Consejo General de la Psicología ESPAÑA

Psicothema (2022) 34(3) 479-487

Psicothema

https://www.psicothema.com/es • ISSN 0214–7823

Revista del Consejo General de la Psicología de España

Psicothema

Methodology

Adaptation of the Multidimensional Body Self Relations Questionnaire for Young People Between 9 and 16 Years old

María Paula Fernández[1], Soraya Coballes[2], Belén San Pedro[3], David Martín[4], José Labra[1], Carmen González[3] and Javier Herrero[1]

1 Departamento de Psicología. Universidad de Oviedo.
2 Centro Integrado de Formación Profesional del Deporte. Avilés.
3 Departamento de Ciencias de la Educación. Universidad de Oviedo.
4 IES Aramo. Oviedo.

ARTICLE INFO

Received: January 12, 2022
Accepted: April 18, 2022

Keywords:
Body Image
Multidimensional Body Self Relations Questionnaire
Adaptation and validation
Adolescence and pre-adolescence

ABSTRACT

Background: Young adolescents and pre-adolescents are the population most vulnerable to disorders derived from a distorted Body Image (BI). In this study, the Multidimensional Body Self Relations Questionnaire, MBSRQ®, was adapted and validated for young Spanish people between 9 and 16 years old. **Method:** 719 young people of both sexes participated. The internal structure, the invariance of the measure according to sex and age, and evidence of validity and reliability of the measure were examined. **Results:** the dimensional model found in adults was not replicated in young people. The simplest, best-fitting BI construct in young people, examined from the perspective of the BI construct contained in the MBSRQ®, consisted of 20 items in 4 differentially correlated factors. The internal consistency of the factors contained in the MBSRQ-SA-a was shown to be satisfactory, as was the evidence of concurrent validity. Factor invariance was demonstrated as a function of gender and three age groups. **Conclusions:** the MBSRQ-SA-a is reliable and valid for the study of BI in young people aged 9-16 years to the extent permitted by the content of the 4 factors making it up.

Adaptación Española del *Body Self Relations Questionnaire* en jóvenes entre 9 y 16 años

Palabras clave:
Imagen Corporal
Multidimensional Body Self Relations Questionnaire
Adaptación y validación
Adolescencia y preadolescencia

RESUMEN

Antecedentes: los jóvenes adolescentes y preadolescentes son la población más vulnerable a los trastornos derivados de una Imagen Corporal (IC) distorsionada. En esta investigación se realiza la adaptación y validación del Multidimensional Body Self Relations Questionnaire, MBSRQ®, para jóvenes españoles entre 9 y 16 años. **Método:** participan 719 jóvenes de ambos sexos. Se estudia la estructura interna, la invarianza de la medida en función del sexo y de la edad, y la evidencia de validez y la fiabilidad de la medida. **Resultados:** el modelo dimensional hallado en los adultos no se replica en los jóvenes. El modelo más simple y mejor ajustado del constructo IC que tienen los jóvenes, examinado desde la óptica del constructo de IC contenida en el MBSRQ®, está formado por 20 ítems dimensionados en 4 factores diferencialmente correlacionados. Se demostró que la consistencia interna de los factores contenidos en el MBSRQ-SA-a es satisfactoria, y también lo es la evidencia de validez concurrente. Se demostró invarianza factorial en sexo y edad. **Conclusiones:** se concluye que el MBSRQ-SA-a es fiable y válido para el estudio de la IC en jóvenes entre 9-16 años en el alcance que permite el contenido de los 4 factores que lo conforman.

Cite as: Fernández, M. P., Coballes, S., San Pedro, B., Martín, D., Labra, J., González, C., & Herrero, J. (2022). Adaptation of the Multidimensional Body Self Relations Questionnaire for Young People Between 9 and 16 Years old *Psicothema, 34*(3), 479-487. https://doi.org/10.7334/psicothema2022.19
Corresponding author: María Paula Fernández, paula@uniovi.es

The term Body Image (BI) refers to a very broad concept made up of cognitive, perceptual, affective, and behavioural aspects that define the way we relate to our physical self, to our body. It refers to the degree of satisfaction, thoughts or beliefs, and behaviours we have in relation to our physical appearance, our physical condition, and in relation to our biological integrity in the broad sense of the health/illness domain (Brown et al., 1990; Thompson & Schaefer, 2019).

Research has shown that one's self-concept affects quality of life and psychosocial functioning, as it can be both a risk factor in the occurrence of different health-related problems (low self-esteem, social anxiety, depression, eating disorders, etc.) and a protective factor in the preservation of good physical, psychological and social health (social integration, self-perceived competence, etc.) (e.g., Cash & Smolak, 2011; Guest et al., 2019). Thus, it is not surprising that a great deal of research is being conducted around BI, and even less so that there is very significant momentum in the adolescent and pre-adolescent population because they are the most vulnerable to disorders stemming from any distortion of BI in any of the varieties it covers (e.g., Casale et al., 2021; Kusina & Exline, 2019; Marzola et al., 2018).

The Multidimensional Body Self Relations Questionnaire (MBSRQ) (Brown et al., 1990) is perhaps the instrument with the best psychometric characteristics in terms of evidence of reliability and validity to assess BI from a multidimensional approach (Thompson & Schaefer, 2019). This instrument assesses BI from three dimensions, evaluative, cognitive, and behavioural, in three fundamental domains, physical appearance, physical condition and health/illness. It also examines satisfaction with body areas and self-assessment and concern about being overweight. Both the MBSRQ, consisting of 69 items sized into 10 factors (constituting subscales), and its shorter version, MBSRQ-AS (containing 5 MBSRQ scales), have been translated into numerous languages and validated in samples from multiple countries demonstrating high evidence of reliability and strong construct validity in both sexes, both in normal populations (Cash, 2018) and in clinical or quasi-clinical groups (Hrabosky et al., 2009).

In Spain, the translation and adaptation of the MBSRQ has been carried out by Raich et al., (1996) and by Botella et al., (2009), the latter, MBSRQ®, being the most widely used and studied. Using a sample aged between 21-42 years, in the adaptation process, it was reduced to 45 items that made up 4 factors, *Subjective Importance of Bodiliness* (ISC, 30 items), *Behaviours Oriented to Maintaining Physical Fitness* (COMF, 7 items), *Self-Assessed Physical Attractiveness* (AFA, 3 items) and *Caring for Physical Appearance* (CAF, 5 items). Only the factor that Brown et al., (1990) called Self-Classified Weight, consisting of 2 items, is not represented in the MBSRQ® scale. Given the scarcities, and highlighting this nuance, the theoretical substrate of the 4 factors is assumed to constitute the conceptual delimitation of the construct that the original MBSRQ® was intended to assess. As testimonial evidence, there are multiple investigations that have considered this both in Spain (e.g., Bellot-Arcís, et al., 2015; Ruiz & Quiles, 2021) and in Spanish-speaking countries, Costa Rica (Castillo & Moncada, 2013 and 2015), Chile (Cruzat-Mandich, et al., 2017) or Colombia (Nossa, 2020).

Assuming that the MBSRQ® includes all the content of the BI construct presented in the original MBSRQ (with the nuance described above), having demonstrated the enormous usefulness of its measurement, and considering that this instrument has not been validated to date for a population of young people, in this research we propose to adapt the MBSRQ® questionnaire to the population of Spanish preadolescents and adolescents aged 9-16 years and to study its psychometric properties. This general objective is divided into four specific objectives: to determine its dimensionality, to test the hypothesis of factorial invariance as a function of gender and age, to study the reliability of the measure, and to examine evidence of validity.

To respond to the stated objectives, instrumental research was conducted following the standards required for the construction, adaptation, and development of tests (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education, 2014; Hernández et al., 2020; Muñiz & Fonseca-Pedrero, 2019).

Method

Participants

The sample consisted of 719 students aged between 9 and 16 years old from 54 classrooms in 18 schools of the Principality de Asturias, the 54.9% boys (n=395) and 45.1% girls (n=324). WHO (1999) considers classifying the groups 9-11, 12-13, and 14-16 years old, as pre-adolescence, early and middle adolescence, respectively. In the sample, 30.9% (n=222), 31% (n=223) and 38.1% (n=274) were pre-adolescent, early adolescence, and middle adolescence respectively.

Instruments

1.-*Multidimensional Body Self Relations Questionnaire* (MBSRQ®). Questionnaire adapted for Spanish adult sample by Botella et al. (2009) from the original instrument developed by Brown et al. (1990). It consists of 45 items each rated on a 5-point scale from 1 to 5 (strongly disagree-strongly agree). The items are sized into 4 factors, ISC, COMF, AFA and CAF (mentioned above). Botella et al., (2009) report that in their sample analysed the 4 factors explain 43.46% of the variance, and the Cronbach's alpha coefficients were .94, .80, .70 and .84 respectively. A total BI score (neither sum nor average) indicating good or bad BI is not possible, each dimension is a part of the construct, and to do otherwise is incorrect (Cash, 2015).

For the adaptation of the wording of the items of the MBSRQ® scale for the youth population, three specialists (a Spanish-language philologist, an educator, and a psychologist) semantically and syntactically reviewed the wording of all the items in order that young people could correctly understand their meaning without adulterating or altering the content of the original items. Once consensus was reached, a pilot study was carried out in which 16 students (two of each age between 9 and 16 years old) from different schools, but with similar characteristics to the participants, responded to the questionnaires. Following the suggestions of Wilson (2005), after carrying out the test, the students were interviewed individually. The 16 people

stated that they understood all the items well, and 8 recognized that the negative items had been an added difficulty, but not insurmountable. Thus, and to faithfully compare the results found with those described in the older population, we decided to keep the questions negative. The composition of the MBSRQ® scale and items as they were finally presented to the youth can be found in supplementary material (SM).

2.-*Self-Concept and Shape Scale* (AF5) (García & Musitu, 1999). Composed of 30 items on a Likert scale of 1-99 that make up five dimensions of self-concept, academic/professional, social, emotional, family, and physical whose Cronbach's alpha coefficients are .88, .70, .73, .77, and .74 respectively, and .82 for the total scale. A high score indicates good psychosocial adjustment. Some researchers recommend scaling the response from 0-10 to capture variability more effectively in response (e.g., Cummins & Gullone, 2000). In the same way as Malo et al., (2011), the response was collected where 0 corresponds to strongly disagree and 10 to strongly agree.

Procedure

The selection criteria of the sample were young students in public, private and subsidized schools (or institutes) of different population density centers of the Principality de Asturias, of both sexes, and aged between 9 and 16 years old. Were intentionally chosen 25 centers located in 10 councils of the region, and the appropriate steps were taken in the process of requiring their participation. Finally, only 18 centers agreed to participate.

The Application of the questionnaires. were carried out in accordance with the Declaration of Helsinki, and in accordance with the ethical standards existing at the University of Oviedo. The questionnaires were applied prior informed consent, from the center, and from the parents (or legal representative) of the young people. To prevent young people from sharing information the application in each school was carried out at the same time in the morning in all groups. 45 minutes was considered to be sufficient time to respond without haste, thus ensuring complete data collection (Fleming, 2011), and consequently there were no missing data. In all classrooms were encouraged to ask out loud about any comprehension difficulties. The answer was anonymous to guarantee the ethical aspects.

All this process was carried out normally. The difficulties appeared only occasionally, never the same ones, and with similar frequency in all the courses. Always were solved. The information from 21 students over 16 years of age was discarded as they did not meet the selection criteria.

Data analysis

The background and starting points in the process of adapting the questionnaire for the youth population are as follows. Brown et al. (1990) determined the factor structure by means of principal components analysis (PC) and oblimin rotation. Although it is not advisable to do it this way (Ferrando & Anguiano-Carrasco, 2010; Lloret-Segura et al., 2014), the 69 items in 10 factors were chosen considering the multidimensionality of the BI construct (Keeton et al., 1990), and carrying out a careful selection process based on descriptive statistics to capture by this way, the maximum variability among participants and the differences between both sexes (Cash et al., 1986). However, Botella et al., (2009), once the scale was translated, adjusted the dimensionality using PC and varimax rotation, ignoring the correlation between the factors. In addition, although the factors were very unbalanced in the number of items (30, 7, 3, and 5), they did not undertake a descriptive study of them in a sample which, in addition to being small (n=261), the proportion of women was higher (85%). This has not prevented, as previously stated, the MBSRQ® from being used on multiple occasions in Spain and other Spanish-speaking countries, possibly because items from 9 of the 10 MBSRQ factors are represented in the MBSRQ®, and therefore, as in this research, it is assumed to constitute the conceptual delimitation of the construct that original MBSRQ questionnaire assess. Blanco et al., (2017) tested the dimensional structure found by Botella et al., (2009) in a large sample of Mexican adult population and found that it did not have a good fit. Through successive exploratory factor analyses, they carried out a process of selecting the items based on the same criteria used by Cash et al., (1986). Then, on the process of model fit, by confirmatory factor analysis, they determined that only 14 items sized in two factors formed an adequate model, and they found factorial invariance according to sex. The equality of the factor structure is an aspect that occupied much of the research carried out by Brown et al., (1990), and using alternative statistical tests other than the CFA, they concluded that the factor structure was the same for both sexes but admitted that some items were represented differently in men and women. Due to the magnitude of the physical and emotional changes experienced by preadolescents and adolescents (Vega et al., 2017), we also consider it important to assess the factorial invariance in the dimensionality of the BI construct as a function of gender and age.

Thus, the process of assessing the dimensionality structure of the MBSRQ® in the youth sample began by examining the descriptive statistics of the items. This was followed by assessing whether the 4-factor, 45-item model was valid for young people. This was done in two ways, by a Semiconfirmatory Factor Analysis (sCFA) using Procrustean rotations against a target matrix (Ferrando & Lorenzo-Seva, 2014) and by the Confirmatory Factor Analysis (CFA). Since both methods converge in that the original model does not fit the data, a study was carried out to determine which dimensional structure was appropriate.

Following the required procedure for cross-validation, the sample was randomly divided into two halves. With the calibration sample (n=361) successive Exploratory Factor Analysis (EFA) were performed and the most suitable items were selected in two phases in the same way as Cash et al., (1986) and Blanco et al., (2017) did. On the first, were retained the most discriminative items with the greatest power to capture the differences between the participants based on descriptive statistics, specifically, were eliminated the items with standard deviation less than .95 and mean distant from the scale mean (Nunnally & Bernstein, 1995), and items with skewness and/or kurtosis coefficients far from the range (-1.5, 1.5) (e.g., Ferrando & Anguiano-Carrasco, 2010). In the second, items with factor loadings below .40 and complex items (Hair et al., 2006) were removed (see details in Table A1 in SM). The model best fitted by EFA was denoted M1.

Model M1 was then tested by CFA with the validation sample (n=358). Once the good fit of the model was verified, factorial

invariance was examined as a function of gender, and of the three age ranges. The model was again modified to achieve the factorial invariance.

The descriptive study of the items was carried out using IBM SPSS 25. The sCFA was performed using the FACTOR program (V.11.04.02) (Lorenzo-Seva & Ferrando, 2006), which examines the model fit based on the Root Mean Square Deviation (RMSD) (Levine, 1977). If RMSD<0.05 the misfit is trivial, between 0.05 and 0.10 it is moderate and if RMSD>.10 the misfit is substantial (Curran et al., 1996). The EFA was also performed using the FACTOR program, and the CFA with JASP (V.0.14.1.0). Because the items are ordinals, and most of them showed skewness and/or kurtosis values significantly away from normality, the polychoric correlation matrix was used in all the EFA and CFA models tested (Ferrando & Lorenzo-Seva, 2014; Muthen & Kaplan, 1992). The estimation procedure for all EFA was unweighted least squares (ULS), the number of factors was determined by the optimal implementation of Parallel Analysis (Timmerman & Lorenzo-Seva, 2011), and oblimin rotation was used. The model was evaluated with conventional goodness-of-fit indices in absolute terms, in relative terms, and based on a measure of comparative fit with respect to the null model of independence using, respectively, RMSR, RMSEA, and CFI. Satisfactory reference values are CFI≥.95 (Hu & Bentler, 1999; Kline, 2011), RMSR <.05 (Shi et al., 2019), and RMSEA≤.06 (Hair et al., 2006; Hu & Bentler, 1999).

In the CFA, the Diagonally Weighted Least Squares with Mean and Variance corrected (WLSMV) estimation method was used. The correlation between the errors was left free. Model fit was examined using the CFI, RMSEA, SRMR, and the χ^2/gl ratio. Satisfactory reference values of the latter two indices were SRMR <.08 (Hu & Bentler, 1999), and χ2/df<3 (Schermelleh-Engel et al., 2003). Next, the multi-group CFA according to sex and age groups (9-11, 12-13 and 14-16 years old) was performed. The deviation of the metric, scalar and strict invariance models from the configurational invariance model was examined based on the increase in CFI, RMSR and RMSEA (Jak & Jorgensen, 2017). The internal structure analysis was concluded by examining Composite Reliability (CR) (Hair et al., 2017).

The reliability of the measure of the resulting scale, MBSRQ-SA-a, was then estimated by analyzing internal consistency using Cronbach's standardized alpha and McDonald's ordinal omega. Values greater than .70 were considered acceptable (Viladrich, et al., 2017).

Finally, evidence of concurrent validity was examined through correlational analysis examining the relationship between MBSRQ-SA-a scores and scores of the factors of the AF5 test. Values of r ≥.20, ≥.50 and ≥.80 express a minimal, moderate and strong correlation, respectively (Mukaka, 2012).

Results

Evidence of validity based on internal structure and reliability of the measure of the resulting scale.

The model found by Botella et al., (2009) of 45 items and 4 factors does not fit the data from the youth sample. Both the sCFA and the CFA converge in this result. In the sCFA, the RMSD values were .152, .147, .113, and .105 for the ISC, COMF, AFA, and CAF factors respectively, indicating substantial misfit, being the total mean misfit .126. The initial CFA showed unsatisfactory fit on all indices [χ^2/df=5.73; CFI=.833; SRMR=.091 and RMSEA=.081] (see Table 2).

A modeling process was then initiated with the calibration sample (n=361) through successive exploratory factor analyses. The adequacy of the data examined by means of the KMO sphericity test and Bartlett's test was always satisfactory. Based on the descriptive statistics of the items, in the first stage 17 items were eliminated, and 5 items (1 complex item and 4 items with loadings below .40) in the second (see details in Table A1 in SM). A total of 22 items were eliminated. It was concluded that Model M1sized with 4 factors consisting of a total of 23 items (F1, F2, F3, and F4 have 8, 4, 3, and 8 items respectively) is the simplest model and best adjusted [BIC=921.89; CFI=.987; RMSR=.045; RMSEA=.036; S=.96] (see Table 2) by EFA. The UniCo=.792 and ECV=.715 indexes show that the structure of the M1 model moves away from Unidimensionality (Ferrando & Lorenzo-Seva, 2018), as expected. The CFA with the validation sample (n=358) corroborated a satisfactory fit of the M1 Model [χ^2/df=1.33; CFI=.979; SRMR=.058 and RMSEA=.031] (see Table 2). Table 1 presents the items that make up the 4 Factors, their descriptive statistics, and the factor loadings of both EFA and CFA.

The factorial invariance of M1 as a function of sex and gender was then tested. The results are presented in detail in Table 2. Although based on the fit indexes χ^2/df, CFI, RMSEA, and based on the increase in SRMR and RMSEA it could be concluded that there is strong invariance (configurational, metric, and scalar) for the groups defined by both variables, the increase in CFI, allows us to conclude that the M1 Model is only invariant as a function of age (ΔCFI= -.007 and -.004 in metric and scalar invariance respectively), but not as a function of sex (ΔCFI= -.019 in metric invariance).

To find an invariant structure, we began by examining the standardized factor loadings of boys and girls in model M1 (see Table 1). We decided to successively eliminate the items with the largest differences (Putnick & Bornstein, 2016), and to test again the fit of the CFA and the invariance model as a function of both variables. The most dissimilar loadings are observed for items 23 and 43 of F1 and item 20 of F3. Once the three items are removed, Model M2 (4 factors and 20 items) shows a more satisfactory fit than Model M1 [χ^2/df=1.20; CFI=.986; SRMR=.055 and RMSEA=.024] (see Table 2) and shows strong factorial invariance as a function of the variables sex and age. The Composite reliability is excellent, .871, .723, .623 and .737 on Factors F1, F2, F3 (in this one slightly worse) and F4 respectively (see Table 3).

The internal consistency evaluated by the Cronbach's alpha test and by McDonald's ordinal omega was adequate in F1, F2, and F4, and marginally adequate in F3, probably because this factor only has 3 items (see Table 3).

It is thus concluded that M2 sized with 4 factors consisting of a total of 20 items is the simplest model, best adjusted in the sample of young people, it is invariant according to sex and the three age groups, and the measure derived from each of its factors is reliable. The new questionnaire for preadolescents and adolescents is called MBSRQ-SA-a. The resulting *Factors were defined as Satisfaction with appearance* (F1), *Concern about appearance* (F2), *Concern about physical shape/Satisfaction with physical shape* (F3), and *Concern about illness* (F4).

Table 1.
Descriptive statistics of the items of the MBSRQ® (Botella et al., 2009) that make up the questionnaire adapted to the population of young Spanish population, MBSRQ-SA-a, and factor loadings of the Model M1 in EFA and CFA, and of the Model invariant according to sex and age, Model M2, in CFA.

					Factor loads				
	M	SD	Asy.	Kur.	[C]EFA M1; K=25	[V]CFA M1; K=25			[V]CFA M2; K=20
F1: Satisfacción por el aspecto físico [Satisfaction with appearance] (M1 k=8; M2 k=6)						Girls&Boys	Girls	Boys	Girls&Boys
A4. Mi cuerpo es sexualmente atractivo [My body is sexually appealing]	3.39	1.05	-.36	-.13	.768	.791	.834	.717	.770
8. Me gusta mi aspecto tal y como es [I like the way I look as I am]	3.93	1.12	-.88	.03	.778	.732	.714	.628	.711
16. Casi todo el mundo me considera guapo/a [Nearly everyone thinks I'm handsome]	3.27	.97	-.27	.26	.508	.612	.666	.598	.725
23. Me gusta el aspecto de mi cuerpo sin ropa [I like the look of my unclothed body]	3.24	1.18	-.34	-.55	.751	.777	.750	.579	------
28. Me gusta cómo me sienta la ropa [I like the way my clothes fit me]	3.94	1.02	-.86	.36	.563	.577	.575	.574	.625
41. Estoy satisfecho con la parte media del cuerpo (abdomen y estómago) [I am satisfied with the middle part of the body (abdomen and stomach)]	3.58	1.01	-.43	-.24	.783	.579	.627	.552	.538
43. Estoy satisfecho con el tono muscular [I am satisfied with muscle tone]	3.63	.96	-.34	-.21	.448	.535	.592	.461	------
44. Estoy satisfecho con mi peso [I am satisfied with my weight]	3.68	1.07	-.52	-.36	.777	.617	.638	.535	.526
F2: Preocupación por la apariencia [Concern about appearance] (M1 & M2 k=4)									
9. Compruebo mi aspecto en un espejo siempre que puedo [I check my appearance in a mirror whenever I can]	3.23	1.25	-.19	-.92	.696	.791	.833	.840	.867
10. Antes de salir invierto mucho tiempo en arreglarme [I spend a lot of time getting ready before I go out]	2.99	1.30	.03	-1.1	.686	.823	.507	.507	.568
29. Presto especial atención al cuidado de mi pelo [I pay special attention to the hair care]	3.82	1.12	-.70	-.29	.693	.705	.609	.551	.664
*33. Nunca pienso en mi aspecto [I never think about how I look]	4.17	1.00	-1.1	.98	.664	.538	.546	.537	.519
F3: Preocupación por la enfermedad [Concern about illness] (M1 & M2 k=3)									
32. Presto atención a cualquier signo que indique que puedo estar enfermo [I pay attention to any signs indicating that I may be ill]	3.58	1.19	-.54	-.51	.645	.613	.554	.549	.550
38. Soy muy consciente de pequeños cambios en mi salud [I am very aware of small changes in my health]	3.58	1.02	-.49	-.07	.594	.735	.724	.718	.701
39. Al primer signo de enfermedad voy al médico [I go to the doctor at the first sign of illness]	2.67	1.30	.26	-1	.620	.615	.484	.479	.480
F4: Preocupación por la forma física/Satisfacción con la forma física [Concern about physical shape/Satisfaction with physical shape] (M1 k=8; M2 k=7)									
03. Para mí es importante tener mucha fuerza [It is important for me to have a lot of strength]	3.26	1.07	-.02	-.56	.458	.384	.305	.320	.351
11. Tengo una buena capacidad de resistencia física (piensa en las actividades deportivas) [I have a good physical endurance capacity (think of sports activities)]	3.73	1.02	-.51	-.39	.531	.790	.793	.754	.796
*19. Estar en forma no es una prioridad en mi vida [Fitness is not a priority in my life]	3.97	1.15	-.86	-.27	.587	.405	.323	.313	.320
20. Hago cosas que aumenten mi fuerza física [I do things that increase my physical strength]	3.48	1.20	-.42	-.71	.665	.646	.491	.759	------
*24. No soy bueno en deportes o juegos (piensa en las actividades deportivas) [I am not skilled in sports or games (think sports activities)]	4.16	1.14	-1.1	.18	.495	.605	.519	.535	.590
*25. Raramente pienso en mis aptitudes deportivas [I rarely think about my sporting abilities]	3.54	1.09	-.37	-.48	.559	.395	.344	.303	.344
26. Me esfuerzo en mejorar mi resistencia física [I strive to improve my physical endurance]	4.02	1.06	-.93	.14	.702	.584	.500	.484	.543
*30. No le doy importancia a mejorar mis habilidades en actividades físicas [I don't attach importance to improving my skills in physical activities]	4.17	1.04	1.25	.54	.696	.539	.410	.472	.411

Legend. A = numbering of the items in MBSRQ® scale (see the complete scale in SM); * = inverse item; M, DT, Asy. and Kur. = Mean, standard deviation, Asymmetry, Kurtosis; [C]= calibration sample (50% approx. n = 361); [V]= validation sample (50% approx. n = 358: Girls=148; Boys=210); EFA M1= Factorial loadings of M1 in EFA; CFA M1= Standardized factorial loadings of M1 in CFA; CFA M2= Standardized factorial loadings of M2 (Model M1 where items 23 and 43 of F1 and item 20 of F4 are omitted because the standardized factor loadings of boys and girls differed, they were .171, .268 y .131 respectively; K= number of items in the tested model; k= number of items in the factor.

Table 2.
Dimensionality models tested using EFA and CFA of the Multidimensional Body Self Relations Questionnaire (MBSRQ®) in the adaptation process to a sample of young Spanish population.

	MODELS	χ² (df)	χ²/df	BIC/ECVI	CFI	RMSEA[90%CI]	RMSR[1]/SRMR	S		
[T]CFA	MBSRQ®	5388.38(939)	5.73	7.72	.833	.081[.079-.083]	.091			
[C]EFA	M1(k=23)			921.89	.987	.036	.045	.968		
[V]CFA	M1(k=23)	286.89)215	1.33	1.145	.979	.031[.020-.040]	.058			
[V,4]Invariance	M1 Sex2	χ2 (df)	χ2/df		CFI	RMSEA[90%CI]	SRMR	ΔCFI	ΔSRMR	ΔRMSEA
Conf.Invar.		441.003(430)	1.02		.997	.012[0-.029]	.071			
Metr.Invar.		521.193(449)	1.16		.978	.030[.016-.047]	.078	-.019	.007	.018
Invariance	M1 EAge3									
Conf.Invar.		595.655(645)	.92		1	0[0-.011]	.082			
Metr.Invar.		707(683)	1.03		.993	.011[0-.034]	.090	-.007	.008	.011
Scal. Invar		757(721)	1.04		.989	.021[0-.035]	.089	-.004	.001	.010
[V]CFA	M2 (k=20)	189.79(157)		.829	.986	.024[.0006-.036]	.054			
[V,4]Invariance	M2 Sex2	χ² (df)	χ²/df		CFI	RMSEA[90%CI]	SRMR	ΔCFI	ΔSRMR	ΔRMSEA
Conf.Invar.		307.125(314)	.97		1	0[0-.026]	.068			
Metr.Invar.		344.62(330)	1.04		.994	.016[0-.033]	.072	-.006	.004	.016
Scal. Invar		373.34(346)	1.07		.988	.021[0-.036]	.072	-.006	0	.005
Invariance	M2 Age3									
Conf.Invar.		405.179(471)	.86		1	0[0-.0]	.078			
Metr.Invar.		474.520(503)	.94		1	0[0-.0020]	.085	0	.007	0
Scal. Invar		515.489(535)	.96		1	0[0-.025]	.084	0	.001	0

Legend. MBSRQ®, Model found by Botella et al., (2009), K=45 items and 4 Factors; [T]=Total sample, N=719; BIC/ECVI = parsimony indices, BIC information criteria in EFA, and expected cross-validation index in CFA respectively; RMSR/SRMR=Root Mean Square of Residuals in EFA and sCFA, and Standarized Root Mean Square of Residuals in CFA; RMSEA=Root Mean Square Error of Approximation; [1]= FACTOR does not provide the value of the limits of the interval; S= Bentler's simplicity index; [4] = Configural, Metric and Scalar Invariance, respectively; Δ= Comparison of Increment of the observed value in CFI, SRMR and RMSEA; [2]= Boys=210 and Girls=148; [3]= 9-11 years old 30.9% (n=222), 12-13 years 31% (n=223), and, 14-16 years 38.1% (n=274); Fort the rest, see Table 1.

Evidence of validity based on the relationship with other variables

The results are shown for the whole sample in Table 3 in the text, and separately for each gender and by age group in Tables A2 and A3 in the SM. The results converge in the expected direction.

Table 3.
Empirical correlations, and exposition of the calculation of different reliability coefficients (N=719).

[1,2]Correlation between the MBSRQ-SA-a factors.					Evidence of reliability of the MBSRQ-SA-a			
	F1	F2	F3	F4		Standardized Cronbach's Alfa	McD ω	CR
F1	1	.163*	.245*	**.412***	F1	.810	.750	.871
F2	.290	1	.200	.042	F2	.730	.752	.723
F3	.326*	.315*	1	.220*	F3	.626	.591	.623
F4	**.535***	.063	.303*	1	F4	.713	.684	.737
					Total	.798	.767	

Correlation between factor measurements, MBSRQ-SA-a and AF5					
	Ac	S	E	Fs	Fm
F1	.382**	.357**	.151**	**.636****	.237**
F2	.142**	.141**	-21**	.043	.005
F3	.266**	.183**	-.066	.296**	.147**
F4	.187**	.315**	.208**	**.651****	.102**

Legend. F1, F2, F3 and F4= MBSRQ-SA-a factors; [1]= Above the diagonal the correlation between the direct scores is represented; [2]= under the diagonal the correlation between the latent factors is represented; McD ω.= McDonalds' Omega ordinal; CR= composite reliability; Ac, S, E, Fs and Fm= scales of the AF5 questionnaire, Academic, Social, Emotional, Physical and Family, respectively]; **,*= p<.001 and p<.05 respect.

Based on the relationship between the factors of the MBSRQ-SA-a: Table 3 shows a moderate correlation. between factors F1 and F4, higher in boys than in girls. However, this relationship is neither stable nor the same in both samples when examined across all three age groups. See details in Table A2 in SM.

Based on the relationship between the empirical scores of the MBSRQ-SA-a factors with the factors of the AF5: it is observed that factors F1 and F4 have a moderate relationship with the Physical Self-Concept scale in both sexes and in all age groups. At the age of 9-11 years, in girls F1 and F2, and in boys F1, have a moderate relationship with the *Academic* Self-Concept scale, which weakens with increasing age. It is remarkable, not for its magnitude, but for its sign, that the *Emotional* Self-Concept scale has a negative relationship with factors F2 and F3. All these results are to be expected considering those found by Fraguela-Vale et al., (2020) and Galindo-Domínguez (2019), among others. See details in Table A3 in SP.

Discussion

The adolescent and pre-adolescent population are more vulnerable than adults to disorders stemming from any distortion of BI in any of the nuances it encompasses (eg, Casale et al., 2021; Kusina & Exline, 2019; Marzola et al., 2018). The instrument with the best psychometric characteristics in terms of reliability of the measure and evidence of validity to assess BI from a multidimensional approach is the MBSRQ developed by (Brown et al., 1990) (Thompson & Schaefer, 2019), and it was adapted for

the Spanish adult population by Botella et al., (2009), MBSRQ®. This research proposes to adapt the MBSRQ® questionnaire to the population of young Spanish preadolescents and adolescents.

The results of this research allow us to conclude that the model underlying the MBSRQ® scale (Botella et al., 2009) in the adult population (45 items in 4 factors with 30, 7, 3, and 5 items) is not valid for the youth sample, thus coinciding with the result found by Blanco et al., (2017) in the sample of adults.

The most decisive part in the adaptation process occurs in the performance of the exploratory analysis of the data, where in the first stage only the most discriminative items with the greatest power to capture the differences between the individuals in the sample were retained based on the descriptive statistics, and in a second stage the simplest items with the greatest strength within their dimension were retained, in the same way as Cash et al., (1986) (except for method differences), and Blanco et al., (2017) did. Make it this way, it was concluded that the simplest and best-fitting model of the BI construct of pre-adolescent and adolescent youth examined from the perspective of the BI construct contained in the MBSRQ® consists of 20 items sized into 4 differentially correlated factors, *Satisfaction with physical appearance, Concern about appearance, Concern about illness*, and *Concern about physical shape/Satisfaction with physical shape*. The MBSRQ-SA-a is shown to have satisfactory levels of reliability in the score of the 4 factors and adequate evidence of concurrent validity. The factorial invariance was demonstrated as a function of gender and the three age groups.

It is necessary to analyze in-depth the differences between the content of the questionnaire in young people and the content of the questionnaire in adults found by Blanco et al., (2017), and both with respect to the content of the questionnaire by Botella et al., (2009). In a first approximation, it is striking that only 14 items in two factors (8 and 6 items) constitute the MBSRQ in the Mexican adult population, and 7 items of the first factor coincide with items of the factor that we have called *Satisfaction with physical appearance* in the population of young people. But it is also necessary to analyze in-depth the differences between the MBSRQ-S_{A-a} and the MBSRQ-AS adapted for 12-14-year-olds by Marco et al., (2017) since it contains 5 MBSRQ scales. Marco et al., (2017) concluded that the dimensionality of the MBSRQ-AS was valid in young people, however, they admitted that the factor loadings of two items were very low (−.17 and −.22), probably not statistically significant, although they do not write anything about this. In addition, they show that 6 standardized factor loadings are negatives and this can happen, either because they correspond to inverse items and have not been transformed, or because they are represented in various factors. However, they do not extend any explanation for it, nor have they taken into account that items 24, 25, and 10 have an SD=.67, .72, and .85 respectively, and therefore, with very little force to evaluate differences between young people.

This research is not without limitations, and possibly the most notable is that the sample was incidental. However, the care is taken in the selection of schools so that they were represented the main characteristics that they have, and the acceptable final sample size could make it possible for the participants to be representative of the Spanish population they intend to represent. It would have been desirable for the sample to include 17 and 18-year-olds. It was not possible due to the refusal of the centers due to the proximity of the university entrance exam. It was also not possible to study the stability of the measure because only 25 people decided to take the re-test. For all these reasons, the results found in this research should be considered provisional.

Based on the strength of the results found, despite the limitations, it can be concluded that the MBSRQ-SA-a questionnaire is reliable and valid for the study of BI in young people aged 9-16 years to the extent permitted by the content of the 4 factors that make it up.

This result should be considered a starting point that requires future research on at least the following issues, to study the differences between boys and girls on the different factors and to examine whether age is a moderating effect on these differences (the factorial invariance tested allows for this analysis), and to evaluate the practical validity of the measure and its predictive validity to determine its usefulness as a diagnostic or assessment measure in different disorders suffered by preadolescents and adolescents in which the body image is distorted (see, eg., Espina, et al., 2001; Jordana et al., 2020; Tucci & Peters, 2008; Sepúlveda et al., 2001), and for the study of its evolution (Livacic-Rojas, et al., 2010; Vallejo et al., 2018).

Addendum

The Supplementary Material can be found at https://www.unioviedo.es/dise_investigacion/sm2021.pdf.

Acknowledgements

We appreciate the comments made by the editor and the reviewers because they have served to substantially improve the report of this research.

Funding

The present investigation has not received aid specific from agencies of the public sector, commercial sector or non-profit entities.

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