

# Reliability and construct validity of the Body Modification Scale (BMS) in young male adolescent subjects

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Original article

## SUMMARY

The acquisition of strategies for the modification of body shape among male subjects has been registered in several countries. This may ensue to several sorts of aims: weight loss, weight gain and increment of muscle mass or tone; however there exist few instruments to asses these aspects differentially. The purpose of this investigation was to render an adaptation of the Body Modification Scale into Spanish, as well as to asses its psychometric properties onto young adolescent males. The first study spanned across the translation, adaptation and experimental application of the BMS; the internal consistency and factor structure was assessed on two hundred and seventy (270) adolescent males ( $M_{\text{age}}=12.84$ ), among whom one hundred and seventy one (171) took part in the re-issuing of the test ("re-test"). The second study addressed the assessment, with an independent sample ( $n=200$ ;  $M_{\text{age}}=13.46$ ), of the adequacy of the derived factor structure with the one of the original instrument. The Spanish language version of the BMS showed adequate internal consistency ( $\alpha=0.88$ ) and *test-retest* reliability ( $r=0.80$ ). The exploratory analysis of factors initially yielded four of them, between two of which conceptual overlapping was observed; wherof the analysis was repeated and the factors obtained reduced to three. They explained 44.1% of the variance, covering 20 from the original 24 questions. The reliability of factors "weight loss" and "muscle mass/tonne gain" was adequate ( $\alpha \geq 0.86$ ;  $r \geq 0.80$ ), unlike the one of "weight gain" which was substantially inferior, that is 0.63 and 0.74. The factor analyses for confirmation are good foundations for the adequacy of both structures; nonetheless, the one presently proposed appears as better suited. In an overview, the Spanish language rendering of the BMS demonstrated adequate psychometric properties for male adolescent subjects; yet, this shall need to be confirmed for other age ranges and female populations.

**Key words:** body perception, change in body weight, reliability, validity, adolescents, male subjects.

## RESUMEN

En diversos países se ha constatado no sólo la adopción de estrategias de cambio corporal por parte de los varones, sino que éstas pueden responder a distintas intenciones: perder peso, ganar peso e incrementar tono o masa muscular. Sin embargo, son escasos los instrumentos que permiten evaluar diferencialmente estos aspectos. Por tanto, el propósito de esta investigación fue obtener una versión en español de la Body Modification Scale (BMS), así como examinar sus propiedades psicométricas en varones adolescentes. El primer estudio comprendió la traducción, adaptación y aplicación piloto de la BMS; la consistencia interna y estructura factorial fue evaluada con 270 adolescentes ( $M_{\text{edad}}=12.84$ ), de los cuales 171 participaron en el *retest*. El segundo estudio se dirigió a probar, en una muestra independiente ( $n=200$ ;  $M_{\text{edad}}=13.46$ ), la adecuación de la estructura factorial derivada respecto a la original. La versión en español de la BMS mostró tener adecuada consistencia interna ( $\alpha=.88$ ) y confiabilidad *test-retest* ( $r=.80$ ). El análisis factorial exploratorio derivó inicialmente cuatro factores, observándose traslapamiento conceptual entre dos de ellos; por tanto, se optó por replicar el análisis forzando la extracción a tres factores. Éstos explicaron 44.1% de la varianza, agrupando 20 de los 24 reactivos originales. Los factores perder peso y aumentar tono o masa muscular mostraron adecuada confiabilidad ( $\alpha \geq .86$ ;  $r \geq .80$ ), resultando sustancialmente menor la del factor ganar peso (.63 y .74, respectivamente). Los análisis factoriales confirmatorios fundamentaron la adecuación de ambas estructuras; sin embargo, el modelo correspondiente a la aquí propuesta mostró un mejor ajuste. En general, la versión en español de la BMS mostró poseer adecuadas propiedades psicométricas en varones adolescentes. Sin embargo, esto deberá corroborarse no sólo en otras edades, sino también en mujeres.

**Palabras clave:** Imagen corporal, cambio del peso corporal, confiabilidad, validez, adolescentes, varones.

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## INTRODUCTION

The lack of satisfaction about body shape has been elicited as one of the prime factors for the development, endurance and symptomatic characterisation of certain mental disorders. Instances of them are eating disorders (ED), which can be distinguished by the excessive desire to become slim and morbid fear of obesity.<sup>1</sup> In addition to this, during the nineties there appeared the warning about the existence of yet another syndrome which has come to be known as muscle dysmorphia (MD), characterized by the morbid desire to increase the muscle mass.<sup>2,3</sup>

Whether MD must be defined as a separate entity, or one variation of the Body Dysmorphic Disorder or of ED remains an unfinished process;<sup>4,5</sup> the latter have been found to bear close parallelism, especially of nervous anorexia and nervous bulimia with the MD,<sup>6,7</sup> though they have been differentiated on the basis of the strategies for body change which are associated to them,<sup>8,9</sup> pro-thin or pro-muscle, correspondingly.

The strategies for body modification are conducts whose aim is to change the shape, the size or the weight of the own body;<sup>10</sup> they are acquired by women and men.<sup>11,12</sup> Such strategies, mostly among male subjects, are not only the enactment of the desire to become slender, but also of the one to increase their muscle mass or tone,<sup>13-19</sup> which corresponds to a body ideal centered around the possession of greater strength and muscle mass.<sup>20,21</sup>

According to this idealisation, body modification behaviors may include dietary modifications, excessive physical exercise, substance use<sup>10,18,22,23</sup> and even surgical procedures (e.g.: implant plastic surgery).<sup>24</sup> These may in turn cause difficulties in the physical and mental health.<sup>25</sup>

The acknowledgement of the divergence between men and women regarding their body ideals,<sup>26,27</sup> which may be interiorised since the early stages of life,<sup>28,29</sup> the necessity arises for the availability of valid and reliable instruments that allow for the assessment of such conducts of body change which are not univocally aimed at slenderness, but also to the increment of body weight, or specifically muscle mass or tone. On this matter, a recent systematic review brought awareness to the fact that the studies which deal with the utilisation of instruments for the evaluation of both trends of body change – pro-thin and pro-muscle – are still scarce.<sup>30</sup> Nonetheless, the existence of a self-report instrument developed to that purpose: the Body Modification Scale (BMS), was acknowledged.<sup>18</sup>

McCabe and Vincent<sup>18</sup> found that among male subjects between 11-17 years of age, the BMS bears a great internal consistency ( $\alpha=0.93$ ), and confirmed, based on the Exploratory Factor Analysis (EFA), the foreseen structure of three factors: loss of weight ( $\alpha=0.99$ ), gain of weight ( $\alpha=0.98$ ), and increment in muscle mass or tone ( $\alpha=0.95$ ), each one developed along eight questions. Just as well, the scale displayed stability over time (*test-retest*) in its total score ( $r=0.90$ ) and

in each single factor: 0.88; 0.92; 0.89, for the corresponding factors. On this basis, the present authors suggest that the BMS is a valid and reliable instrument; but emphasizing that there remains the necessity to demonstrate this in further studies. Thus, the purpose of the present investigation was to render a Spanish language version of the Body Modification Scale, as well as the assessment of its reliability and construct validity on adolescent male subjects. The present work embodies two studies. The first explores the internal consistency, temporal stability and factor structure of the scale. The second deals with the proof of validity for such structure. This investigation has been approved by a University Committee for Ethics.

## FIRST STUDY

### Method

#### Sample

Non-probabilistic, intended sample type. The size was calculated according to the recommendation that it be ten times the one of the variables to be analysed.<sup>31</sup> Thus the sample, integrated by two hundred and seventy (270) adolescent males between eleven and fifteen years in age ( $M=12.84$ ;  $SD=0.99$ ) who were then residing within the metropolitan zone of Mexico City and studying at two public education centres. One hundred and seventy one (171) of them participated in the *re-test* ( $M_{age}=12.81$ ;  $SD=1.03$ ).

#### Instrument

It is the Body Modification Scale (BMS),<sup>18</sup> which is a self-report questionnaire with twenty four (24) questions of the Likert type (1=*never*, 6=*always*), in which a higher score portrays a greater presence of the trait.

#### Procedure

1. *Translation.* The translation of the instrument was performed in a cross-check fashion, (English-Spanish; Spanish-English); then it was revised by three expert language professionals, so as to avoid any misinterpretation by the adolescents about the questions. Finally, they were adapted according to the language usage of the subjects to guarantee thorough comprehension by the adolescents.
2. *Probe Study.* When the definitive version had been completed, the school authorities were summoned and the purpose of the investigation was expounded to them; their authorisation was then requested to carry out the data collection. Afterwards, the students were invited to participate in an "investigation about body image among adolescents"; from those who voluntarily accepted, their personal consent and the one of their parents

or tutors was requested, with the due guarantee that the data would be used anonymously. Thus, during the probing application of the BMS there was the participation of two groups with fifteen adolescents each, ranging between eleven and fourteen years in age ( $M=12.00$ ;  $SD=0.64$ ). During the session of application, the directions and all items were read aloud and clearly to the group, encouraging the participants to point out if the former turned out to be confusing or unclear, or if any word was unknown. The subjects found the questions to be clear and that they showed no difficulty to understand the language employed. Whereof it was unnecessary to perform changes on the instrument.

3. *Data Collection.* The application of the BMS on the main sample was performed during the regular class schedule and in groups (with populations between fifteen and twenty participants), along one session of approximately twenty minutes. For the *re-test*, the participants answered the scale on a second occasion, one month after the first application.
4. *Data Analysis.* This task was performed by means of the Statistical Package for the Social Sciences (SPSS, 17.0 version for Windows ©OS). It consisted of the computation of the internal consistency (*alpha* Cronbach coefficient) and the temporal stability of the measurements (*r* Pearson coefficient between the re-issuings of the test:

*test-retest*). Finally, the construct validity was assessed through Exploratory Factor Analysis (EFA), through the method for the extraction of main axes and the Varimax rotation.

## Results

The value of the *alpha* Cronbach coefficient yielded a good internal consistency for the BMS ( $\alpha=0.88$ ). The *r* Pearson coefficient signaled a positive and significant correlation between the twenty four items and the total score (21 questions with  $p=0.0001$ ). About the magnitude of the correlation, whilst the figure for four questions (1, 4, 16 & 22) was exceedingly weak ( $r\leq 0.29$ ), the figure for fourteen other questions ranged between moderate and strong ( $r\geq 0.50$ ). The *test-retest* correlation of the total scores equaled 0.80 ( $p=0.0001$ ). Prior to the realisation of the EFA, the adequacy of the data was examined. The crossed correlation of the items resulted in a maximum coefficient of 0.71, thus confirming the non co-linearity of the variables; the Kaise-Meyer-Olkin (KMO) index yielded 0.86, greater than the advised minimum of 0.70;<sup>32</sup> the calculated sphericity proof of Barlett is quite telling ( $\chi^2=2895.21$ ,  $p\leq 0.0001$ ). The EFA gave four factors with *eigen* values greater than one, which explained 49.96% of the total variance and which, with the basis on the criterion of a minimal factor load of 0.40, grouped twenty one ques-

**Table 1.** Factor loads of the items during the first EFA

Item	Factors			
	1	2	3	4
1 Do you eat food that will help you to increase your weight?				
2 Are you worried about being too fat?	.58			
3 Do you practice weight-lifting to develop your muscles or make them stronger?		.63		
4 Would you like to gain weight from the things that you eat?			.44	
5 Do you do exercise to lose weight?	.45	.55		
6 Do you do exercise to increase the size of your muscles?		.77		
7 Do you eat in excess on purpose to gain weight?			.64	
8 Do you think about eating less to lose weight?	.72			
9 Do you think about having bigger muscles?		.43		.59
10 Does it upset you that what you eat does not increase your weight?			.48	
11 Do you think about doing exercise to lose weight?	.74			
12 Would you be happier if your body frame were bulky, with big muscles?				.69
13 Do you do exercise to gain weight?				
14 Is the thought of losing weight always on your mind?	.83			
15 Do you go to the gym to increase the size of your muscles?		.55		
16 Do you think of eating more to gain weight?			.74	
17 Do you eat low-fat food because you do not want to gain weight?	.57			
18 Do you think of doing exercise to increase the size of your muscles?		.53		.57
19 Do you eat between meals intentionally to gain weight?			.59	
20 Do you care about your food because you want to slim down?	.75			
21 Do you do exercise or practice any sport to increase the size of your muscles?		.65		
22 Do you think about doing exercise to gain weight?				
23 Do you intentionally eat less to lose weight?	.80			
24 Does it worry you that your body is not muscled enough?				.56
<i>Eigen</i> value	4.27	2.75	2.04	1.89
Percentage of explained variance	17.79	11.47	8.50	7.90

tions; whereof three of the latter, addressing weight gain (1, 13, 22) (table 1), were excluded. Nevertheless, in both the second and the fourth factors questions were grouped as aimed at the evaluation of thoughts and conducts vincu- lated to the desire of increasing muscle mass or tone. Based on these findings and the original intent for BMS to measure the conducts of body change ensuing three different mo- tives (weight loss, weight gain, increment in muscle mass or tone), a second EFA process was performed, this time with a pre-determined outcome of three factors.

These factors account for 44.06% of the total variance and included the same 21 questions (table 2). In particular, the fifth item (addressing weight loss) scored highly for two factors with only a difference of 0.10 between factorial loads, whereof it was omitted. So, twenty of the original twenty four questions remained as the base for the three-factor structure of the BMS, distributed as follows: weight loss, seven questions (2, 8, 11, 14, 17, 20, 23); increment in muscle mass or tone, eight questions (3, 6, 9, 12, 15, 18, 21, 24); weight gain, five questions (4, 7, 10, 16, 19). The internal consistency of the factors is satisfactory, with  $\alpha$  coefficients: 0.89, 0.86 and 0.74 correspondingly. The correlation among the three factors is relevant between first and second ( $r=0.43$ ;  $p=0.0001$ ) and between second and third ( $r=0.27$ ;  $p=0.0001$ ); though not quite so between third and first ( $r=0.08$ ,  $p=0.21$ ). Lastly, the *test-retest* stability was assessed for the score in

factors ( $n=171$ ), with values for  $r$  obtained as follows: 0.81, 0.80 and 0.63, correspondingly, all with  $p=0.0001$  in value.

## SECOND STUDY

### Method

#### Sample

Non-probabilistic, intended type sample. The participants were two hundred adolescent male subjects, ranging between twelve and sixteen years in age ( $M=13.46$ ;  $SD=1.09$ ). They all resided within the metropolitan zone of Mexico City and studied at a public education centre at the moment of the study.

#### Instrument

Rendering of the BMS derived in the previous study into Spanish language.

#### Procedure

The application of the scale test was performed in the formerly described fashion for the main sample of the first study.

1. *Data analysis.* At first, came the evaluation of the internal consistency ( $\alpha$  Cronbach coefficient); then ensued the

**Table 2.** Factor loads for the items during the second EFA

Item	Factors		
	1	2	3
1 Do you eat food that will help you to increase your weight?			
2 Are you worried about being too fat?	<b>.58</b>		
3 Do you practice weight-lifting to develop your muscles or make them stronger?		<b>.58</b>	
4 Would you like to gain weight from the things that you eat?			<b>.58</b>
5 Do you do exercise to lose weight?	.40	.47	
6 Do you do exercise to increase the size of your muscles?		<b>.77</b>	
7 Do you eat in excess intent on gaining weight?			<b>.65</b>
8 Do you think about eating less to lose weight?	<b>.72</b>		
9 Do you think about having bigger muscles?		<b>.65</b>	
10 Does it upset you that what you eat does not increase your weight?			<b>.52</b>
11 Do you think about doing exercise to lose weight?	<b>.71</b>		
12 Would you be happier if your body frame were bulky, with big muscles?		<b>.55</b>	
13 Do you do exercise to gain weight?			
14 Is the thought of losing weight always on your mind?	<b>.84</b>		
15 Do you go to the gym to increase the size of your muscles?		<b>.51</b>	
16 Do you think of eating more to gain weight?			<b>.76</b>
17 Do you eat low-fat food because you do not want to gain weight?	<b>.60</b>		
18 Do you think of doing exercise to increase the size of your muscles?		<b>.74</b>	
19 Do you eat between meals intentionally to gain weight?			<b>.55</b>
20 Do you care about your food because you want to slim down?	<b>.76</b>		
21 Do you do exercise or practice any sport to increase the size of your muscles?		<b>.73</b>	
22 Do you think about doing exercise to gain weight?			
23 Do you intentionally eat less to lose weight?	<b>.80</b>		
24 Does it worry you that your body is not muscled enough?		<b>.42</b>	
Eigen value	4.38	3.67	2.52
Percentage of explained variance	18.27	15.27	10.52

Note: In bold letters are written the factor loads of the questions retained in the corresponding factor.



Confirmatory Factor Analyses (CFA) by means of the Structural Equations Programme (EQS, 6.1 version for Windows® OS). These measurements were performed with the basis on the method of maximum likelihood and the optimisation of the indices of Lagrange and Wald. The adequacy of the model was tested for the following indicators:  $\chi^2$ , normalised  $\chi^2$  (NC, formula:  $\chi^2/gl$ ), non-normalised fit index (NNFI), goodness-of-fit index (GFI), comparative fit index of Bentler (CFI), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA); the following criteria were the references:  $CN < 3$ ; NNFI, GFI,  $CFI \geq 0.90$ ; SRMR  $\leq 0.08$ ; RMSEA  $\leq 0.06$ .<sup>35,36</sup>

## Results

The BMS showed good internal consistency, in the case of its total score ( $\alpha=0.88$ ) and for each factor ( $\alpha=0.88$ ;  $\alpha=0.87$ ;  $\alpha=0.72$ ; correspondingly). Regarding the assessment of the factor structure derived in the previous study, the CFA qualified the model with a significant  $\chi^2$  ( $\chi^2, 153=229.68$ ;  $p=0.0002$ ), and adequate adjustment values for  $CN$  (1.50),  $NNFI$  (0.95),  $GFI$  (0.96),  $CFI$  (0.90),  $SRMR$  (0.08) and  $RMSEA$  (0.05). While testing in the same sample the BMS structure proposed by McCabe and Vincent<sup>18</sup> CFA model proved less well adjusted ( $\chi^2, 153=381.01$ ;  $p < 0.0001$ ;  $CN=2.49$ ;  $NNFI=0.92$ ;  $GFI=0.93$ ;  $CFI=0.86$ ;  $SRMR=0.08$ ;  $RMSEA=0.06$ ).

## DISCUSSION

The results of the present study show that the BMS is a reliable instrument to assess the body modification strategies in adolescent male subjects. Nevertheless, even when the scale demonstrated adequate internal consistency and temporal stability, both coefficients turned out to be substantially lower than those reported by McCabe and Vincent.<sup>18</sup> Regarding the factor structure of the scale, the three proposed factors were confirmed:<sup>18</sup> loss of weight, gain of weight and increment in muscle mass or tone; but in the present study there appeared aspects which diverge from the original structure, namely: 1. The factors embodied only twenty of the former twenty four questions; 2. Although they explained a percentage of the variance higher than 40%, that was importantly lower than what had been previously informed;<sup>18</sup> 3. On the other hand, the eigen values and the variances explained by the derived factors showed an importantly greater balance than the one of the original study,<sup>18</sup> in which the first factor alone explained 37.7% of the total variance; 4. The hierarchy of the factors varied, so that weight loss showed to be the prime one, followed by increment in muscle mass or tone and weight gain was third.

In particular, three of the four non-grouped questions – given they did not meet the minimum factor load crite-

– were addressed to the gain of weight, two of them through exercise. In detail, it seems clear enough that adolescent males may identify two different aims for the practice of physical exercise as a strategy for body change: becoming more slender or increase muscle mass or tone; but not specifically for increasing their weight. Alternately, one question directed towards loss of weight through exercise was discarded because it displayed similar factor load for two issues: loss of weight and increment in muscle mass or tone. This may arise from the fact, found in previous studies, that both intentions are significantly correlated,<sup>8,14,16,37-39</sup> they coexist,<sup>9-11</sup> and the first may be predictive for the second,<sup>40</sup> given that the masculine body ideal implies both the reduction of body fat and the increase in muscle mass or tone.

In this study, factors weight-gain and weight-loss were not found to be relevantly associated, as has been informed in other studies carried out with male subjects.<sup>18,38</sup> Besides, contrary to what was informed by McCabe and Vincent,<sup>18</sup> only factors weight-loss and increment-in muscle-mass-or-tone of the BMS demonstrated adequate internal consistency and stability over time; whilst for the case of weight-gain, including solely questions about food ingestion, both properties were barely satisfactory.

Regarding the CFA processes performed, the three-factor model of the BMS here obtained showed a better adjustment than the original one or the structure of McCabe and Vincent.<sup>18</sup> For the three models the statistical quantity *Chi-square* resulted significant; yet, the one regarding the factor structure proposed in the present study displayed better adjustment indices, especially when these are compared to the ones obtained by the mentioned authors and, particularly, *normalised Chi-square* index, whose value (6.3) was exceedingly greater than the suggested maximum.<sup>33</sup> In consequence, even if at length the validity of the three-factor of BMS was confirmed for male adolescents, the present study sets foundation for a new structure of the questions that develop its factors.

Finally, it is important to highlight that these results beget only the first assessment of the psychometric properties of the BMS in its Spanish language rendering; whereof the relevance that future studies should assess the validity of the proposed structure on a larger sample, as well as establish its usefulness for the evaluation of the conducts of body change, not only in males of other age ranges, but also in female populations. Furthermore, even when the BMS appears as a capable instrument for the assessment of behaviors aimed at body change (in terms of weight or shape), it does not bear the objective of identifying the symptoms of feeding behavior disorders or body dysmorphia, nor their diagnosis. It must be also remembered that, without neglecting the great usefulness of self-report instruments in the field of mental health, a diagnosis can only be formulated from the personal interview with a specialist.

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