Factorial Invariance of the Body Image Anxiety Scale Questionnaire on Health and Social Sciences Mexican College Students

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Abstract: The present study analyzes the psychometric properties of the Body Image Anxiety Scale (BIAS) trait-version test on Health and Social Sciences college students. The total sample included 1,113 participants: 524 Health Sciences students and 589 Social Sciences students with an average age of 18.20 years (SD=0.72) and 18.24 years (SD=0.74) respectively. The exploratory and confirmatory factorial analyses showed a viable and adequate bifactorial structure for both, Health Sciences and Social Sciences, populations according to the established psychometric requirements set when the informants are the students themselves. Furthermore, the factorial structure, loads, and intercepts are invariant in both groups; nevertheless, there are average weight differences between both populations.

Keywords: Anxiety, Factorial Structure, Measurement Invariance, Multi-Sample Confirmatory Factorial Analysis

1. Introduction

The current Western aesthetic norms dictating body image may impact male and female psychological development. However, it is females, pre and teenagers, who more frequently tend to experience body-image development conflicts leading to eating disorders [1, 3]. These conflicts are due to the especially rigid standards on "beauty and thinness" applied to women [4].

Ideal thinness and weight concerns are the result of a cultural concept, which even though is nowadays considered aesthetic, is just an unhealthy fad. This unattainable fashion may generate negative consequences, such as shape and weight concerns channeled through body image dissatisfaction. Such concerns are expressed via physical disdain and/or body image distortion, defined as inaccurate body sizing [5, 6].

In the past few years, body image has reached a peak in modern societies. There is a subculture based on the importance and perception of the ideal physique [7]. The wish to lose weight or stay thin has become a core value in our culture and has permeated most of us. The generalized and emotional motivation to lose weight is a key risk factor for eating disorders [8].

Research on anxiety has traditionally been made in the psychological and psychiatric fields. Psychology traces anxiety as an altered emotional state, influenced by elements in the social environment and as a permanent personality trait reflecting individual differences derived from intrinsic elements [9, 10] analyzed on the basis of psychometric tools. Psychiatry studies anxiety as a disease or mental disorder, based on qualitative categories from a case-study perspective offered by the Diagnostic and Statistical Manual of Mental Disorders (DSM) from the American Psychiatric Association (APA).

This study is grounded on the psychological perspective on anxiety. Psychological measuring tools are used on a clinically sound population to observe their anxiety levels, state, and trait on their body image [11, 12].

The purpose of the present study is to analyze the inner consistency and the factorial structure of a self-report instrument that allows researchers to identify body-related

anxiety. The specific body areas observed correlate to body weight; for instance, hips, abs, and waist. Moreover, the instrument also focuses on beauty-related body parts not affected by weight, such as the nose, forehead, ears, and hands. The data and evidence resulting from this study will aid in the implementation of an educational intervention focused on school diversity.

This paper emphasizes not only the instrument's factorial structure, but also its psychometric equivalence in different groups, since in the intergroup comparative context it is of foremost importance to adapt a psychological measurement device which meets all equivalence criteria. Specially, the key issue to be considered is whether the same factorial structure applies to different groups, and in a broader sense, different populations [13-15]. This consideration is relevant since it provides our universities with valuable information for the tutoring and personal development systems. The resulting evidence and data will foster an educational intervention focused on school diversity.

2. Method

2.1. Participants

The overall sample of 1,113 participants consists of 524 (47.1%) health sciences students and 589 (52.9%) social sciences students. This pool is the result of a convenience sample representing the different social sciences and health sciences undergraduate programs offered at the Autonomous University of Chihuahua.

The health sciences, 524 participants include 202 (38.5%) women and 322 (61.5%) men. Their age ranges between 17 and 20 years, with a mean of 18.20 and a standard deviation of 0.72 years.

The social sciences, 589-participant sample is made up by 376 (63.8%) women and 213 (36.2%) men. Their age ranges between 17 and 20 years, with a mean of 18.24 and a standard deviation of 0.74 years.

2.2. Instrument

The original version of the Body Image Anxiety Scale (BIAS) consists of a 15-item questionnaire assessing weight-related anxiety-trait (Weight Factor, 8 items) and non-weight-related body areas (No weight Factor, 7 items). On a 0 to 4 scale, participants express how anxious, apprehensive, or nervous they feel about specific body areas. According to Raich [11], BIAS has a sound inner consistency and reliable validity and temporal stability, which agrees with the inner consistency and validity indexes reported by Ornelas, Gastélum, Blanco and Peinado [16] using Cronbach alphas and congruency coefficients above.9. BIAS is a friendly-application survey [17] which provides a good, first-order basis to arrange individuals on the feature being gauged.

For the purposes of this study, the original questionnaire underwent three modifications:

First modification: the original scale provides five choices for every item; in the version used in this study, the individual may choose among eleven possible answers. There is a blend of the original BIAS and our version of it. The following is the scale as used in this study: nothing (0), slightly (1, 2, 3), moderately (4, 5, 6), a lot (7, 8, 9), and too much (10). The reason for this first revision is to match the survey's scale to the standard 0 to 10 academic grading scale students are used to in Mexico. Viciana, Cervelló and Ramírez [18] report a similar change on a scale validation including quite similar characteristics on Spanish population, and [16] applied such changes in a study with Mexican college students.

Second modification: in our version, we employed 12 items only, according to the results found by [16].

The third and last modification consisted in applying the instrument via computers. The object was to faster and more accurately store data, avoiding previous codification stages [19].

2.3. Procedure

UACH's Social Sciences and Health Sciences freshman students were invited to participate in the study. Those who agreed to participate signed the corresponding informed consent letter. The aforementioned instrument was then answered via personal computer, using the 2.0 scale editor version of the questionnaire's management module [19]. The schools' computer labs were used in sessions of approximately 25 minutes. Each session opened with a brief introduction outlining the importance of the present study and a tutorial on how to access BIAS questionnaire. Instructions on how to answer the questions appeared on the first slides. They preceded the first item. At the end of each session, student participation was acknowledged.

Once the participants answered the questionnaire, data was gathered using the 2.0 scale editor version of the result generator [19].

2.4. Data Analysis

The psychometric analysis was implemented in two phases: 1) confirmatory factorial analysis and 2) factorial invariance analysis. This implementation sought the best possible test to cast anxiety scores on body image as perceived by college students in the social sciences and health sciences fields.

To generate the confirmatory factorial analysis for each sample, AMOS 21 software [20] was used. Error term variances were specified as free parameters. Structural coefficients were established for each latent variable (factor) to match its scale to that of one of the superficial variables (items). The Maximum Likelihood Estimation method was used under B. Thompson's [21] recommendation stating that whenever a confirmatory factorial analysis is implemented, not only is the theoretical model adjustment corroborated, but it is also recommended to compare the adjustment indexes of several alternative models to make a better choice.

The following measures were employed to evaluate the model's absolute adjustment: statistic Chi-square test, the

goodness fit index (GFI), root mean square residual (RMR), root mean square error of approximation (RMSEA), and the expected cross validation index (ECVI). The adjusted goodness of fit index (AGFI), the Tucker-Lewis index (TLI), the normed fit index (NFI), and the comparative fit index (CFI) were used as incremental adjustment measures. The parsimony normed fit index (PNFI), the parsimony goodness of fit index (PGFI), the chi-squared fit index divided by degrees of freedom (CMIN/GL), and the Akaike information criterion (AIC) were implemented as parsimony adjustment measures [22, 23].

In order to corroborate the factorial invariance of the Body Image Anxiety Scale (BIAS) among health sciences and social sciences college students, a series of multi-sample confirmatory factorial analyses were run through AMOS 21 software [20].

3. Results

Confirmatory Factorial Analysis

According to Table 1 results, the confirmatory factorial analysis of the 12 items set into two factor-groups in the health sciences sample is acceptable (GFI.900 and RMSEA.103). Moreover, considering the parsimony and incremental adjustment measures (Tables 2 and 3), it is significantly superior to the independent model and very similar to the saturated model.

Furthermore, the confirmatory factorial analysis in the social sciences sample also indicates that the two-factor measurement model is acceptable (GFI.899 and RMSEA.106). According to the parsimony and incremental adjustment measures (Tables 2 and 3), it is significantly superior to the independent model and very similar to the saturated model.

Table 1. *Absolute fit measurements for the generated models. Health and social sciences confirmatory factor analysis.*

Model	Fit indices				
	χ^2	GFI	RMR	RMSEA	ECVI
Factor solution health sciences					
Independent	4562.149 *	.244	3.738	.361	8.769
Saturated	0	1	0		0.298
Two-factors 12 items	347.615 *	.900	0.388	.103	0.760
Factor solution social sciences					
Independent	4173.712 *	.301	3.418	.325	7.139
Saturated	0	1	0		0.265
Two-factors 12 items	403.543 *	.899	0.457	.106	0.771

Note: * p <.01; ECVI=expected cross validation index; GFI=goodness of fit index; RMR=root mean square residual; RMSEA=root mean square error of approximation.

Table 2. *Incremental fit measurements for the generated models. Health and social sciences confirmatory factor analysis.*

Model	Fit indices			
	AGFI	TLI	NFI	CFI
Factor solution health sciences				
Independent	.107	0	0	0
Saturated			1	1
Two-factors 12 items	.861	.915	.921	.932
Factor solution social sciences				
Independent	.174	0	0	0
Saturated			1	1
Two-factors 12 items	.852	.918	.924	.934

Note: AGFI=adjusted goodness of fit index; CFI=comparative fit index; NFI=normed fit index; TLI=Tucker-Lewis index.

Table 3. *Parsimony fit measurements for the generated models. Health and social sciences confirmatory factor analysis.*

Model	Fit indices			
	PNFI	PGFI	CMIN/GL	AIC
Factor solution health sciences				
Independent	0	.207	69.123	4586.149
Saturated	0			156.000
Two-factors 12 items	.742	.611	6.559	397.615
Factor solution social sciences				
Independent	0	.255	63.238	4197.712
Saturated	0			156.000
Two-factors 12 items	.725	.611	7.614	453.543

Note: AIC=Akaike information criterion; CMIN/DF=chi-squared fit index divided by degrees of freedom; PGFI=parsimony goodness of fit index; PNFI=parsimony normed fit index.

Figure 1 introduces the measurement model for the first confirmatory factorial analysis (health sciences students) for the 12 items grouped according to three factors, including standardized regression coefficients among items, factors, and standardized factorial saturations (commonalities) of each item
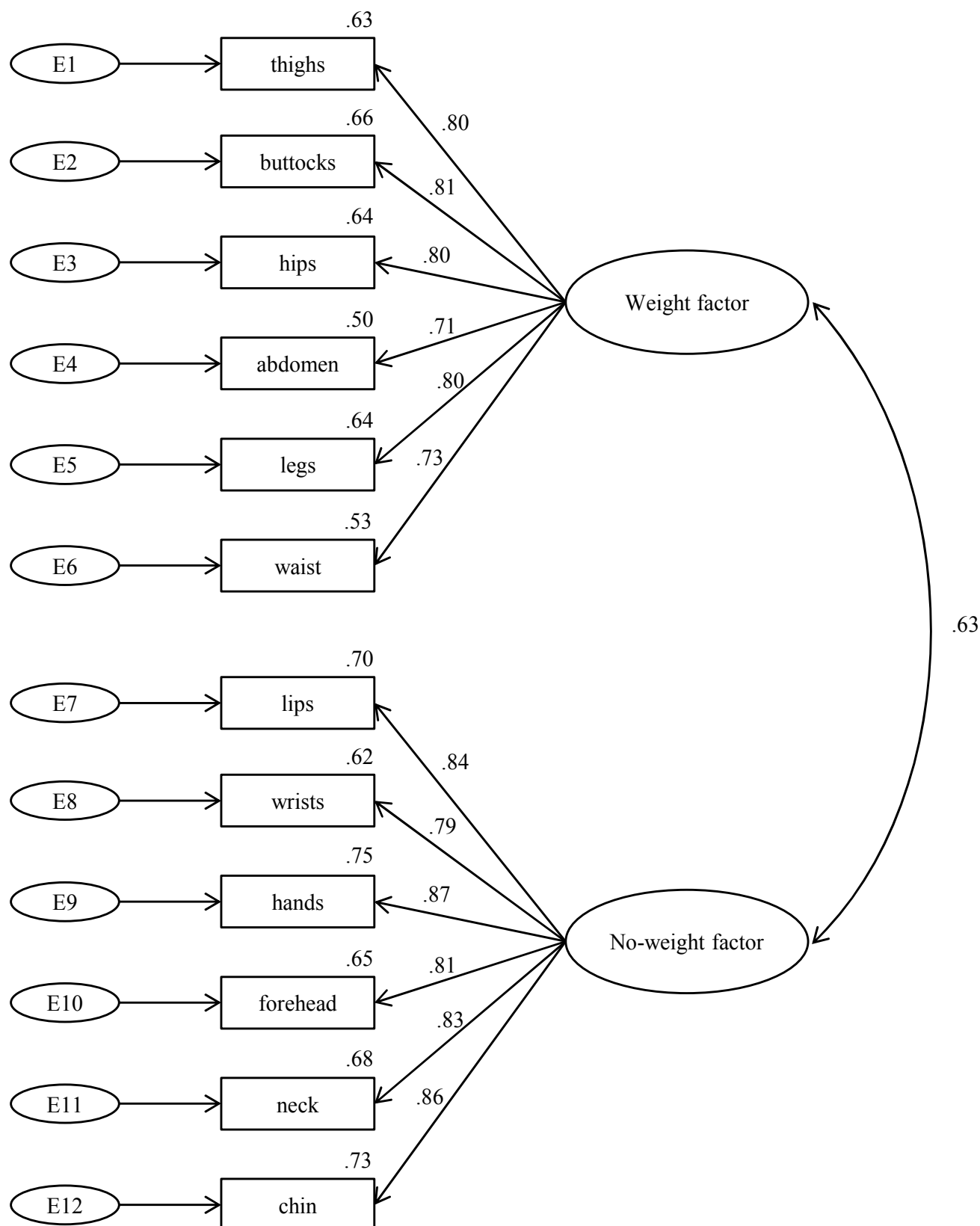
Figure 1. Scale measurement model. Health sciences students' confirmatory factorial analysis.

Both, Weight Anxiety Trait and No-Weight Anxiety Trait factors indicate high, standardized, factorial saturation (≥.50); hence, every item is adequately explained by these factors.

Furthermore, the Weight Anxiety Trait and No-Weight Anxiety Trait factors correlation in the scale is.63, which shows that as the anxiety level of one factor increases, so does the other.

Figure 2 presents the measurement model for the second confirmatory factorial analysis (social sciences students) for the 12 items grouped within the two factors, including the standardized regression coefficients among items, factors, and standardized factorial saturations (commonalities) of each item.
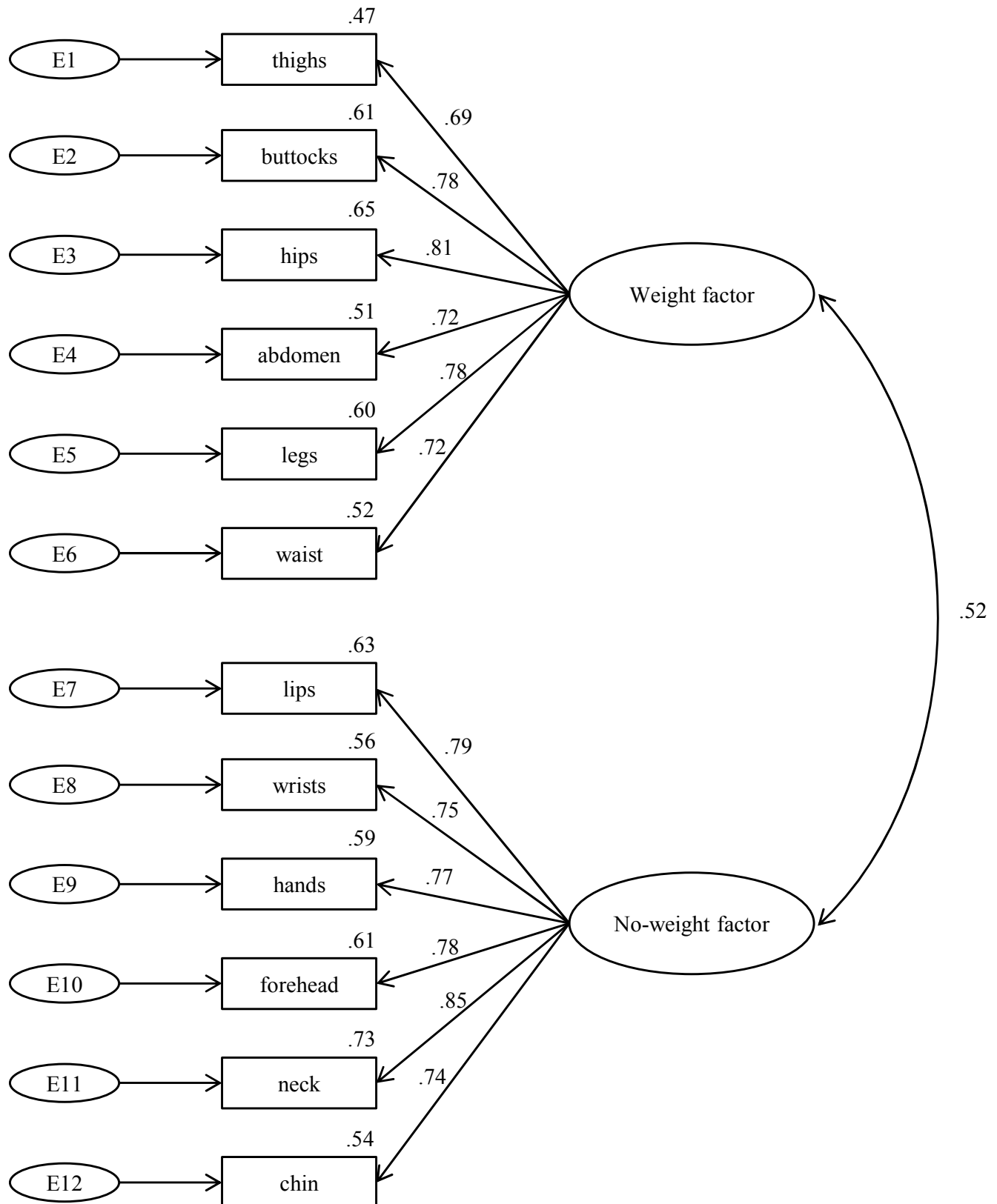

Figure 2. Scale measurement model. Social sciences students' confirmatory factorial analysis.

Both, Weight Anxiety Trait and No-Weight Anxiety Trait factors indicate high, standardized, factorial saturation (>.45); hence, every item is adequately explained by these factors.

Furthermore, the Weight Anxiety Trait and No-Weight Anxiety Trait factors correlation in the scale is.52, which shows that as the anxiety level of one factor increases, so does the other.

Factorial Structure Invariance between Social Sciences and Health Sciences Students

Abalo's et al. [13] recommendations were followed to analyze the questionnaire's factorial invariance considering the same model for both samples. Adjustment indexes (Table 4) validate the basic measurement models equivalence between both samples. Even though the Chi-square value exceeds the acceptable boundaries to take in the invariance hypothesis, the remaining indexes contradict this conclusion (GFI.899; CFI.925; RMSEA.074; AIC 851.157), which makes the invariance base model satisfactory (unbounded model).

Metric invariance was characterized by adding restrictions on the factorial loads to the base model. Values shown in Table 4 make the invariance level viable. The general adjustment index (GFI=.897) and the root mean square error of approximation (RMSEA=.071) provide converging information. Besides, the Akaike Information Criterion (AIC=852.082) and Bentler's comparative index (CFI=.924) do not show important variations compared to the previous model. According to Cheung and Rensvold [24] sheltered models evaluation criterion, suggesting that if both sheltered models' CFI difference decreases.01 or less, the restricted model is valid; hence so is the factorial invariance performance; the.001 CFIs difference obtained validates the metric invariance model. Therefore, we may conclude that the factorial loads are equivalent in both samples.

Once metric invariance was demonstrated in both samples, the intercepts (strong factorial invariance) equivalence was evaluated. Table 4 indexes show the model's adjustment, both as independently tested and as analyzed according to its sheltering with the metric invariance model. The difference between Bentler's comparative indexes is.001, the general adjustment index is.896, and the RMSEA is.071. Once the strong invariance was accepted, both tested models appear equivalent according to factorial and intercept coefficients.

Table 4. *Adjusted goodness of fit indexes of each model analyzed from the factor invariance test.*

Model	Fit indexes						
	χ^2	gl	GFI	NFI	CFI	RMSEA	AIC
Model without restrictions	751.157 *	106	.899	.914	.925	.074	851.157
Metric Invariance	772.082 *	116	.897	.912	.924	.071	852.082
Strong factor invariance	779.426 *	119	.896	.911	.923	.071	853.426

Note: * p <.05; AIC=Akaike information criterion; CFI=comparative fit index; GFI=goodness of fit index; NFI=normed fit index; RMSEA=root mean square error of approximation.

Means Contrasts of the Factors between Social Sciences and Health Sciences Students

Once factorial invariance was verified, the factors' means differences for both samples were obtained taking the social sciences group as referent, setting the means value for that sample as 0, and freely setting the means value for the health sciences group. The regression and intercept coefficients restrictions required for means contrasts were automatically obtained via AMOS 21 software [20]. The means comparisons results indicated that the Weight Factor mean was significantly lower (-0.472, p <0.01) for the health sciences students.

4. Discussion and Conclusions

The following conclusions were reached based on the analysis and discussion results, and taking into consideration that the main objective of the present study is to examine the factorial structure and the invariance measurement of such structure in social sciences and health sciences students:

1) The Confirmatory Factorial Analysis indicated that the data adjustment to the theoretical model of the 12 items grouped into two factors is acceptable. Moreover, both factors overtly present adequate standardized factorial saturations. Besides, factors correlate positively and in a statistically significant manner, which indicates that as perceived anxiety increases in one of the factors, so does it escalates in the other.

2) The factorial invariance analysis indicates a high level of congruency between factor pairs. Such congruency level suggests the existence of strong evidence for the measurement's crossed validation, hence, the structure's stability.

3) Contrast between samples showed significant weight factor differences in favor of the health sciences students. Health sciences students show lower anxiety levels than their social sciences counterparts pertaining weight-related body parts.

In brief, the analysis of psychometric properties has demonstrated the viability and appropriateness of a bifactorial structure, according to established psychometric requirements when informants are the students themselves. The structure of both factors, based on statistical and substantial criteria, has shown adequate adjustment, reliability, and validity indicators, which agrees with Ornelas' et al. findings [16]. Nevertheless, we believe further research is necessary to corroborate or question the present study results.

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References

[1] R. Francisco, M. Alarcão, I. Narciso, Avaliação de factores de risco de desenvolvimento de perturbações alimentares: Desenvolvimento e estudos de validação da versão portuguesa do mcknight risk factor survey iv, Revista Iberoamericana de Diagnóstico y Evaluación Psicológica, Vol. 32, pp. 143-170, 2011.

[2] J. K. Thompson, Introduction: Body image, eating disorders, and obesity – an emerging synthesis, in: J. K. Thompson (Ed.) Body image, eating disorders, and obesity: An integrative guide for assessment and treatment, American Psychological Association, Washington, D C, 2003, pp. 1-20.

[3] J. Verstuyf, S. Van Petegem, M. Vansteenkiste, B. Soenens, L. Boone, The body perfect ideal and eating regulation goals: Investigating the role of adolescents' identity styles, Journal of Youth and Adolescence, Vol. 43, pp. 284-297, 2014.

[4] M. Calaf, M. León, C. Hilerio, J. Rodríguez, Inventario de imagen corporal para féminas adolescentes (iicfa), Revista Interamericana de psicología, Vol. 39, pp. 347-354, 2005.

[5] A. Anuel, A. Bracho, N. Brito, J. E. Rondón, D. Sulbarán, Autoaceptación y mecanismos cognitivos sobre la imagen corporal, Psicothema, Vol. 24, pp. 390-395, 2012.

[6] J. G. Fernández, Í. González, O. R. Contreras, R. Cuevas, Relación entre imagen corporal y autoconcepto físico en mujeres adolescentes, Revista Latinoamericana de Psicología, Vol. 47, pp. 25-33, 2015.

[7] S. Banfield, M. P. McCabe, An evaluation of the construct of body image, Adolescence, Vol. 37, pp. 373-393, 2002.

[8] N. Solano-Pinto, A. Cano-Vindel, Ansiedad en los trastornos alimentarios: Un estudio comparativo, Psicothema, Vol. 24, pp. 384-389, 2012.

[9] R. S. Lazarus, Emotion and adaptation, Oxford University Press, New York, 1994.

[10] C. D. Spielberger, Current trends in theory and research on anxiety, in: C. D. Spielberger (Ed.) Anxiety: Current trends in theory and research, Academic Press, New York, 1972.

[11] R. M. Raich, Imagen corporal. Conocer y valorar el propio cuerpo, Pirámide, Madrid, 2000.

[12] R. M. Raich, Una perspectiva desde la psicología de la salud de la imagen corporal, Revista Avances en Psicología Latinoamericana, Vol. 22, pp. 15-27, 2004.

[13] J. Abalo, J. Lévy, A. Rial, J. Varela, Invarianza factorial con muestras múltiples, in: J. Lévy (Ed.) Modelización con estructuras de covarianzas en ciencias sociales Netbiblo, Madrid, 2006, pp. 259-278.

[14] H. Blanco, M. Martínez, M. d. C. Zueck, G. Gastélum, Análisis psicométrico de la escala autoeficacia en conductas académicas en universitarios de primer ingreso, Actualidades Investigativas en Educación, Vol. 11, pp. 1-27, 2011.

[15] S. Castañeda, M. d. L. Pineda, E. Gutiérrez, N. Romero, E. Peñalosa, Construcción de instrumentos de estrategias de estudio, autorregulación y epistemología personal. Validación de constructo, Revista Mexicana de Psicología, Vol. 27, pp. 77-85, 2010.

[16] M. Ornelas, G. Gastélum, H. Blanco, J. E. Peinado, Análisis psicométrico de la prueba body image anxiety scale versión rasgo en alumnos de educación superior, Perfiles Educativos, Vol. 36, pp. 120-137, 2014.

[17] A. Raviolo, P. Ramirez, E. A. López, A. Aguilar, Concepciones sobre el conocimiento y los modelos científicos: Un estudio preliminar, Formación Universitaria, Vol. 3, pp. 29-36, 2010.

[18] J. Viciana, E. M. Cervelló, J. Ramírez, Effects of manipulating positive and negative feedback on goal orientation, perceived motivational climate, satisfaction, task choice, perception of ability, and attitude to physical education lessons, Perceptual and motor skills, Vol. 105, pp. 67-82, 2007.

[19] H. Blanco, M. Ornelas, J. L. Tristán, A. Cocca, D. Mayorga-Vega, J. López-Walle, J. Viciana, Editor for creating and applying computerise surveys, Procedia Social and Behavioral Sciences, Vol. 106, pp. 935-940, 2013.

[20] J. R. Arbuckle, Amos users guide version 21.0, Marketing Department, SPSS Incorporated, Chicago, IL, 2012.

[21] B. Thompson, Exploratory and confirmatory factor analysis. Understanding concepts and applications., American Psychological Association, Washington, D C, 2004.

[22] E. Gelabert, L. García-Esteve, R. Martín-Santos, F. Gutiérrez, A. Torres, S. Subirà, Psychometric properties of the spanish version of the frost multidimensional perfectionism scale in women, Psicothema, Vol. 23, pp. 133-139, 2011.

[23] J. Leighton, R. Gokiert, Y. Cui, Using exploratory and confirmatory methods to identify the cognitive dimensions in a large-scale science assessment, International Journal of Testing, Vol. 7, pp. 141-189, 2007.

[24] G. W. Cheung, R. B. Rensvold, Evaluating goodness-of-fit indexes for testing measurement invariance, Structural Equation Modeling, Vol. 9, pp. 233-255, 2002.