18] single individuals



Fig. 1 Screen plot of the PCA

are more inclined to search for social aid and attend to their mental well-being compared to married individuals. Therefore, it can be used as a useful and relevant instrument for the assessment of individual behaviors that correspond to a healthy way of life and to self-control. The health benefits of a healthy lifestyle continue to grow in number and importance [6]. Many studies show that improvements in the above areas are essential for a better quality of life [13, 17, 36, 37, 38, 39]. Doctors, public health practitioners and other health professionals should be convinced of the growing and well-documented benefits of lifestyle change, and should redouble their efforts to help patients live longer [40]. Swedish research has identified a number of factors that may be barriers to the uptake of health promotion services by the general public [40]. A key element in the prevention of chronic diseases is the identification and improvement of health literacy, as health literacy can be a target for interventions to achieve the national goal of preventing and controlling lifestyle-related diseases [41, 42, 43]. In this context, the rationale for adapting the HLPCQ was the lack of an appropriately structured instrument in Slovenia for synthetic analysis of lifestyle variables, including self-monitoring. Overall, the HLPCQ performs well in measuring lifestyle habits and can be considered for future use in population health epidemiological studies and primary health care. From a public health perspective, the Slovenian version provides a valuable, culturally sensitive tool for assessing individuals' health-promoting behaviours and perceived control over daily life. This is particularly important in primary care, where early identification of unhealthy lifestyle habits can lead to timely, tailored interventions. By supporting the systematic assessment and tracking of lifestyle factors, the HLPCQ has the potential to enhance national prevention efforts aimed at reducing the impact of noncommunicable diseases.

To our knowledge, this is the first study to validate the HLPCQ in the Slovenian context. Therefore, no prior public health studies have used this version of the instrument. However, our findings suggest strong potential for future applications in population-level health monitoring and prevention initiatives.

#### Limitations

The research also has several limitations that need to be highlighted. Although the sample size is sufficient to assess the main aims of the study, it could be improved by including a larger number of participants. Limitation is also that the use of social networks and email for recruitment did not allow for the detection or verification of potential disabilities among participants, which may limit the generalizability of the findings to populations with diverse abilities. Limitation is that we obtained low Cronbach's  $\alpha$  values for individual subscale. The general culture of the Slovenian population may have had an influence on the Cronbach's  $\alpha$ . Another limitation is that the survey was conducted only through an online platform, which means that we excluded some potential participants who do not have internet access, are older and rarely use the internet. It would be useful to have each person surveyed by health organizations over several years and then analyze the data in detail. This would give a really accurate picture of the lifestyle of the Slovenian population. For practical reasons, repeated testing was not done. The sample of adults in this survey was diverse in age but homogeneous in gender.

## Conclusion

The study successfully validated the Slovenian adaptation of the HLPCQ, demonstrating its excellent validity and reliability in assessing individual's ability to manage various aspects of their lifestyle. The highest scores were observed in healthy lifestyle practices, followed by daily routines, healthy dietary choices, dietary harm avoidance, organized physical activity, and social and mental balance. These results highlight the utility of the instrument in identifying key areas for lifestyle management and informing targeted interventions.

The results also underline the importance of cultural context in shaping health-related behaviours. For example, certain items, such as cooking habits and sharing personal concerns, may reflect culturally specific norms and practices, that underscore the need for culturally sensitive adaptations. The Slovenian version of the HLPCQ is a valuable resource for health promotion efforts, offering a culturally sensitive framework for understanding and improving individual lifestyle behaviours. It serves not only as a meaningful tool for family medicine professionals but also holds significant potential from a public health perspective. By enabling population-wide surveillance of lifestyle-related risk factors and supporting the design of behaviour change strategies, the HLPCQ contributes to broader national health promotion objectives. Future research could build on these findings by exploring cultural differences and their implications for effective health interventions in diverse populations.

#### Abbreviations

КМО	Kaiser-Meyer-Olkin index
NCDs	Noncommunicable diseases
CVDs	Cardiovascular diseases
HLPCQ	Healthy Lifestyle and Personal Control Questionnaire
a	Cronbach's alpha
PCA	Principal component analysis
Varimax	orthogonal rotation at factor analysis
WHO	World Health Organization
1	CVI-Item content validity index
S	CVI-The scale content validity index
S	CVI/UA-The scale for which all raters agreed on content validity
S	CVI/Ave-The average scale validity index
Pc	probability of chance agreement
Ν	Sample size
Δ	number of experts who agree that the item is relevant

number of experts who agree that the item is relevant

- BMI Body mass index
- No Number of questions
- k\* kappa indicating agreement on relevance
- SD Standard deviation
- Μ Mean
- RS 14-SL-the 14-item Resilience Scale

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#### Author contributions

AS, ML, made substantial contributions to the study design, performed the acquisition of data collection and analysis, interpreted the data and prepared a draft. GŠ made substantial contributions to the study design, analysis the data and revised the manuscript. GŠ, ML made substantial contributions at the revision of the manuscript. All authors approved the submitted version.

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#### Declarations

#### **Competing interests**

The authors declare no competing interests.

#### Ethical approval and consent to participate

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## **Consent for publication**

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