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ORIGINALES

Psychometric review of the Self-regulation scale of eating habits in Mexican adults: Is a short version feasible?

Revisión psicométrica de la Escala de autorregulación de hábitos alimentarios en adultos mexicanos: ¿es factible una versión breve?

Sergio Dominguez-Lara[1]
Libertad Paredes-Díaz[2]
Alma Elena Díaz-Vázquez[3]
Yolanda Campos-Uscanga[2]

[1] South American Center for Education and Research in Public Health, Private University Norbert Wiener, Lima, Peru.
[2] Institute of Public Health, Universidad Veracruzana. Xalapa, Veracruz, Mexico. ycampos@uv.mx
[3] Institute of Psychological Research, Universidad Veracruzana. Xalapa, Veracruz, Mexico.

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ABSTRACT:

Introduction: According to official records, 75.0% of Mexican women and 69.6% of Mexican men are obese or overweight, conditions that can develop chronic diseases. In that sense, habits are determinate factors for this prevalence, among those that significantly influence health are eating habits. Therefore, the aim of this work was to analyze the psychometric properties of the Self-Regulation Scale of Eating Habits to obtain a brief version.
Materials and methods: An instrumental study was carried out with 442 Mexican adults (60% women; Mage= 32.486 years). In addition to the Self-Regulation of Eating Habits Scale, a sociodemographic data sheet was included. The evidence of validity was analyzed with an analytical-factorial approach by an exploratory structural equation modeling (ESEM); as well reliability was estimated at the level of scores (alpha coefficient) and construct (omega coefficient).
Results: The scale responds to an essentially one-dimensional structure, a short version of 8 items was obtained, which showed an adequate adjustment index, high factor loads, excellent reliability, and being invariant between men and women.
Conclusions: The Self-Regulation of Eating Habits Scale presents a solid one-dimensional structure; its adequate reliability allows it’s to use at the level of basic and applied research. Also evaluates self-regulation in men and women in an equivalent way.

Keywords: Self-regulation; Eating Habits; Psychometry.

RESUMEN:

Introducción: De acuerdo con cifras oficiales, 75.0% de las mujeres y 69.6% de los hombres mexicanos presentan obesidad o sobrepeso, estas condiciones pueden desencadenar enfermedades crónicas. En ese sentido, los hábitos son factores determinantes para dicha prevalencia, y entre los que

influyen de forma significativa sobre la salud están los hábitos alimentarios. Entonces, el objetivo de este trabajo fue analizar las propiedades psicométricas de la Escala de Autorregulación de Hábitos Alimentarios, y derivar una versión breve.
Material y método: Se realizó un estudio instrumental en el que participaron 442 adultos mexicanos (60% mujeres; Medad = 32.486 años). Además de la Escala de Autorregulación de Hábitos Alimentarios, se incluyó una ficha de datos sociodemográficos. Las evidencias de validez se analizaron desde un enfoque analítico-factorial mediante un modelamiento exploratorio de ecuaciones estructurales (ESEM, por sus siglas en inglés); mientras que la fiabilidad se estimó a nivel de puntuaciones (coeficiente alfa) y de constructo (coeficiente omega).
Resultados: La escala responde a una estructura esencialmente unidimensional, de la cual se derivó una versión breve de 8 ítems que evidenció adecuados índices de ajuste, cargas factoriales elevadas, excelente fiabilidad, y es invariante entre hombres y mujeres.
Conclusiones: La Escala de Autorregulación de Hábitos Alimentarios presenta una estructura unidimensional sólida, su adecuada fiabilidad permite su uso a nivel de investigación básica y aplicada, y evalúa de forma equivalente la autorregulación en hombres y mujeres.

Palabras clave: Autorregulación; Hábitos Alimentarios; Psicometría.

INTRODUCTION

Mexico is one of the largest consumers of high-calorie foods. On average, an adult Mexican consumes 214 kilos of ultra-processed foods and 163 liters of sugary drinks such as soft drinks, juices, and dairy drinks per year. These eating behaviors are reflected in the prevalence of overweight and obesity in the majority of the population[1].

According to the National Health and Nutrition Survey, 75.0% of Mexican women and 69.6% of Mexican men are overweight. The prevalence of overweight is higher in men (37.8%) than in women (33.9%), but regarding obesity, women present a prevalence of 41.1% and men of 31.8%. This combined prevalence of 75.2% places Mexico among the countries with a greater population with overweight and obesity[2].

It has also been shown that being overweight and obese can trigger chronic diseases such as type 2 diabetes mellitus, dyslipidemia, hypertension, kidney failure, and various types of cancer[3]. A determining factor for this prevalence are habits, which are defined as a repetitive behavior that starts from an internal process, resulting from the individual’s interaction with the environment, in which three essential functions are involved: self-observation, self-evaluation and self-reaction[4].

One of the main habits that have an influence on health are eating habits, which require effective self-management to maintain health. For this reason, it is important to implement self-regulation strategies such as observation and evaluation to motivate behavior change, and thus achieve healthy lifestyles that function as protective factors[5]. In this sense, there are successful interventions to modify unhealthy habits, such as encouraging healthy cooking habits, physical activity and active leisure, nutrition education workshops and other interventions that promote healthy attitudes and practices[6], demonstrating the possibility of change.

On the other hand, there is evidence of some differences in self-regulation between men and women. For example, in Polish adolescents it was observed that men more frequently present high self-regulation of eating behaviors (27.4%) compared to women (18.8%)[7]. On the other hand, in Italian university students it was found that women show higher scores in setting goals and rules compared to men, and prefer a strategy that directly addresses the goal by expressing intentions or explicit plans to eat healthy[8]. Finally, in Saudi adults, no relation was found between sex and self-regulation of eating habits[9].

There are some instruments to measure self-regulation of eating habits, such as the Self-Regulation of Eating Behavior Questionnaire (SREBQ)[10], the Tempest Self-Regulation Questionnaire for Eating (TESQ-E)[11], or Children's Self-Regulation of Eating (CSRE)[12]. Regarding the TESQ-E and the CSRE, they are created and focused on adolescents and children, respectively, which disable their use for the adult population considering the natural evolutionary and social differences between groups[13].

On the other hand, the SREBQ is a viable option, but its construction showed limitations. For example, the determination of the final version from the initial pool of 102 items, towards shorter versions of 14 and 5 items, was carried out using the principal component analysis, which artificially increases the factor loadings because it does not distinguish the measurement error[14]. Moreover, there is no evidence of the equivalence between the long version and the short version, nor is there an invariance analysis that suggests that the construct is evaluated equally between men and women.

Additionally, the differences between individuals from different populations are known, given that culture has an important influence on parenting practices, which in turn impact the forms and objectives of self-regulation that children develop and manifest through behaviors, emotions and cognitions[15]. In this way, given that these forms of regulation are usually quite stable, the measurement of self-regulation of eating habits must be carried out using instruments created in a context close to that of the person evaluated.

In the absence of instruments created in the Latin American context, in 2015 the Escala de Autorregulación de Hábitos Alimentarios (Eating Habits Self-regulation Scale) (EAHA in Spanish) was built for Mexican university students[5]. The first version consisted of 41 items, and after an analytic-factorial process using the extraction method of unweighted least squares (ULS), a version of 14 items was obtained with a three-dimensional structure called self-reaction (6 items), self-observation (4 items), and self-evaluation (4 items), in addition to showing acceptable Cronbach's alpha values ($\alpha_{self\text{-}reaction} = .864$; $\alpha_{self\text{-}observation} = .730$; $\alpha_{self\text{-}evaluation} = .719$)[5].

However, the conclusions could be provisional pending more studies that confirm the findings, especially with regard to the factorial structure. For example, although the factor extraction method (ULS) is adequate, to determine the number of factors they used the Kaiser's rule, which suggests extracting all the factors whose Eigen value are greater than unity[16]. This procedure has limitations because it overestimates the number of factors that should be retained [17], which would affect the interpretation of EAHA's internal structure.

In this sense, it is necessary to periodically review the psychometric properties of the instruments created as decisions could be made based on scores without sufficient empirical support. For example, due to the choice of a certain method, a multidimensional structure could be suggested to a unidimensional construct.

Therefore, the purpose of this manuscript is to complement the advances presented in the seminal article[5] with procedures that elucidate the internal structure of the EAHA, such as confirmatory factor analysis and bifactor. Regarding the first aspect, although the evidence of validity observed in the initial study was obtained using an exploratory approach[5], it would be convenient to analyze the EAHA with approaches such as the exploratory structural equation modeling (ESEM)[18].

The ESEM preserves the statistical power of confirmatory analyzes in relation to traditional fit indices (e.g., CFI), and is complemented with the estimation of all factor loadings, both the main ones (corresponding to the theoretical factor) and the secondary ones (factor loadings of the item in factors other than the original one) in a similar way to the exploratory factor analysis[18].

EAHA has been widely used as its usage was for seeking relations with knowledge about health and about obesity[19] as evidence of convergent validity for adapting the physical activity self-regulation scale[20], to determine the anthropometric indicator most strongly associated with body fat percentage[21], and even to determine if the variations in the body mass index during the first two years of studies are influenced by self-regulation[22]. Additionally, it has been used in other countries to measure the association with diet, nutritional status and subjective well-being in adults, although without following the necessary adaptation processes[23]. Despite its extensive use, the EAHA has not been revalidated in populations other than university students.

Therefore, and as evidenced above, this scale has wide potential uses, both for the analysis of the self-regulation of eating habits itself, and for the study of the relation it may have with other variables of interest for health and well-being[24]. However, validity evidence is required in populations other than university students to expand its scope and usefulness. Likewise, it would be useful to prepare a short version to optimize the evaluation time, and thus increase the motivation and commitment of the examinees with the resolution of the scale. This strategy was observed in another scale[25], with favorable results in the objective context, and with the possibility of incorporating this short version in multivariate studies.

For this reason, this research aimed to carry out a psychometric review of the EAHA by analyzing the internal structure of oblique and bifactor models under an ESEM approach, and from them to generate a short version.

MATERIAL AND METHOD

This corresponds to a study with an instrumental design, which aimed to analyze the psychometric properties of the Eating Habits Self-regulation Scale[5] in Mexican adults.

Population and sample

The sample was obtained with a non-probabilistic sampling. 442 Mexican citizens were included, 177 men (40%) and 265 women (60%), between 18 and 74 years old (M_{age} = 32,486; SD_{age} = 12,842), and most of them were residents of Veracruz (72,850%). The majority reported being single (53.167%), and as for occupation, the presence of students (63.801%) and freelance workers (23.303%) stands out, followed by employees (8.145%) and retired workers (3.620%).

Data collection procedure

The collection was carried out between October and November 2022 through the Survey Monkey online platform. People were invited to participate through the most popular social networks in Mexico: WhatsApp, Facebook and Instagram.

Instruments

Sociodemographic data questionnaire. Sex, age, place of residence, educational level and occupation were asked.

Eating Habits Self-regulation Scale(5).The original version of 41 items was used, scaled in five response options (from never [1] to always [5]) and representing the AHA dimensions: self-observation, self-evaluation, and self-reaction. The version validated in Mexico of 14 items was extracted from this version.

Data analysis

Estimation and software. The measurement models were analyzed under an ESEM(18) approach with the Mplus v. 7 sofware(26). The weighted least square mean and variance adjusted (WLSMV) with the polychoric correlation matrix was used as the estimation method. Likewise, an oblique target rotation (ε = .05)(18) was implemented; which freely estimates those factor loadings that belong to the items of each theoretical factor (main loads), and specifies as close to zero (~0) the factor loadings that belong to the secondary factors. Finally, specific modules were used to calculate the complementary indices for the bifactor analysis and the measurement invariance analysis from the effect size perspective(27).

Validity evidence based on internal structure: long version. Measurement models. Initially, three measurement models were evaluated: the original three-factor oblique model (model 1) considering the original items (41 items)(5), a three-factor oblique model (model 2) that represents the final version of the first validation study (14 items)(5), and a bifactor model (model 3) that considers the presence of a general factor (GF) as the items presented a degree of factorial complexity that suggests its existence, accompanied by three specific factors.

Preliminary analysis. Regarding univariate normality, this was evaluated by examining skewness (<2) and kurtosis (<7). Likewise, in relation to multivariate normality, the G2 coefficient was used, which values below 70 are considered acceptable.

Evaluation of measurement models. The proposed models were evaluated following various criteria. Firstly, through the magnitude of various fit indices such as the CFI (> .90), the RMSEA (< .08), and the WRMR (< 1). Secondly, the magnitude of the factor loadings (> .50) was considered. Thirdly, the factor simplicity index (FSI) was calculated in the oblique models, which, if it exceeds a certain value (> .70), allows determining if the item receives a significant influence from the other factors (secondary loads); and in relation to the bifactor model, the magnitude of the hierarchical omega (ωH; > .70) was considered and from the total explained common variance (ECV > .60), it can be concluded that the GF influences the items to a greater extent than the specific factors.

Validity evidence based on internal structure: Short version. The EAHA's short version was prepared considering the items that, after a progressive elimination, obtained factor loadings greater than .80, and in order to rule out potential redundancy in terms of the selected items, the inter-item correlation was analyzed and it was determined that there is multicolinearity if the correlations are greater than .85.

The empirical equivalence between the short version and the long version was evaluated by means of a corrected correlational analysis because they share items, expecting magnitudes greater than .70.

Reliability

The score reliability ($\alpha > .70$) and the construct reliability ($\omega > .70$) were estimated, with confidence interval (CI) using the bias-corrected bootstrap method. Finally, the difference between the coefficients ($\Delta\omega$-α) is significant if it is greater than $|.06|$.

Measurement invariance

An invariance analysis was performed between men and women. Firstly, the configural invariance (or statistical equivalence of the internal structure), weak invariance (or statistical equivalence of the factor loadings), strong invariance (or statistical equivalence of the thresholds) and strict invariance (or statistical equivalence of residuals) were evaluated. Then, it is possible to provide favorable evidence to invariance if the CFI decreases in .01 or less (ΔCFI $\geq$ -.01) and the RMSEA increases in .015 or less (ΔRMSEA $\leq$ .015)[28]. In the same way, invariance was analyzed from an effect size (ES) approach, comparing three specific parameters associated with different degrees of invariance between the groups[29] using Cohen's statistics. In this way, to compare factor loadings, q coefficient was used, where values less than $|.10|$ indicate no differences. Regarding the thresholds, we expect d less than $|0.20|$ to conclude equivalence, and to compare residuals, the h statistic was used, and values less than $|0.10|$ indicate that they do not differ between groups.

Ethical considerations

The research was conducted in accordance with the international and national guidelines that guide research in human beings, such as the Declaration of Helsinki and the General Health Law. It was approved by Comité de Ética en Investigación del Instituto de Salud Pública (Research Ethics Committee of the Public Health Institute) at Universidad Veracruzana, which assigned the CEI-ISP-R04/2020 Register.

RESULTS

Validity evidence regarding internal structure

Preliminary analysis. The EAHA items present acceptable indicators of skewness and kurtosis (Table 1), but at multivariate normality level, what was found is above what is suggested (G2 = 334.475).

Table 1. Descriptive statístics

	M	SD	g_1	g_2			M	DE	g_1	g_2
Ítem 1	3.826	0.947	-0.482	-0.360		**Ítem 22**	3.912	1.007	-0.624	-0.246
Ítem 2	3.722	0.988	-0.368	-0.407		**Ítem 23**	4.066	1.011	-0.872	0.234
Ítem 3	2.853	1.214	0.208	-0.962		**Ítem 24**	3.919	1.029	-0.651	-0.263
Ítem 4	2.837	1.209	0.161	-0.916		**Ítem 25**	3.590	1.097	-0.294	-0.706
Ítem 5	2.930	1.165	0.085	-0.807		**Ítem 26**	3.346	1.195	-0.149	-0.865
Ítem 6	4.158	0.993	-1.075	0.669		**Ítem 27**	3.473	1.115	-0.203	-0.660
Ítem 7	3.538	1.092	-0.393	-0.548		**Ítem 28**	3.348	1.111	-0.152	-0.741
Ítem 8	3.371	1.221	-0.243	-0.860		**Ítem 29**	2.810	1.216	0.186	-0.886
Ítem 9	3.301	1.120	-0.156	-0.692		**Ítem 30**	3.339	1.083	-0.200	-0.599
Ítem 10	2.910	1.190	0.151	-0.844		**Ítem 31**	3.079	1.111	-0.087	-0.553
Ítem 11	1.851	1.061	1.240	0.836		**Ítem 32**	3.204	1.160	-0.141	-0.720
Ítem 12	3.002	1.209	-0.004	-0.857		**Ítem 33**	3.498	1.171	-0.442	-0.510
Ítem 13	2.441	1.246	0.601	-0.607		**Ítem 34**	3.624	1.125	-0.510	-0.472
Ítem 14	3.405	1.031	-0.024	-0.693		**Ítem 35**	3.880	1.089	-0.767	0.042
Ítem 15	3.190	1.129	0.048	-0.761		**Ítem 36**	3.633	1.109	-0.460	-0.445
Ítem 16	3.647	1.148	-0.472	-0.583		**Ítem 37**	4.086	0.963	-0.801	0.024
Ítem 17	2.995	1.182	0.050	-0.781		**Ítem 38**	4.072	0.976	-0.867	0.256
Ítem 18	3.274	1.201	-0.153	-0.854		**Ítem 39**	3.466	1.086	-0.195	-0.636
Ítem 19	3.367	1.113	-0.147	-0.687		**Ítem 40**	3.464	1.115	-0.210	-0.668
Ítem 20	3.808	0.984	-0.440	-0.392		**Ítem 41**	3.810	1.019	-0.568	-0.247
Ítem 21	3.287	1.155	-0.054	-0.758						

Note: M: Mean; SD: Standard Deviation; g_1: Skewness; g_2: Kurtosis

Evaluation of measurement models. Although acceptable fit indices were obtained in the first model (CFI = .956; RMSEA = .058, CI90% .055, .062; WRMR = 1.039) as well as in the second model (CFI = .985; RMSEA = .085, CI90 % .074, .097; WRMR = 0.676), a significant number of complex items (FSI < .70) was observed both in the first model (61%) and the second model (36%), in addition to items with low factor loadings in their theoretical factor (Table 2). Finally, regarding the third model (bifactor), even though the fit indices were adequate (CFI = .966; RMSEA = .053, CI 90% .049, .056; WRMR = 0.883), the complementary information indicates that the FG presents greater strength (ECV = .892; ω_H = .968) compared to the specific factors of self-observation (ω_{HS} = .010), self-evaluation (ω_{HS} = .014), and self-reaction (ω_{HS} = .001) because the factor loadings in the FG are higher (Table 2).

Table 2. Factorial parameters of oblique and bifactor models.

	F1	F2	F3	FSI	F1	F2	F3	FSI	F1	F2	F3	GF
Ítem 1	*.356*	-.062	.275	.519					-.17	-.153	.084	.475
Ítem 4	*.238*	.626	-.095	.79					.263	-.043	-.376	.572
Ítem 7	*.102*	.503	.193	.766					.274	-.067	-.115	.602
Ítem 9	*.388*	.144	.271	.462					-.076	-.102	-.004	.646
Ítem 10	*.032*	.576	.143	.91					.327	.037	-.149	.553
Ítem 12	*.477*	.185	.116	.743					-.096	-.137	-.14	.625
Ítem 13	*-.208*	.429	-.211	.516					.323	.122	-.233	-.036
Ítem 14	*.513*	.27	.186	.572					-.027	-.344	-.17	.776
Ítem 16	*.439*	.144	.332	.46					-.061	-.341	.01	.74
Ítem 19	*.465*	.265	.336	.326	.24	.196	.557	.647	-.042	-.098	-.033	.849
Ítem 23	*.339*	-.202	.682	.632					-.265	.065	.401	.679
Ítem 27	*.715*	.139	.228	.818	.114	-.005	.855	.974	-.257	-.038	-.108	.878
Ítem 31	*-.187*	.415	.332	.375					.316	.188	.104	.404
Ítem 32	*.349*	.314	.291	.106					.011	.077	-.034	.746
Ítem 34	*-.306*	.402	.682	.476					.433	-.072	.323	.582
Ítem 36	*-.247*	.42	.671	.504					.399	-.01	.296	.633
Ítem 38	*.26*	-.272	.772	.712	.743	-.18	.236	.794	-.271	.11	.517	.632
Ítem 2	.462	*.293*	.109	.568					-.045	-.028	-.174	.682
Ítem 5	.244	*.685*	-.012	.836	-.11	.586	.34	.623	.267	.1	-.333	.683
Ítem 8	.211	*.61*	.073	.827	-.053	.518	.343	.593	.24	.109	-.243	.668
Ítem 17	.207	*.262*	.106	.406					.029	.139	-.082	.441

Ítem 20	.062	*.142*	.642	.918					.122	-.228	.297	.675
Ítem 24	.136	*.103*	.613	.892					.014	.043	.295	.676
Ítem 26	.558	*.157*	.262	.661					-.206	.193	-.035	.777
Ítem 29	-.136	*.678*	.095	.915	-.128	.745	-.008	.957	.42	.311	-.148	.44
Ítem 30	.482	*.179*	.342	.457					-.136	.11	.017	.798
Ítem 41	.346	*-.091*	*.596*	.635	.538	-.127	.41	.501	-.211	.074	.308	.696
Ítem 3	.325	.509	*-.263*	.402					.1	.151	-.433	.421
Ítem 6	.351	.147	*.361*	.383					-.07	-.007	.067	.686
Ítem 11	-.098	.69	*-.216*	.844					.394	.268	-.356	.234
Ítem 15	.48	.354	*.204*	.412	.06	.251	.62	.787	-.012	-.037	-.145	.818
Ítem 18	.586	.297	*.147*	.649	.022	.14	.749	.949	-.118	.063	-.176	.815
Ítem 21	.569	.187	*.257*	.646	.179	.074	.67	.886	-.162	.021	-.066	.812
Ítem 22	.121	-.001	*.673*	.953	.593	.131	.107	.887	0	-.202	.356	.643
Ítem 25	.352	.244	*.397*	.253					-.037	.161	.063	.778
Ítem 28	.693	.183	*.221*	.781	.075	.025	.864	.988	-.258	.154	-.115	.878
Ítem 33	-.217	.356	*.412*	.314	.355	.523	-.261	.392	.314	.121	.174	.402
Ítem 35	.201	.157	*.632*	.79					.008	.099	.275	.781
Ítem 37	-.041	-.023	*.826*	.995	.89	.159	-.179	.899	.054	-.094	.506	.613
Ítem 39	.219	.352	*.401*	.3					.072	.314	.072	.743
Ítem 40	.29	.252	*.476*	.411					.002	.149	.123	.797

Note: F1: self-observation; F2: self-evaluation; F3: self-reaction; in italics: items belong to theoretical factor

Short version

Based on EAHA's long version, the short version was obtained after the progressive elimination of items until all of them obtained factor loadings greater than .80. The EAHA's short version was made up of eight items with factor loadings above .80 (Table 3), and without evidence of multicollinearity ($r_{average}$ = .658; range $_{correlations}$ = .574 - .808). Then, the fit was acceptable (CFI = .994; RMSEA = .086, CI 90% .068 - .105; WRMR = 0.707), and evidence of empirical equivalence with the long version because the initial correlation was .940, and after correction, it maintained a high magnitude (.923).

Table 3. Factor loadings of the short version.

	Statement	Factor loading	Original Dimension
Item 15	When I fail in my eating plans, I look for alternatives to improve	.806	SR
Item 18	I look for mechanisms to keep motivation and achieve my eating goals	.837	SR
Item 19	I keep track of the amount of food I eat	.831	SO
Item 21	If one day I fail in my eating plans, I take them back the next day with more motivation	.824	SR
Item 26	I follow the recommendations of experts to improve my diet	.816	SE
Item 27	I pay a lot of attention to the way I eat	.914	SO
Item 28	I look for the mechanisms to achieve the goals that I have set in terms of my diet	.933	SR
Item 30	Once I set eating goals, I closely monitor my progress	.815	SE
Note: SO: self-observation; SE: self-evaluation; SR: self-reaction			

Reliability

The reliability coefficients obtained high magnitudes both at level of scores (α = .945, 95%CI .922 - .959) and of construct (ω = .954, CI 95% .945 - .960), without evidencing significant differences between both coefficients. ($\Delta_{\omega-\alpha}$ = .009).

Measurement invariance

The variation of the fit indices provides favorable evidence regarding the invariance of the model between men and women (Table 4), which is reinforced when comparing the individual parameters (Annex 1) as no differences were found in terms of factor loadings (q < .10), thresholds (d < 0.20), and residuals (h < 0.10) (Table 5).

Table 4. Measurement invariance of brief version

	CFI	RMSEA (CI 90%)	ΔCFI	ΔRMSEA
Configural	.999	.109 (.090, .129)		
Weak	.999	.034 (.000, .058)	.000	-.075
Strong	.991	.084 (.069, .099)	-.008	.050
Strict	.992	.074 (.059, .089)	.001	-.010

Table 5. Measurement invariance: effect size.

	ES_{λ}	$ES_{\tau 1}$	$ES_{\tau 2}$	$ES_{\tau 3}$	$ES_{\tau 4}$	ES_{Θ}
Ítem 15	-0.019	0.109	-0.007	-0.051	-0.116	-0.114
Ítem 18	0.004	0.043	-0.075	0.014	0.045	0.029
Ítem 19	0.008	0.042	0.017	0.003	-0.079	0.055
Ítem 21	-0.005	0.177	-0.031	0.014	0.072	-0.035
Ítem 26	0.004	0.123	-0.011	-0.030	-0.004	0.024

Ítem 27	-0.003		0.079	-0.074	0.013	0.090		-0.030
Ítem 28	-0.002		0.162	-0.034	-0.006	0.038		-0.028
Ítem 30	0.016		0.173	-0.053	0.047	0.048		0.101
Note: ES = effect size; λ = factor loading; Θ = residual; τ_n = threshold n-th								

DISCUSSION

This work represents a methodological update of the procedures used in the original psychometric article[5] as the possible overestimation of the number of factors, due to the method used (Kaiser's rule), could be clarified through the ESEM given that the instrument structure responds to a single factor. Moreover, obtaining a short version with high factor loadings, i.e. with a good empirical representation of the construct (λ > .80), reinforces the idea of an adequate selection of the items.

However, this does not contradict the initial conception of the AHA as a complex construct based on three processes (self-reaction, self-observation, and self-evaluation)[5], but it does consolidate the idea that these are processes that occur simultaneously. In this way, the short version is focused on action and for this reason, some original self-reaction items stand out since, in daily life, it is of little use that there is good observation and evaluation if this does not translate into concrete actions that help the person to achieve their goals.

In this order of ideas, these findings are reinforced with an excellent realibility, which indicates that the measurement collects a tolerable amount of measurement error that does not interfere with the interpretation of the scores, i.e. that its use in empirical research guarantees an evaluation focused on the construct; and at a practical level, this situation would favor its use as an efficacy measure for interventions focused on eating habits, given that the items represent behaviors that are susceptible to change through a counseling process and said change could be attributed to the intervention and not to the measurement error.

Thus, this short version is beneficial due to the facility to include it in extensive evaluation protocols for multivariate investigations, and to be used in professional settings for diagnostic and interventional purposes such as those described in the previous paragraph.

Another aspect to highlight is the invariance analysis according to sex, which represents an advance in the AHA study given that, in general, the psychometric properties of the scales are analyzed without considering sample characteristics (e.g., sex) that could represent a bias source in the instrument configuration and interpretation of the scores, and for this reason, its implementation is necessary[30]. In addition, this was corroborated at a specific level by individual comparison of factorial parameters such as factor loadings as a representation measure of the construct, resulting in that the factor’s influence on the items was similar between men and women. Similarly, there were no significant differences in the thresholds, which represent the percentage distribution of the choice of response options for the items; this indicates that there was no predominance of certain options (e.g. *never*) in any of the groups. In this way, if the AHA measurement is equivalent between men and women, the comparisons derived from its use (e.g., comparative designs) or the consideration of a total sample for epidemiological purposes (men and women) will not be biased.

Among the main limitations of the study is the form of recruitment of participants as it was limited to users of social networks. It is known that the use of social networks is less in older people, therefore, the functioning of the scale in groups that are less frequent on social networks is unknown. In this sense, further studies with random samples that include adults who do not use social networks are recommended.

It is also identified as limiting that a significant proportion of participants were students, and this does not represent the general population. Therefore, in subsequent studies a proportional representation by population group should be sought.

Among the main strengths of this work are providing additional psychometric evidence of an instrument that measures self-regulation of eating habits in Mexican adults, which will allow us to carry out research in this population group. On the other hand, the procedures followed to review the validity and reliability of the scale are the most robust and appropriate for the type of variable. In addition, reviewing different versions of the scale allows us to know that the final version is the one with the greatest support: unidimensional and short.

Thus, having this scale for the Mexican adult population is relevant given the history of high prevalence of overweight and obesity in this age group(2), which requires the development of research to understand the factors associated with it, as well as to evaluate the effect of interventions that seek to improve eating habits and reduce the prevalence of many chronic noncommunicable diseases.

CONCLUSIONS

It is concluded that the short version of the EAHA is essentially unidimensional and invariant between men and women, and with adequate levels of reliability that enable its use in the Mexican adult population.

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ANNEX 1

Table A. Factorial parameters of men and women

	Men						**Women**					
	λ	Θ	τ_1	τ_2	τ_3	τ_4	λ	Θ	τ_1	τ_2	τ_3	τ_4
Ítem 15	.787	.381	-1.411	-0.592	0.415	1.182	.821	.326	-1.692	-0.574	0.283	0.883
Ítem 18	.844	.288	-1.339	-0.733	0.164	0.810	.836	.301	-1.436	-0.563	0.195	0.911
Ítem 19	.845	.286	-1.585	-0.771	0.149	1.002	.830	.311	-1.692	-0.815	0.157	0.802
Ítem 21	.816	.334	-1.304	-0.752	0.250	0.752	.826	.318	-1.733	-0.677	0.283	0.926
Ítem 26	.824	.321	-1.338	-0.715	0.207	0.771	.817	.333	-1.618	-0.689	0.138	0.763
Ítem 27	.915	.163	-1.585	-1.050	0.078	0.609	.921	.152	-1.778	-0.869	0.109	0.828
Ítem 28	.931	.133	-1.451	-0.790	0.135	0.870	.936	.124	-1.878	-0.701	0.118	0.970
Ítem 30	.834	.304	-1.411	-0.870	0.050	0.934	.805	.352	-1.878	-0.726	0.176	1.065

Note: λ = factor loading; Θ = residual; τ_n = threshold n-th

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