Rev Rene. 2024;25:e93456.
DOI: 10.15253/2175-6783.20242593456
www.periodicos.ufc.br/rene

Original Article

Healthy Lifestyle Motivation Questionnaire: theoretical framework and validity evidence*

Questionário de Motivação ao Estilo de Vida Saudável: quadro teórico e evidências de validade

How to cite this article:
Carvalho IS, Moreira TMM, Arruda LSNS, Lima GS, Loureiro AMO, Gomes EB, et al. Healthy Lifestyle Motivation Questionnaire: theoretical framework and validity evidence. Rev Rene. 2024;25:e93456. DOI: https://doi.org/10.15253/2175-6783.20242593456

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*Extracted from the thesis "Motivação ao estilo de vida saudável: construção e evidências de validade de um instrumento avaliativo, Universidade Estadual do Ceará, 2020.

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Conflict of interest: the authors have declared that there is no conflict of interest.

EDITOR IN CHIEF: Ana Fatima Carvalho Fernandes
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ABSTRACT

Objective: to develop and verify evidence of the validity of the Healthy Lifestyle Motivation Questionnaire. **Methods**: methodological study anchored in Psychometrics. The construct was structured on the theory of self-determination and the constitutive elements of a healthy lifestyle. A total of 29 items were developed, evaluated by eight specialists and 30 users, and applied to a sample of 972 adults in nine Primary Health Care Units. **Results**: a questionnaire was developed containing 29 items with answers according to the quality of motivation. Evidence of content validity showed indices (0.75 to 1.0, $p<0.05$), with good theoretical formulation, while the response process allowed for adjustments to its items. The internal structure revealed a final model of 22 items distributed in four dimensions with an explained variance of 66.58%, factor loadings (0.349 to 0.911), adequate communality ($0.20 \leq h2 \leq 0.98$), and good accuracy indicators. **Conclusion**: the questionnaire, with 22 items in four dimensions, showed good evidence of construct validity, content validity, response process, and internal structure for measuring the construct. **Contributions to practice**: the application of the questionnaire can enhance health promotion actions related to lifestyle changes for the effective prevention of morbidities.

Descriptors: Motivation; Validation Study; Healthy Lifestyle; Psychometrics; Technology.

RESUMO

Objetivo: construir e verificar evidências de validade do Questionário de Motivação ao Estilo de Vida Saudável. **Métodos:** estudo metodológico ancorado na Psicometria. O construto foi estruturado na teoria da autodeterminação e elementos constitutivos do estilo de vida saudável. Foram desenvolvidos 29 itens avaliados por oito especialistas e 30 usuários, e aplicados a uma amostra de 972 adultos em nove Unidades de Atenção Primária à Saúde. **Resultados:** elaborou-se um questionário contendo 29 itens com respostas segundo a qualidade da motivação. As evidências de validade de conteúdo mostraram índices (0,75 a 1,0, $p<0,05$), com boa formulação teórica, enquanto o processo de resposta permitiu adequações aos seus itens. A estrutura interna revelou um modelo final de 22 itens distribuídos em quatro dimensões com variância explicada de 66,58%, cargas fatoriais (0,349 a 0,911), adequada comunalidade ($0,20 \leq h2 \leq 0,98$) e bons indicadores de precisão. **Conclusão:** o questionário, com 22 itens em quatro dimensões, demonstrou boas evidências de construção, validade de conteúdo, processo de resposta e de estrutura interna para a mensuração do construto. **Contribuições para a prática:** a aplicação do questionário pode potencializar as ações de promoção da saúde relacionada às mudanças no estilo de vida para a prevenção efetiva de morbidades.

Descritores: Motivação; Estudo de Validação; Estilo de Vida Saudável; Psicometria; Tecnologia.

Received: May 28th 2024; Accepted: July 29th 2024.

Introduction

A healthy lifestyle has become one of the factors in determining health, representing a series of daily behaviors that reflect personal attitudes and values aimed at quality of life[1]. The confrontation of various daily forces toward the acquisition of these healthy behaviors can be interpreted as motivation. Motivation is the emergent, regulatory, and sustaining force behind individuals' actions. It is a complex process that influences the initiation and maintenance of an activity with persistence and vigor over time[2].

Based on the Self-Determination Theory[2], motivation influences the acquisition and maintenance of new behaviors and is classified into three types: intrinsic motivation, which arises from the pleasure of performing an activity; extrinsic motivation, influenced by external factors; and amotivation, characterized by the absence of motivation for the connections between interests and actions[2]. Applying this framework to the measurement of a healthy lifestyle provides new horizons for research and health-promoting interventions.

There are some instruments for measuring lifestyle: individual lifestyle[3], fantastic lifestyle[4], Mediterranean lifestyle[5], major life-changing decisions profile[6], motivation to change behavior for dementia risk reduction[7], and case-finding and help assessment tool[8]. However, these tools lack a theoretical framework based on motivation, which provides an opportunity to develop a questionnaire that assesses motivation for a healthy lifestyle. This questionnaire is based on the main aspects of instrument development, which include theoretical foundation, validity evidence, reliability, impartiality, fairness and accessibility, item development, variety of test forms and consistency, scoring procedures and interpretation, as well as review, updating, and ethics[9]. The prevalent domains are eating habits, physical activity, sleep, stress, leisure, well-being, sadness, relationships, and the use of licit drugs (alcohol and smoking)[10].

In order to fill this gap, this study aimed to develop and verify evidence of the validity of the Healthy Lifestyle Motivation Questionnaire.

Methods

This is a methodological study anchored in Psychometrics[9]. The construct was based on the Self-Determination Theory and the constituent elements of a healthy lifestyle[2,10]. In order to understand the construct, we reviewed the literature[10] on lifestyle assessment tools for adults, aligning it with Self-Determination Theory[2]. These procedures resulted in the construct: Motivation for a healthy lifestyle. The constitutive definitions were worked on, giving rise to the operational dimensions and the items[11]. The structure of the items and their answers were built on the types of motivation in the Self-Determination Theory[2]. These theoretical procedures resulted in a theory to anchor the construct.

The construct theory, items, and their adjectival response scale were sent to a committee to check the evidence of the test's content validity. This was a multidisciplinary panel of eight experts - doctors/masters - with experience in creating instruments and involved with healthy lifestyles in teaching/research/extension. They were selected on the website of the National Council for Scientific and Technological Development (CNPq), through a search on the Lattes Platform using the keywords "lifestyle" and "validity studies". They were contacted by e-mail with an invitation letter containing information about the research and the specialist's duties in the study.

This assessment was made on an ordinal scale (1- Not indicative, 2- Very little indicative, 3-Considerably indicative, and 4- Very indicative). The Content Validity Index (CVI) of the items was calculated, considering: CVI ≥ 0.78 excellent; CVI from 0.60 to 0.77 good, and CVI < 0.59 poor[11]. For the statistical reliability of the CVIs, the exact binomial distribution test was used ($p>0.05$) and 0.75 was the proportion for the desired agreement, all in International Business Machines SPSS® version 23.

After complying with the experts' requests, the items and the response scale were applied in a cognitive interview with fifteen patients. This was carried out by two researchers in a Primary Health Care Unit (UAPS) in Fortaleza-CE-Brazil, chosen for convenience due to its ease of access. At this point, the participants' difficulties in understanding the terms of the instrument were observed, with the need to reformulate the items, making them more comprehensible. The participants' suggestions were followed to make the items clearer. The instrument was then reapplied to fifteen different patients to check their understanding of the new format of the items and their responses, finalizing the pilot structure.

In order to observe the validity of the internal structure of the Healthy Lifestyle Motivation Questionnaire (HLMQ), it was applied to 972 adults and elderly people, both healthy and chronically ill. In order to obtain good evidence of the validity of the internal structure, it is essential to intentionally heterogenize the sample so that it includes people with different levels of the behavior to be measured, from those who perform the behavior to those who do not. This can guarantee responses to all items and response categories, avoiding the ceiling and floor effect.

The sample was collected at two points in time due to the restrictions imposed by the COVID-19 pandemic, before and after the health measures adopted. Data collection took place in nine UAPS in Fortaleza between 2020 and 2022. After composing the database, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were applied. Dimensionality was tested via Parallel Analysis in Optimal Implementation of Parallel Analysis. The test was robust using bootstrap association with sample extrapolation to 1,000 cases[12]. The factors were extracted using Robust Unweighted Least Squares (ULS) with polychoric correlation and reduction of matrix residuals[13]. Items with factor loadings <0.3, shared between factors, and Haywood cases (factor loadings >1) were eliminated. The analyses were carried out using Factor® software. We also investigated the commonality, which indicates how much each variable is explained by the factors[12], and the factor loadings, which reveal how much each factor explains each variable[13], all considering the assumptions of the Self-Determination Theory in the context of healthy lifestyle.

Reliability was checked using Factor® software by estimating the quality of the factor scores with the Factor Determination Index (FDI) (>0.80 indicating adequate quality) and Overall Realibity of Fully- Informative Prior Oblique N-EAP scores (ORION) marginal reliability (>0.80 indicating adequate quality). AFC was performed to test the fit of the data to the pentafactor structure. The following indices were used to assess the quality of the model's fit and its 95% Confidence Intervals (CI): Tucker Lewis Index (TLI > 0.90); Comparative Fit Index (CFI > 0.94); Goodness of Fit Index (GFI > 0.95); Adjusted Goodness of Fit Index (AGFI > 0.93); Root Mean Square Error of Approximation (RMSEA < 0.07) and Root Mean Square of Residuals (RMSR < 0.08)[13].

This research was approved by the Research Ethics Committee of the State University of Ceará under opinion no. 3,345,431/2019, and Certificate of Presentation for Ethical Appraisal 13440419.6.0000.5534.

Results

The construct "Motivation for a healthy lifestyle" was defined as the direction of needs according to internal/external stimuli for adopting and practicing healthy habits and customs. It was initially organized into three domains: behaviors, physical activity, and healthy eating habits. After analysis by the expert committee, five domains remained: 1) psycho-emotional aspects (well-being, sadness, and stress), 2) activity/rest (physical activity, sleep, and leisure), 3) coping with licit drugs (smoking and alcoholism), 4) relationships and 5) eating habits, all worked into ten constitutive definitions (Table 1).

The experts were women (63.0%), 36 years old on average, from the Northeast (87.5%) and southern Brazil (12.5%). They had degrees in Nursing (50%),

Physical Education (25%), Psychology (12.5%), and Economics (12.5%), with an average of 12.25 years since graduating. Of the total, 62.5% had a doctorate, and 100% had experience in lifestyle studies and instrument construction. A nutritionist and a doctor were also invited, but there was no response.

Tables 2 and 3 show the CVI and binomial test of the construct's constitutive and operational definitions and items. The constitutive and operational definitions with CVI < 0.78 were reorganized, following the experts' suggestions. All the definitions showed p>0.05 in the binomial test, denoting agreement between the judges. Based on the latent trait theory with its constitutive and operational definitions (Table 1), the HLMQ was drawn up, with 29 items and their answers graded according to the quality of motivation (amotivation, extrinsic motivation, and intrinsic motivation).

Table 1 – Content Validity Index and binomial test of the constitutive and operational definitions of the latent trait of the Healthy Lifestyle Motivation Questionnaire. Fortaleza, CE, Brazil, 2024

Variables	Constitutive definitions	CVIi*	p†	Operational definitions	CVIi	p
Wellness	Extension of the perception of one's own state of health. It consists of a set of practices that encompass physical, psychological, mental, and spiritual well-being.	0.75	0.630	Being satisfied with work/studies/spirituality.	0.75	0.630
Leisure	It lies in the possibility of encouraging active attitudes when using free time.	0.88	0.370	Use free time to rest or to do activities that bring pleasure.	0.75	0.630
Sleep	The quality of the hours slept enables better physical and mental performance.	0.88	0.370	Identifying the quality of sleep; recognizing factors that interfere with sleep.	0.88	0.370
Stress	The set of reactions that the body develops when subjected to a situation arising from a stimulus or situation that requires effort to adapt.	1.0	0.100	Recognize stress levels.	0.88	0.630
Sadness	The perception of sadness is the human response to situations of loss, disappointment, and other adversities that affect the individual's emotional state.	0.88	0.370	Feeling sad or depressed; losing interest and enjoyment in life's events.	0.75	0.630
Smoking	Consuming cigarettes or other products containing tobacco, whose active ingredient is nicotine, causes physical and psychological dependence and is one of the main health risk factors.	0.88	0.370	Using tobacco.	0.75	0.630
Alcohol use	Abuse of and dependence on chemical substances, such as alcohol, threatens political, economic, and social values and is a negative indicator of health.	0.88	0.370	Drinking alcohol regularly or moderately.	0.88	0.370
Relationships	Good relationships with family, friends and/or social groups contribute to physical and mental health, providing well-being and emotional balance.	0.88	0.370	Having people to talk to about personal matters that are important to each individual; cultivating friends; taking part in group and community activities.	0.88	0.370
Physical activity	Physical activity is identified as any bodily movement produced by the musculoskeletal system that results in energy expenditure. It is a protective factor for health and has various beneficial effects on the body, being recommended as a strategy for health promotion and disease prevention.	0.88	0.370	Engage in regular physical activity.	0.88	0.370
Healthy eating	Adequate eating habits provide the human body with the conditions for a healthy life and influence health.	0.88	0.630	Practicing exercise or sports.	0.88	0.370

*CVIi: Item Content Validity Index; †Binomial Test

Table 2 shows the items and their CVIs. The experts also assessed the relevance of the answer options per item. The CVIs ranged from 0.75 to 1 and were therefore adequate.

Table 2 – Content Validity Index and Binomial Test of the items in the Healthy Lifestyle Motivation Questionnaire, based on Self-Determination Theory. Fortaleza, CE, Brazil, 2024

Items	CVIi*	p†
1. Am I motivated by my work?	1.0	0.100
2. Am I motivated by my studies?	1.0	0.100
3. Am I motivated by my spirituality?	0.88	0.370
4. Do I use my free time to rest?	0.88	0.370
5. Do I use my leisure time to do activities that bring me pleasure?	0.88	0.370
6. What is my motivation for enjoying my leisure time?	1.0	0.100
7. What motivates me to enjoy my sleeping time?	0.75	0.630
8. What motivates me to get a good night's sleep?	0.88	0.370
9. What is my motivation for coping with stress?	1.0	0.100
10. What is my motivation for coping with excessive anger?	0.88	0.370
11. What is my motivation for coping with sadness?	1.0	0.100
12. What is my motivation for coping with a lack of enthusiasm?	0.88	0.370
13. What motivates me to take an interest in everyday events in my life?	0.88	0.630
14. What is my motivation for developing enjoyment with the events in my life?	0.75	0.630
15. What is my motivation for tackling smoking?	0.88	0.370
16. What is my motivation for coping with drinking alcohol?	0.88	0.370
17. What motivates me to find people to talk to?	0.88	0.370
18. What motivates me to have a friendly relationship with my work colleagues?	0.88	0.370
19. What motivates me to have a friendly relationship with my fellow students?	0.75	0.630
20. What motivates me to have a good relationship with the people I work with?	0.88	0.370
21. What motivates me to cultivate friendships?	1.00	0.100
22. What motivates me to take part in group activities?	1.00	0.100
23. What is my motivation for practicing physical activity?	1.00	0.100
24. Do I practice physical activity regularly (at least 2 to 3 times a week)?	0.88	0.370
25. What is my motivation for practicing sports (volleyball, swimming, cycling, walking, running)?	0.88	0.370
26. What motivates me to eat healthily?	0.88	0.370
27. What motivates me to avoid eating fatty foods?	0.88	0.370
28. What motivates me to avoid eating foods high in sugar?	0.88	0.370
29. What is my motivation for avoiding salt or salty foods?	0.88	0.370

*CVI: Item Content Validity Index; †Binomial test

The HLMQ items showed excellent CVI, indicating good theoretical formulation. Items with CVI ≤ 0.88 were adjusted according to the judges' suggestions. In the binominal test, the 29 items obtained p>0.05 or agreement between judges. The total CVI of the questionnaire was 0.90.

In the evidence of construction, content validity, and response process, through the cognitive interview, the respondents' difficulties in understanding the questions were observed, and they considered the questionnaire to be long, indicating the need to refor mulate the items to improve understanding. The participants suggested ways of making the items more comprehensible. The response scale for the items was modified and summarized in words that identified the quality of motivation based on the regulatory factors of Self-Determination Theory. After adjusting the answers to the instrument, the questionnaire was reapplied to another 15 patients at the UAPS. The new version was better understood by them (Figure 1).

Levels of motivation	Regulation	Cognitive interview response scale	
		Before	After
Amotivation	Nonexistent	I don't think I need to tackle smoking.	Doesn't do it
Controlled motivation (extrinsic)	External	I try to cope with smoking because of the influence of the people around me.	Does it to get recognition from people
	Introjected	I try to tackle smoking so that I don't feel guilty for not tackling this addiction.	Does it out of guilt / anxiety / obligation
Autonomous motivation (extrinsic)	Identified	I try to cope with smoking because I want to achieve a state of independence from this addiction.	Does it for appreciation / consequences
	Integrated	I try to cope with smoking because I need to have all the advantages of a life without this addiction.	Does it for awareness
Intrinsic motivation	Intrinsic	I try to cope with smoking because I feel satisfied, happy, and fulfilled in this process of coping, in order to achieve a life without this addiction.	Does it for pleasure / liking / feeling good

Figure 1 – Changes in the response scale in the evidence related to the response process. Fortaleza, CE, Brazil, 2024

In order to prove the validity of the HLMQS internal structure, it was applied to adults aged 42 ± 15.6 years, women (72.7%), brown (50.8%), with completed high school (37.8%), with a partner (71.4%), Catholic (54.3%) and with an income of < two minimum wages (51.9%).

The initial model was tested with 29 items. The Parallel Analysis indicated the extraction of five dimensions, reaching an accumulated explained variance of 64.2%, with 27.5%, 11.6%, 10.4%, 7.9%, and 6.7% for each dimension, respectively. In the EFA, items 03, 13, 14, 15, 16, and 22 were eliminated because they had a factor load below <0.3; item 28 was eliminated because it had a Haywood case with a factor load of 1.032. After excluding these items, the Parallel Analysis indicated an internal structure with four factors and an accumulated explained variance of 66.6%, with 32.9%, 12.8%, 12.0%, and 8.8% of each factor, respectively.

Table 3 details the results of the HLMQS EFA. Factor 1 (6 items - 23, 24, 25, 26, 27 and 29) encompassed aspects of nutrition and physical activity; factor 2 (4 items - 9, 10, 11 and 12), items on psycho-emotional aspects; factor 3 (7 items - 1, 02, 17, 18, 19, 20, 21) was made up of items relating to relationships; and factor 4 (5 items - 4, 5, 6, 7, 8) on rest and leisure.

The ORION and FDI indices showed the HLMQS adequate reliability with 22 items with acceptable fit indices in the EFA (Non-normed Fit Index (NNFI)= 0.921; CFI= 0.983; GFI= 0.975; AGFI=0.961). Table 4 shows the fit indices of the models tested and reveals the quality of the final model over the initial one, expressed by the values found in the Confirmatory Factor Analysis (CFA).

Table 3 – Factor loadings, commonalities, and kurtosis of the Healthy Lifestyle Motivation Questionnaire. Fortaleza, CE, Brazil, 2024

Item	Factor 1	Factor 2	Factor 3	Factor 4	h2*	K†
	Nutrition and physical activity	Psycho-emotional aspects	Relationships	Rest and leisure		
4	0.019	-0.038	-0.001	0.795	0.627	1.837
5	0.033	-0.042	0.042	0.836	0.736	1.353
6	0.015	-0.021	-0.010	0.900	0.801	1.443
7	-0.079	0.031	-0.028	0.774	0.559	2.006
8	-0.010	0.085	-0.012	0.623	0.412	1.566
9	0.001	0.765	-0.016	0.031	0.595	-0.871
10	-0.034	0.864	0.023	-0.035	0.724	-1.004
11	0.002	0.911	-0.005	-0.015	0.822	-0.866
12	0.021	0.814	0.012	0.017	0.683	-0.874
1	0.112	0.078	0.373	0.047	0.230	-0.978
2	0.100	0.126	0.349	0.072	0.236	-1.691
17	-0.059	-0.027	0.792	0.009	0.593	-0.097
18	-0.040	0.040	0.882	-0.009	0.756	-0.954
19	0.080	0.019	0.768	0.034	0.681	-1.593
20	0.000	-0.042	0.865	0.064	0.691	0.155
21	-0.022	-0.030	0.779	0.002	0.588	1.137
23	0.749	-0.003	0.096	-0.000	0.627	-1.258
24	0.817	-0.034	0.006	0.020	0.671	-1.327
25	0.835	-0.039	0.024	0.000	0.698	-1.486
26	0.728	-0.038	0.007	0.020	0.531	-0.246
27	0.748	0.056	-0.060	-0.037	0.534	-0.799
29	0.721	0.054	-0.082	-0.021	0.491	-0.867
Variance (%)	32.86	12.75	12.05	8.92		
ORION	0.905	0.917	0.913	0.918	Total 66.58%	
FDI	0.952	0.958	0.956	0.958		

*h2: commonality; †K: kurtosis; ORION: Overall Realibity of Fully- Informative Prior Oblique N-EAP scores; FDI: Factor Determination Index

Table 4 – Fit indices of the initial and final models of the Healthy Lifestyle Motivation Questionnaire. Fortaleza, CE, Brazil, 2024

Indexes	Initial model	Final Model *	95%CI†
Kaiser-Meyer-Olkin	0.626	0.792	(0.721; 0.808)
Tucker Lewis Index	–	0.973	(0.987; 0.990)
Comparative Fit Index	–	0.983	(0.991; 0.994)
Goodness of Fit Index	0.974	0.975	(0.968; 0.980)
Adjusted Goodness of Fit Index	0.961	0.961	(0.950; 0.968)
Root Mean Square Error of Approximation	–	0.056	(0.036; 0.038)
Root Mean Square of Residuals	0.059	0.064	(0.055; 0.069)

*Confirmatory Factor Analysis; †95%CI: Confidence Interval for the Final Model

Discussion

This study provides construction and validity evidence for the HLMQ in terms of its content, response process, and internal structure. The HLMQS theoretical dimensionality was based on an integrative review of lifestyle and adopted Self-Determination Theory[2] as a reference. The first stage in creating the questionnaire was the theoretical foundation of its construct, listing its attributes, dimensions, constitutive and operational definitions, and the items of the construct[14].

The appropriate theoretical structuring of the HLMQ resulted in good validity estimates for its content. The construction process took into account the complexity of the construct and included the domains related to the characteristics of attitudes/values in people's lives necessary for measurement[13]. These aspects were captured by the multidisciplinary panel of experts. This was because this study considered the qualifications of the experts over quantity, in search of accurate evaluations[11]. In this sense, after the experts' analysis, the theoretical framework was reorganized into five domains in line with a review study on healthy lifestyle, generating a greater understanding of the construct[10]. The items also obtained adequate CVIs, indicating that they form a representative set of construct content[9].

Regarding the validity of the response process, this investigation directly investigates the ways in which individuals deal with items in an effort to clarify the processes underlying item response and task performance. In this evidence, the HLMQ was evaluated by means of cognitive interviews to access participants' cognitive processes and help determine whether the question is generating the information its author intends[15]. This stage allowed for the refinement of the response scale to the items, maintaining coherence between the Self-Determination Theory and the respondents' understanding. The HLMQS response options were graded based on this theory according to the quality and regulatory factors of motivation. The answers were given at the following theoretical levels: amotivation (nonexistent regulation), extrinsic motivation (external, introjected, identified, and integrated regulation), and intrinsic motivation (intrinsic regulation)[2].

The lowest level is amotivation, characterized in the individual by the absence of perceived associations between interests and actions. Thus, there is no personal meaning to the actions. They are random, independent of internal/external interferences on personal choices. Extrinsic motivation, in which actions are motivated by rewards or desired results. This type is divided into four forms: external regulation, regulation by introjection, regulation by identification, and integrated regulation. All four are progressively closer to self-determination. Finally, in intrinsic motivation, the personal stimulus stems from what the activity itself and its benefits represent. The Self-Determination Theory predicts the highest level of autonomous quality in individual actions/choices with the presence of intrinsic motivation[2].

In addition, the response process made it possible to verify the comprehension of the items and their subsequent adaptation to the educational and cultural level of the population being assessed, strengthening the link between the constructive and operational definitions in the instrument[16].

Evidence of the validity of the internal structure seeks to demonstrate the extent to which the relationships between the items and the components of the test are in line with the construct on which the proposed interpretations of the test score are based[9]. In this sense, the HLMQ demonstrated a factor structure consistent with the theory that supports the construct, based on the assertion of an instrument with four dimensions.

When constructing the internal structure, some changes were necessary in the search for evidence of validity. The EFA indicated the need to revise the instrument due to the irregularity of some items. As a result, seven items were excluded because they had inadequate factor loading, and one of these items was eliminated because it had a Haywood case. The factor load indicates how much information an item

contributes to the factor, and is not appropriate below <0.3. The Haywood case is when the factor loading is >1 which arose for various reasons, such as the small sample size or discrepant values in the responses to the item resulting in incorrect specifications of the factor model[17]. By excluding these items, the model solution was appropriate and there were no deleterious effects arising from the sample and, above all, from the established model[18].

The EFA and CFA presented the HLMQ with four dimensions: the first brought together items on diet and physical activity; the second on psycho-emotional aspects (well-being, sadness, and stress); the third on relationships (family, friends, and work) and the fourth on rest/leisure. The first dimension brings to the instrument the evidence already established in the literature on the need for healthy eating and active living. Motivation for physical activity and healthy eating is linked to factors such as fun, physical appearance, and feeling capable of accomplishing something when compared to other people. On the other hand, the consumption of inadequate food generates changes in the quality/quantity of the diet, associated with changes in lifestyle and economic/social/cultural/demographic conditions. This has had an impact on population health, increasing overweight/obesity[19].

The second dimension includes psycho-emotional aspects (well-being, sadness, and stress). The first relates to individual health, which goes beyond the health sector, requiring the population to lead a healthier lifestyle[20]. With regard to sadness, the literature shows that lifestyle habits including an inadequate diet, lack of self-care, a sedentary lifestyle, and sleep disorders are correlated with an increased risk of depression[21]. Finally, stress manifests itself in everyday life as a risk factor for physical and psychological health[22].

The third dimension deals with relationships or interpersonal relations at work, with family, and among friends. The presence of more positive resources/positive affections generates greater individual satisfaction, as well as increasing self-esteem and well-being[23]. The influence of relationships on individual behavior goes beyond controlled and autonomous external motivation, requiring health professionals to mobilize conditioning factors in order to build internal motivation.

The fourth dimension corresponds to rest/leisure. It consists of health-protective behaviors with beneficial organic effects. They are recommended as health-promoting strategies and preventive measures against alterations and illnesses. However, leisure is activities carried out in one's free time, a form of rest/recreation, which generates well-being and increases the quality of life and health[24]. Experiencing moments of rest and leisure in everyday life requires people to build intrinsic motivation.

The instrument was based on the Self-Determination Theory, which envisages the human being in their natural tendency, and in search of an elaboration and integration of the self. In this sense, behaviors are based on contexts to support their psychological needs, demanding autonomy/competence/connectivity in relationships, depending on the type of motivation[2].

Study limitations

Some limitations were detected, such as the absence of specialists from areas other than health. However, those who did take part had expertise in the construct and the type of study. There is also a need to deepen the evidence of the validity of the response process, and the creation of a parameterization, which could be outlined through the construction of an interpretative scale using Item Response Theory.

The sample was collected at two points in time due to the restrictions of the COVID-19 pandemic, before and after the health measures adopted. This may reflect changes in lifestyle related to the pandemic. Despite being collected in a city in the Northeast, the sample size was sufficient, and bootstrapping was used to correct the estimates, overcoming the limitations.

Contributions to practice

The application of the HLMQ can enhance health-promoting actions related to lifestyle changes in order to provide effective morbidity prevention. In addition, the results of this study can support future research to use this questionnaire in different data sets and population groups, with the aim of exploring the categorization of motivation for a healthy lifestyle (intrinsic motivation, extrinsic motivation, and amotivation), in various geographical areas of the country and the world, for the planning of actions to promote health and a healthy lifestyle.

Conclusion

The Healthy Lifestyle Motivation Questionnaire with 22 items and four dimensions (diet and physical activity; psycho-emotional aspects; rest and leisure; relationships) showed satisfactory psychometric properties, indicating that it is a model with good evidence of validity (content/response process/internal structure validity), and shows plausibility between the theory of the construct and the instrument.

Acknowledgments

To the National Council for Scientific and Technological Development for awarding the Research Productivity Scholarship to Thereza Maria Magalhães Moreira, process no. 305888/2018-8.

Authors' contribution

Conception and design or data analysis and interpretation: Carvalho IS, Moreira TMM. Writing of the manuscript or relevant critical review of the intellectual content; final approval of the version to be published and agreement to be responsible for all aspects of the manuscript related to the accuracy or integrity of any part of the manuscript: Carvalho IS, Moreira TMM, Arruda LSNS, Lima GS, Loureiro AMO, Gomes EB, Borges JWP.

References

1. Çetinkaya S, Sert H. Healthy lifestyle behaviors of university students and related factors. Acta Paul Enferm. 2021;34:eAPE02942. doi: https://doi.org/10.37689/acta-ape/2021AO02942
2. Ryan RM, Deci EL. Self-Determination theory: basic psychological needs in motivation, development, and wellness. New York, NY, USA: Guilford Publications; 2017.
3. Lima MA, Cunha GH, Lopes MV, Fontenele MS, Siqueira LR, Ramalho AK, et al. Booklet for healthy lifestyle in people with HIV: a clinical trial. Acta Paul Enferm. 2023;36:eAPE03101. doi: https://doi.org/10.37689/acta-ape/2023AO031011
4. Rodrigues-Pires F, Festas C, Amado J, Neves-Amado J, Almeida S. The FANTASTIC questionnaire: translation, adaptation, and validation of the lifestyle assessment instrument in Portuguese preadolescents. Rev Enferm Ref. 2023;6(2):e22108. doi: https://doi.org/10.12707/RVI22108
5. Hershey MS, Sotos-Prieto M, Ruiz-Canela M, Christophi CA, Moffatt S, Martínez-González MÁ, et al. The Mediterranean lifestyle (MEDLIFE) index and metabolic syndrome in a non-Mediterranean working population. Clin Nutr. 2021;40(5):2494-503. doi: http://doi.org/10.1016/j.clnu.2021.03.026
6. Wójcik E, Reszke R, Krajewski PK, Matusiak Ł, Madziarska K, Ali FM, et al. Major life changing decision profile: creation of the polish language version. Dermatol Ther. 2021;34(1):e14568. doi: https://doi.org/10.1111/dth.14568
7. Oliveira D, Aubeeluck A, Stupple E, Kim S, Orrell M. Factor and reliability analysis of a brief scale to measure motivation to change lifestyle for dementia risk reduction in the UK: the MOCHAD-10. Health Qual Life Outocomes. 2019;17(1):75. doi: https://doi.org/10.1186/s12955-019-1143-8
8. Thabrew H, Goodyear-Smith F. Youth version, Case-finding and Help Assessment Tool (Youth-CHAT): An electronic, psychosocial screener for young people with long-term physical conditions. J Paediatr Child Health. 2020;56(1):102-6. doi: https://doi.org/10.1111/jpc.14503
9. American Educational Research Association (AERA), American Psychological Association (APA), & National Council on Measurement in Ed-

ucation (NCME). Standards for educational and psychological testing. Washington: AERA; 2014.

10. Carvalho IS, Borges JWP, Moreira TMM, Salles DL. Elementos constituintes e validade dos instrumentos avaliativos do estilo de vida em adultos: revisão integrativa. Gestão Amp Cuid Saúde [Internet]. 2023 [cited Apr 13, 2024];1(1):e11132. Available from: https://revistas.uece.br/index.php/gestaoecuidado/article/view/11132

11. Cestari VRF, Borges JWP, Florêncio RS, Garces TS, Pessoa VLMDP, Moreira TMM. Structure internal of the dimension Human Person of the Questionnaire of Health Vulnerability in Heart Failure. Rev Esc Enferm USP. 2022;56:e20220117. doi: https://doi.org/10.1590/1980-220X-REEUSP-2022-0117en

12. Lorenzo-Seva U. SOLOMON: a method for splitting a sample into equivalent subsamples in factor analysis. Behav Res Methods. 2022;54(6):2665-77. doi: https://dx.doi.org/10.3758/s13428-021-01750-y

13. Hair FJ, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. Essex: Pearson Education Limited; 2013.

14. Bandalos DL. Measurement theory and applications for the social sciences. Series: Methodology in the social sciences [Internet]. 2018 [cited Apr 13, 2024]. Available from: https://www.soc.univ.kiev.ua/sites/default/files/library/elopen/methodology_in_the_social_sciences_deborah_l._bandalos_-_measurement_theory_and_applications_for_the_social_sciences-the_guilford_press_2018.pdf

15. Barbosa ALA, Azoni CAS. Validity evidence based on response processes of the TRILHAR – screening tool for infant vocabulary. CoDAS. 2021;33(1):e20190285. doi: https://dx.doi.org/10.1590/2317-1782/20202019285

16. Cestari VRF, Florêncio RS, Pessoa VLMP, Moreira TMM. Health vulnerability assessment questionnaire for people with heart failure: construction and validation. Rev Eletr Enferm. 2021;23:67807. doi: http://doi.org/10.5216/ree.v23.67807

17. Farooq R. Heywood cases: Possible causes and solutions. Int J Data Anal Tech Strategies. 2022;14(1):79-88. doi: https://doi.org/10.1504/IJDATS.2022.121506

18. Mialhe FL, Moraes KL, Bado FMR, Brasil VV, Sampaio HADC, Rebustini F. Psychometric properties of the adapted instrument European Health Literacy Survey Questionnaire short-short form. Rev Latino-Am Enfermagem. 2021;29:e3436. doi: https://doi.org/10.1590/1518-8345.4362.3436

19. Grohmann M, Sica CD. Conhecimento sobre alimentação saudável, hábitos alimentares e estilo de vida em escolares com excesso de peso e seus responsáveis. RBONE [Internet]. 2020 [cited Apr 13, 2024];13(80):576-87. Available from: http://www.rbone.com.br/index.php/rbone/article/view/1019

20. Hirschle ANT, Gondim SMG. Stress and well-being at work: a literature review. Ciênc Saúde Colet. 2020;25(7):2721-36. doi: https://dx.doi.org/10.1590/1413-81232020257.27902017

21. Kunugi H. Depression and lifestyle: Focusing on nutrition, exercise, and their possible relevance to molecular mechanisms. Psychiatry Clin Neurosci. 2023;77(8):420-33. doi: http://doi.org/10.1111/pcn.13551

22. Guo X, Gong S, Chen Y, Hou X, Sun T, Wen J, et al. Lifestyle behaviors and stress are risk factors for overweight and obesity in healthcare workers: a cross-sectional survey. BMC Public Health. 2023;23(1):1791. doi: https://doi.org/10.1186/s12889-023-16673-w

23. Santos LA, Uzeda AL, Garcia LR, Goulart MCL, Góes FGB, Santos JL. Nursing work during the COVID-19 pandemic: (dis)satisfaction and (de)motivation. Rev Rene. 2023;24:e85209. doi: https://doi.org/10.15253/2175-6783.20232485209

24. Marcino LF, Giacon-Arruda BCC, Teston EF, Souza ASD, Marcheti PM, Lima HDP, et al. Leisure practice in adolescents and associated factors: implications for care. Acta Paul Enferm. 2022;35:eAPE02041. doi: https://dx.doi.org/10.37689/acta-ape/2022AO02041