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RESEARCH ARTICLE

Validity and Reliability Study of Turkish Version of "Muscle Dysmorphic Disorder Inventory" and "Bodybuilder Image Grid" Scales

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Abstract: ***Background*:** Although bigorexia symptoms are rapidly increasing, it is mostly an under-recognized condition in Turkish male bodybuilders. There are no validated screening tools to identify the symptoms.

***Objective*:** The purpose of this study is to evaluate the validity of the Turkish version of the MDDI and the BIG towards the diagnosis of bigorexia and to provide health care professionals with early screening tools.

***Methods*:** One hundred twenty male bodybuilders, fifty-eight professional bodybuilders and sixty-two recreational bodybuilders, all of whom matched the research criteria, were included in this study. MDDI and BIG forms were filled by the bodybuilders, along with an "Individual Characteristic Information Form", a "Nutrition-related Information Form", and a "Bodybuilding-related Information Form". To evaluate the construct validity, factor analysis was conducted and resulted in a three-factor construct.

***Results*:** The factor-loading values ranged from 0.542- 0.827. Calculations of Cronbach's alpha for the MDDI sum ($\alpha = 0.657$) revealed a good internal consistency. The MDDI, BIG O, and BIG S intraclass correlation coefficients (ICC) were found to be 0.840, 0.908, and 0.879, respectively. As a result, MDDI had acceptable reliability and that of BIG O and BIG S was excellent.

***Discussion*:** Turkish MDDI, BIG-O and BIG-S forms proved to be valid and reliable scales and were adequate for determining the symptoms of bigorexia in male bodybuilders. Using these forms, there was a statistically significant relationship between bigorexia and eating disorders, which were significantly positively correlated.

***Conclusion*:** Our results support the feasibility of using the MDDI, the BIG-O, and the BIG-S forms to determine symptoms of bigorexia in Turkish population. Further studies are needed to confirm if this result can be generalized to female bodybuilders.

Keywords: Bigorexia, Bodybuilder Image Grid (BIG), bodybuilder, fat-free mass index (FFMI), muscle dysmorphia, Muscle Dysmorphic Disorder Inventory (MDDI).

1. INTRODUCTION

Bigorexia (commonly known as muscle dysmorphia (MD)) is a body dysmorphic disorder that is more common in males [1-4]. The prevalence of bigorexia has increased in recent years and appropriate diagnosis plays a key role in the treatment of the disorders [5]. Therefore, in recent years, most studies on eating or body dysmorphic disorders have been focused on both women and men to develop effective strategies for early diagnosis and treatment [6, 7].

Pope *et al*. [1] determined the diagnostic criteria for bigorexia. Individuals with bigorexia are preoccupied with their body shape, think of themselves as thin and small, and feel that they are not muscular enough. Because of this pre-occupation, they follow a strict diet, exercise, and weight-lifting programs, and give up social, recreational, or other pre-occupational activities to maintain their workout program [8, 9].

The characteristics of bigorexia are as follows: a strong desire for increasing muscle mass, decreasing fat mass [10], hiding one's body or wearing multiple layers of clothing when other people are around [11], and using health-threatening drugs such as anabolic androgenic steroids (AAS) [12]. AAS use causes unusual increases in muscle mass and FFMI values and may lead to cardiovascular [13], neuroendocrine [14], and psychiatric diseases [15]. Males with bigorexia disregard all of the risks entailed in being more muscular and leaner. Due to the prohibition of AAS by The World Anti-Doping Agency (WADA), some individuals hide the substances they use [16]. One of the most common

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characteristics of bigorexia is the dependency on bodybuilding exercises to increase musculature [17]. Bodybuilding is a male-dominated sport and bodybuilders spend hours in gyms to become leaner, more muscular, and improve their physical appearance [18, 19]. Bigorexia first emerged in the literature following a study by Pope *et al*. [20] who conducted a study with bodybuilders; the concept was initially called 'reverse anorexia' (now it is called 'bigorexia'). Several studies have reported that bodybuilders were dissatisfied with their appearance and perceived themselves as weak and small, despite the fact that they were strong, lean, and muscular [15]. The prevalence of bigorexia is higher in bodybuilders than in other weight-dependent sports [21].

Numerous instruments have been developed for the identification of bigorexia and muscularity-related body dysmorphic disorders. Some are questionnaires, such as the Muscle Appearance Satisfaction Scale (Mayville *et al*. [22]), the Muscle Dysmorphia Inventory (Rhea *et al*. [23]), the Drive for Muscularity Scale (McCreary *et al*. [24]), and some are contour-drawn silhouette scales, such as the figure-rating scale (Stunkard *et al*. [25]), the Contour Drawn Rating Scale (Thompson *et al*. [26]) and The Chest Rating Scale (Thompson and Tentleff [27]). However, no study has examined the validity and reliability of diagnostic measures or scales to determine symptoms of bigorexia in Turkish population. Thus, this study conducts an examination to validate the Muscle Dysmorphic Disorder Inventory (MDDI) and the Body Builder Image Grid (BIG) (both the BIG-Original (BIG-O) and BIG-Scaled (BIG-S) forms) [28], which are used for screening bigorexia in the Turkish population.

2. MATERIALS AND METHODS

2.1. Translation into Turkish Version of the MDDI and BIG Scales

With the permission of Hildebrandt, the MDDI "Muscle Dysmorphic Disorder Inventory" and the BIG "Body Builder Image Grid" were translated into Turkish. Nine researchers, who are fluent in both Turkish and English, translated the MDDI and BIG into Turkish and compared their translations to determine the form of the highest quality in Turkish, then translated it back into English. The back-translation form of the MDDI and the BIG was compared to their original forms by three certified English- Turkish translators. After they approved the Turkish versions of the MDDI and the BIG, nutrition and physiology professionals determined whether the scale items were eligible for Turkish cultural equivalence.

2.2. Feasibility Testing

To determine the feasibility of the MDDI and BIG, 12 nutrition experts, who were fluent in Turkish and English, were examined in the Turkish version. They completed the forms to determine if they agreed with the translation and provided comments or alternatives as necessary. The final draft of the Turkish version, with the original scale in Turkish, was completed of MDDI and BIG forms to determine whether they agree with the translation of each item or not and provided comments or alternative translations. They agreed on approximately 99% of the translation and provided several comments and suggestions. The authors (Bilgic and Devrim) reviewed all feedback and included it in the final version of the Turkish translation of the MDDI and BIG forms. The researchers asked whether reading those forms posed any difficulty in understanding the scales or if they had questions or feedback, which would be considered in the revisions. After these stages were completed, the final Turkish versions of the MDDI and BIG scales were ready for validation by the Turkish population.

2.3. Participants

Participants were asked to read and sign an informed consent form before participating in the study. Fifty-eight competitive male bodybuilders, aged 18-58 (31.05 ± 10.60 yr.) and with an FFMI ranging from 19.16 to 35.12 (24.09 ± 3.05 kg/m2) and 62 recreational bodybuilders aged 18-42 (25.63 ± 6.67 yr.) with an FFMI ranging from 16.38 to 27.11 (21.18 ± 1.93 kg/m2) were recruited from four gyms in Ankara. The inclusion criteria were as follows: 1) male bodybuilders 18-years-old and above, 2) participation in exercise activities with at least one year of continuous bodybuilding experience, 3) participate in bodybuilding exercises at least three times a week and for at least 30 minutes per day on exercise days (3 hours per week). Participants who had been diagnosed with a disease by a physician were excluded from the study.

2.4. Procedures

Bodybuilders who participated in the study completed the MDDI and BIG, along with the "Individual Characteristic Information Form", the "Nutrition-related Information Form," and the "Bodybuilding-Related Information Form". All forms were written in Turkish. The questions on the general information form included: sociodemographic features (age, education status, *etc*.), and questions about general health status (disease status, drug use, *etc*.). The questions on the nutrition-related information form included: eating habits (which diet they performed, who advised them on their diet, the nutritional aids they used, and why they used that particular supplement, *etc*.). The questions on the bodybuilding-related information form included: workout schedule, body dissatisfaction, body-checking behaviors, self- objectification *etc*.).

FFMI represents a calculation of the lean body mass index that was designed by Kouri *et al*. [29]. It represents lean body mass and is calculated as follows: $FFMI = W \times [(100\text{-}BF)/100] \times H^{-2} + 6.1 \times (1.8\text{-} H)$. W is the weight in kilograms, BF is the percentage of body fat, and H is the height in meters. It is established that the highest value of the FFMI that can be achieved without any steroids or drug uses is 25.0.

2.5. Measures

MDDI is a 13-item measure that is used to define MD symptomatology, including three subscales, called Drive For Size (DFS), Appearance Intolerance (AI) and Functional Impairment (FI). The measure was first developed by Schlundt *et al*. [30] according to the proposed diagnostic criteria of an MD and consisted of 16 items referred to col-

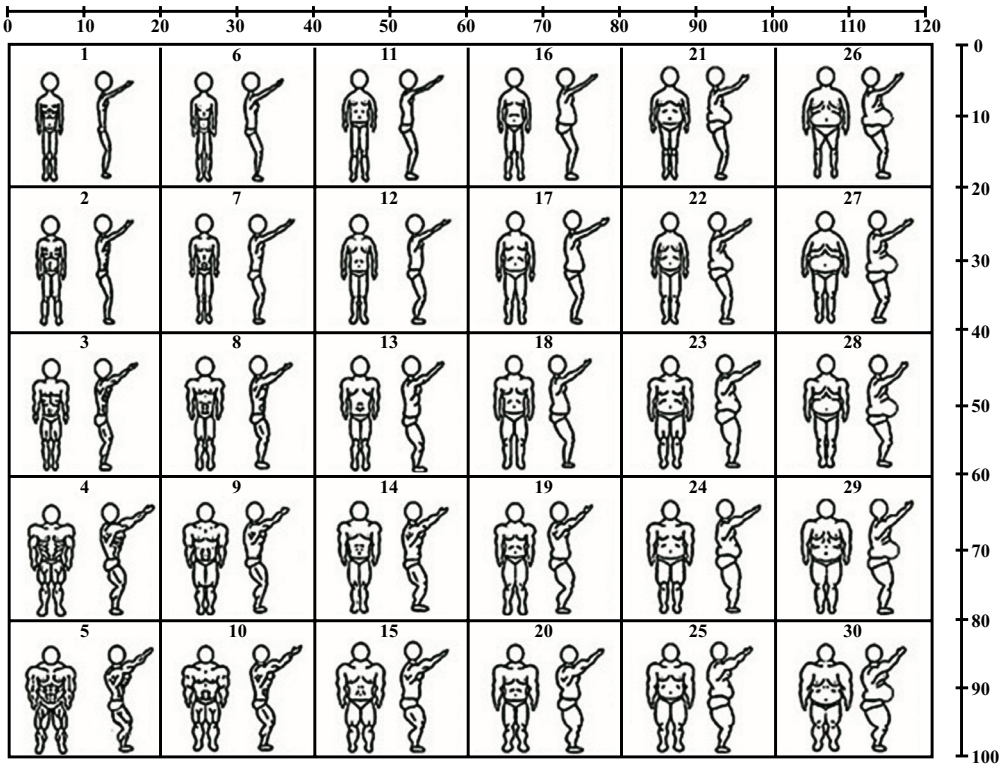

Fig. (1). Bodybuilder Image Grid. The top left figure defines a male silhouette with the least amount of body fat and muscle. As the figures towards to right and down to bottom, degrees of muscle and body fat percentage increases. For BIG S: use scales and remove numbers above figures. For BIG O: use numbers above figures and remove scales.

lectively as the "Muscle Dysmorphia Inventory". Then, Hildebrandt *et al*. [28] revised the scale, added questions about functional impairment, and renamed it the MDDI. A 5-point Likert-type scale from "never" to "always" was used to answer the questions.

MDDI has three subscales as a result of the factorial analysis. The first subcategory, DFS, was comprised of questions including concerns with being smaller and the desire to be more muscular and stronger. The second subcategory, AI, indicates one's negative thoughts about his body and includes any hiding behaviors performed to avoid exposing himself to people. Last, the FI explores obsessions associated with maintaining rigid exercise routines and the avoidance of missing one's workout schedule. The bodybuilder image grid is a scale created as a part of the MDDI by Hildebrandt *et al*. [8] and composed of two different versions: BIG-O (BIG-original) and BIG- S (BIG- scaled). Both of the scales were generated to evaluate body image disturbances in males. BIG-S was also used to test perceived attractiveness of the male body by both men and women. The scales consist of 30 male silhouettes that feature varying degrees of muscle and body fat (Fig. **1**). The top left figure defines a male silhouette with the least amount of body fat and muscle. As the figures progress to the right and down towards the bottom, the degrees of muscle and body fat percentage increase. The body fat percentage increases from the left to the right columns from 1= a body fat percentage of 6.5% to 6= a body fat percentage of 36.0%. The fat-free mass index (FFMI) (kg/m2) is used to determine muscle mass in both BIG O and BIG S. Body muscle mass increases from the top to the bottom and from 1= a FFMI of 15.5 and 5= a FFMI of 29.0.

BIG-O (BIG original) is calculated according to numbers from the top of each silhouette. To determine BIG-S (BIG scaled), the numbers are removed and the scales from the grid are used. BIG-S was designed after BIG-O and was conducted by asking four questions as follows: 1) which body type best represents their current body type, 2) which body type represents their ideal body type, 3) which body type is the most attractive body type, and 4) which body type is the most attractive to the opposite sex. It was emphasized that both the BIG-O and BIG-S were significantly associated with the MDDI and could be available for use by males regardless of sexual preference. The Eating Attitude Test (EAT-40) is a self-reported questionnaire used in the diagnosis of eating disorders which was designed by Garner and Garfinkel [31] (Turkish version by Savasir and Erol *et al*. [32]).

2.6. Statistical Analysis

Statistical analyses were performed using the IBM SPSS Statistics for Windows Ver. 22.0 package. The Kolmogorov-Smirnov test was used to determine whether the distributions of variables were normal. All results are expressed as means ± standard deviation. An exploratory factor analysis with varimax rotation was used to assess the construct validity of the MDDI. The Kaiser-Meyer-Olkin (KMO) measure was used to determine the factor analysis eligibility of the sample size. KMO values that were greater than 0.6 wereconsidered appropriate in most studies. Bartlett's test of sphericity was used to examine the overall significance of the correlation matrix.

Table 1. Internal consistency and factor loading of the MDDI.

Substances	Factor 1	Factor 2	Factor 3	MDDI
Functional Impairment	-	-	-	-
10. I feel anxious when I miss one or more workout days	**0.821**	-0,037	0,106	-
11. I pass up social activities with friends because of my workout schedule	**0.706**	0,068	-0,033	-
12. I feel depressed when I miss one or more workout days	**0.827**	0,052	0,159	-
13. I pass up chances to meet new people because of my workout schedule	**0.581**	0,248	-0,152	-
Drive for Size	-	-	-	-
1. I think my body is too small	0,062	**0.627**	-0,214	-
4. I wish I could get bigger	0,195	**0.697**	0,119	-
5. I think my chest is too small	-0,121	**0.662**	0,191	-
6. I think my legs are too thin	0,084	**0.569**	-0,124	-
8. I wish my arms were bigger	0,093	**0.638**	0,089	-
Appearance Intolerance	-	-	-	-
2. I wear loose clothing so that people can't see my body	0,073	0,120	**0.623**	-
3. I hate my body	-0,057	-0,076	**0.770**	-
7. I feel like I have too much body fat	0,262	-0,242	**0.542**	-
9. I am very shy about letting people see me with my shirt off	-0,022	0,123	**0.730**	-
Cronbach's alpha	**0.73**	**0.66**	**0.60**	**0.66**
Explained variance (%)	**18.03**	**17.02**	**15.14**	**50.2**

Rotation method is Varimax. Salient factor loadings (>0.40) are shown in boldface.

Cronbach's α was calculated to determine the internal consistency of the MDDI and the BIG scales. The Intraclass Correlation Coefficient (ICC) was used to assess test-retest reliability by comparing the variability of repeated measurements of the MDDI and both the BIG-O and BIG-S. The MDDI and BIG scales were administered to randomly select thirty subjects (15 competitive and 15 recreational bodybuilders) after two weeks. Both questionnaires were carried out by the researchers at the gym, which they had joined.

Pearson's and Spearman's rho coefficient was calculated to test convergent validity as appropriate, to determine the relationship between the total MDDI and subMDDI scores (DFS, AI and FI), present FFMI (kg/m2), body fat percentage (%) calculated by researchers, and present FFMI and body fat percentage according to BIG-S.

The paired sample t-test was used to compare the difference between participants' current and desired muscularity and body fat, and to compare the difference between the BIG-O and BIG-S scores. Independent sample t-tests were used to assess the difference between competitive and recreational bodybuilders' scores. $P<0.05$ was considered statistically significant.

3. RESULTS

3.1. MDDI

The KMO was found to be 0.61 which was determined to be appropriate for factor analysis. Bartlett's test of sphericity was significant ($p<0.001$) and determined the overall significance of the correlation matrix. Principal component analysis and scree plots revealed the MDDI as a three-factor structure. The first and third factors, Drive for Size and Functional Impairment, respectively, were loaded with four items, and the second factor, Appearance Intolerance was loaded with five items; which was a similar result to the findings obtained by Hildebrandt *et al*. [28]. The loading factor varied between 0.54 and 0.83, so all items were included in the MDDI (Table **1**). Together, the subscales of the MDDI, DFS, AI, and FI explained 50.2% of the total variance in the MDDI (18.03%, 17.02%, and 15.14%, respectively). Cronbach's alpha coefficient, which was calculated for the total MDDI (α=0.66), DFS (α=0.73), AI (α=0.66), and FI (α=0.60) revealed good internal consistency.

The convergent validity of the MDDI and both the BIG-O and BIG-S are shown in Table **2**. The MDDI scores revealed statistically significant positive correlations between the Drive for Size, the Appearance Intolerance, the Functional impairment, participants' FFMI (kg/m^2) and the Eating Attitude Test (EAT-40), and showed statistically significant negative correlations between participants' body fat percentage (%) and the desired body fat percentage, as defined in the BIG-S. The Drive for size positively correlated with appearance intolerance and functional impairment, and negatively correlated with current body fat percentage and desired body fat percentage, as defined in the BIG-S.

Table 2. Convergent and divergent validity of the MDDI (n=120).

	2	3	4	5	6	7	8
1. MDDI total score	0,696**	0,495**	0,709**	0,390**	-0.251**	0.121	-0.243*
2. Drive for Size	-	-0.012	0.193*	0.210*	-0.173*	-0.136	0.089
3. Apperance Intolerance	-	-	0.153*	0.177*	-0.007	-0.088	-0.029
4. Functional Impairment	-	-	-	0,359**	-0.274*	-0.177*	-0.192*
5. FFMI	-	-	-	-	0.049	0.287**	-0.062
6. Body fat percentage	-	-	-	-	-	0.018	0.258**
7. BIG S-Desired FFMI[a]	-	-	-	-	-	-	-0.072
8. BIG S- desired Body Fat Percentage[a]	-	-	-	-	-	-	-

a: Spearman's rho, *p<0.05, **p<0.01

Table 3. Distribution of subMDDI scores in terms of competitive or recreational bodybuilders.

	Competitive Bodybuilders (n=58) M (SD)	Recreational Bodybuilders (n=62) M (SD)
MDDI total score	36.32 (7.02)	35.87 (7.57)
DFS	14.89 (4.49)	15.64 (4.25)
AI	6.77 (2.58)*	8.19 (3.33)*
FI	14.65 (3.32)**	12.03 (3.90)**

*p<0.05, **p<0.01

Table **3** represents the distribution of the MDDI and sub-MDDI scores in terms of competitive or recreational bodybuilders. Competitive bodybuilders showed significantly lower Appearance Intolerance scores and significantly higher Functional Impairment scores than recreational bodybuilders.

3.2. BIG-O and BIG-S

The ideal body muscle mass defined in BIG-S positively correlated with the actual FFMI (r=0.287, p=0.002), and negatively correlated with the Functional Impairment subscale (r=-0.177, p=0.027).

The ideal body fat mass defined in BIG-S positively correlated with actual body fat percentage (r=0.258, p=0.005), and negatively correlated with the functional impairment subscale (r= -0.192, p=0.018).

The actual FFMI values positively correlated with the current body muscle mass defined in the BIG-O (r= 0.416, p=0.001) and the current body mass defined in the BIG-S (r=0.444, p=0.001). The actual body fat percentage was significantly positively correlated to the current body fat mass defined in both the BIG-S (r=0.488, p=0.001) and BIG-O (r=0.488, p=0.001).

Both the BIG-O and BIG-S revealed acceptable convergent validity, and were applied to detect perceptual disturbances in males. When the BIG-S was compared to the BIG-O, all participants revealed that the BIG-S could be answered more easily.

Table **4** represents the intra-class correlation of the BIG-O and BIG-S scales. The differences between the current and ideal muscle mass and body fat were statistically significant (p<0.05). The current and ideal body muscularity and body fat scores defined in the BIG-O and BIG-S revealed statistical differences, except for the current body fat scores, which were defined in both scales. The scores obtained from both the BIG-O and BIG-S showed that all participants desired to be more muscular and have a lower body fat percentage.

4. DISCUSSION

Bigorexia is a mental disorder that encompasses conditions that are pathologically related to being more muscular and leaner [33]. This condition represents body image perceptions in the way a man sees himself socially. In recent years, the idealized perceptions of the ideal male body shape being more muscular and leaner have psychologically affected the male population in terms of the desire to become more muscular [34].

Goodale *et al*. [35] revealed that bigorexia is a disorder that occurs commonly without any noticeable symptoms and an official diagnosis of all existing cases could increase the prevalence of MD.

The aim of this study is to validate the Bigorexia Disorder Inventory and the Bodybuilder Image Grid (both the original and the scaled versions) based on the original version translated into Turkish. Our findings are partially consistent with those presented by Santarnecchi *et al*. [36], who

Table 4. Means, standard deviations and intraclass correlation coefficients for 2-week test-retest reliabilities of the MDDI and BIG scales.

Measures	Sample 2 (n=30)		ICC
	M±SD		
	Week 1	Week 2	
MDDI total score	39.83 (6.14)	38.96 (7.63)	0.84
subMDDI	-	-	-
Drive for Size	17.26 (3.84)	16.63 (3.96)	0.78
Appearance Intolerance	8.73 (3.55)	8.03 (3.03)	0.77
Functional Impairment	13.83 (3.80)	14.30 (3.86)	0.89
BIG O	-	-	-
Current muscularity	46.66 (23.53)	49.33 (24.34)	0.98
Desired muscularity	68.66 (14.79)	66.66 (13.97)	0.91
Current body fat	52.33 (20.95)	52.00 (19.89)	0.96
Desired body fat	32.00 (16.89)	32.00 (16.06)	0.80
BIG S	-	-	-
Current muscularity	21.93 (3.99)	22.03 (4.23)	0.96
Desired muscularity	25.29 (2.69)	24.84 (2.73)	0.95
Most attractive body to himself-muscularity	25.50 (2.05)	25.28 (2.02)	0.91
Most attractive body to women-muscularity	25.28 (1.66)	25.17 (2.10)	0.98
Current body fat	16.50 (7.03)	16.71 (6.93)	0.98
Desired body fat	11.08 (5.42)	11.51 (5.03)	0.82
Most attractive body to himself- body fat	12.16 (4.92)	13,03 (4.74)	0.94
Most attractive body to women-body fat	13.03 (4.74)	12.60 (4.38)	0.93

validated the MDDI and BIG-S from the original version and translated it into Italian as well as those presented by Hildebrandt *et al*. [28], when the measures were first developed.

Bodybuilders have higher scores on the MDDI compared to athletes in other sports. As their main aim is to gain muscle and lose fat, they are quite prone towards developing bigorexia. Hitzeroth *et al*. [37] described a study in which 15/28 amateur competitive bodybuilders with body dysmorphic disorder (BDD) had bigorexia and the subjects with bigorexia had comorbid BDD, which depended heavily on preoccupations rather than muscularity.

Our results revealed the same factorial structure as that reported by Hildebrandt *et al*. [28] for the original version of the MDDI. These factors were as follows, respectively: Drive for size (items 1,4,5,6,8), Appearance Intolerance (items 2,3,7,9) and Functional Impairment (items 10,11,12,13). The items factor loading varied between 0.542 and 0.815 and no items were removed from the MDDI, as reported in the Italian version. These items explained 50.2% of the variance and the analysis supported a 13-item structure, as reported by Hildebrandt *et al*. [28] (Factor loadings = 0.660- 0.965, total variance explained= 63.2%) and as reported by Santarnecchi *et al*. [36] (factor loadings = 0.53-0.88, total variance explained = 66.22%). The MDDI provided a reliable measure of bigorexia symptoms and good convergent validity, as stated by Hildebrandt *et al*. [28], the creator of the original scale.

Cronbach's alpha value (MDDI total score = 0.68) and the ICC correlations (MDDI total score = 0.84) showed that the 13 items of the MDDI and the ICC correlations between the BIG-O and BIG-S had good internal consistency (ICC correlations varied between 0. 89 and 0.98). This result is consistent with that of the study which reported the adaptations of the MDDI to the Italian (alpha = 0.85) language as well as the original version (alpha = 0.81).

Santarnecchi *et al*. [36] reported that the BIG-S is an acceptable grid for use in different research fields, including a detailed exploration of bigorexia which considers other factors, such as narcissism, sexual orientation, and personal traits assessment. The homogeneity in most of the attractive body preferences defined in the BIG-S among all participants can be explained. Scores regarding the most attractive

(to oneself) and the most attractive to women as they were defined in the BIG-S were quite similar in both groups. Most participants indicated that the BIG-S was more informative and coherent with the male predisposition towards a muscular body shape, according to the BIG-O.

The MDDI, BIG-O, and BIG-S are not approved for clinical diagnosis of bigorexia; they are used to assess MD symptoms occurring in males. Hildebrandt *et al*. [16, 38] demonstrated that the instruments were intended to determine symptoms of MD, which is assumed to be a multidimensional construct.

This study has several limitations, including a lack of validation using a female sample and a lack of comparison with a clinically diagnosed bigorexia sample, similar to what was reported by Hildebrandt [28] and Santarnecchi *et al*. [36] in the Italian validation study of the MDDI and BIG-S. Further studies should be performed with both sexes as well as a sample of those diagnosed with bigorexia.

CONCLUSION

The MDDI, BIG-O, and BIG-S were translated into the Turkish language and successfully validated in this study. Both forms of the BIG (BIG-O and BIG-S) were able to be used reliably, but it was found that the BIG-S was more comprehensible for members of the Turkish population.

Early diagnosis is critical in the treatment of bigorexia. Therefore, based on the results of this study, the MDDI and the BIG could be applied by Turkish researchers, coaches, dietitians, and psychologists to detect the symptoms of bigorexia in Turkish male bodybuilders.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by Hacettepe University Ethics Board and Commission (GO 16/162), Ankara, Turkey.

HUMAN AND ANIMAL RIGHTS

No animals were used in the study. All reported human were experimented in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsniki Declaration of 1975, as revised in 2008 (http://www.wma.net/en/20activities/10ethics/10helsinki/).

CONSENT FOR PUBLICATION

Informed written consent was obtained from all the participants of this study.

AVAILABILITY OF DATA AND MATERIALS

The dataset that support the results and findings of this research are available from [PB], upon request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

REFERENCES

[1] Pope HG Jr, Gruber AJ, Choi P, Olivardia R, Phillips KA. Muscle dysmorphia. An underrecognized form of body dysmorphic disorder. Psychosomatics 1997; 38(6): 548-57.

[2] Cafri G, Thompson JK, Ricciardelli L, McCabe M, Smolak L, Yesalis C. Pursuit of the muscular ideal: Physical and psychological consequences and putative risk factors. Clin Psychol Rev 2005; 25(2): 215-39.

[3] Hudson JI, Hiripi E, Pope HG Jr, Kessler RC. The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. Biol Psychiatry 2007; 61(3): 348-58.

[4] Madden S, Morris A, Zurynski YA, Kohn M, Elliot EJ. Burden of eating disorders in 5-13-year-old children in Australia. Med J Aust 2009; 190(8): 410-4.

[5] Lowes J, Tiggemann M. Body dissatisfaction, dieting awareness and the impact of parental influence in young children. Br J Health Psychol 2003; 8(Pt 2): 135-47.

[6] Cororve MB, Gleaves DH. Body dysmorphic disorder: a review of conceptualizations, assessment, and treatment strategies. Clin Psychol Rev 2001; 21(6): 949-70.

[7] Murray SB, Rieger E, Touyz SW, De la Garza García Lic Y. Muscle dysmorphia and the DSM-V conundrum: where does it belong? A review paper. Int J Eat Disord 2010; 43(6): 483-91.

[8] Pope HG Jr, Kanayama G, Hudson JI. Risk factors for illicit anabolic-androgenic steroid use in male weightlifters: a cross-sectional cohort study. Biol Psychiatry 2012; 71(3): 254-61.

[9] Stice E, Shaw HE. Role of body dissatisfaction in the onset and maintenance of eating pathology: a synthesis of research findings. J Psychosom Res 2002; 53(5): 985-93.

[10] Olivardia R, Pope HG Jr, Hudson JI. Muscle dysmorphia in male weightlifters: a case-control study. Am J Psychiatry 2000; 157(8): 1291-6.

[11] Brown J, Graham D. Body Satisfaction in Gym-active Males: An Exploration of Sexuality, Gender, and Narcissism. Sex Roles 2008; 59: 94-106.

[12] Krug I, Pinheiro AP, Bulik C, *et al.* Lifetime substance abuse, family history of alcohol abuse/dependence and novelty seeking in eating disorders: comparison study of eating disorder subgroups. Psychiatry Clin Neurosci 2009; 63(1): 82-7.

[13] Baggish AL, Weiner RB, Kanayama G, *et al.* Long-term anabolic-androgenic steroid use is associated with left ventricular dysfunction. Circ Heart Fail 2010; 3(4): 472-6.

[14] Rahnema CD, Lipshultz LI, Crosnoe LE, Kovac JR, Kim ED. Anabolic steroid-induced hypogonadism: diagnosis and treatment. Fertil Steril 2014; 101(5): 1271-9.

[15] Kanayama G, Hudson JI, Pope HG Jr. Long-term psychiatric and medical consequences of anabolic-androgenic steroid abuse: a looming public health concern? Drug Alcohol Depend 2008; 98(1-2): 1-12.

[16] Hildebrandt T, Alfano L, Langenbucher JW. Body image disturbance in 1000 male appearance and performance enhancing drug users. J Psychiatr Res 2010; 44(13): 841-6.

[17] Mosley PE. Bigorexia: bodybuilding and muscle dysmorphia. Eur Eat Disord Rev 2009; 17(3): 191-8.

[18] González-Martí I, Bustos JG, Jordán OR, Mayville SB. Validation of a Spanish version of the Muscle Appearance Satisfaction Scale: escala de satisfacción muscular. Body Image 2012; 9(4): 517-23.

[19] Goldfield GS, Woodside DB. Body image, disordered eating, and anabolic steroids in male bodybuilders: current versus former users. Phys Sportsmed 2009; 37(1): 111-4.

[20] Pope HG Jr, Katz DL, Hudson JI. Anorexia nervosa and "reverse anorexia" among 108 male bodybuilders. Compr Psychiatry 1993; 34(6): 406-9.

[21] Ravaldi C, Vannacci A, Zucchi T, *et al.* Eating disorders and body image disturbances among ballet dancers, gymnasium users and body builders. Psychopathology 2003; 36(5): 247-54.

[22] Mayville SB, Williamson DA, White MA, Netemeyer RG, Drab DL. Development of the Muscle Appearance Satisfaction Scale: a self-report measure for the assessment of muscle dysmorphia symptoms. Assessment 2002; 9(4): 351-60.

[23] Rhea DJ, Lantz CD, Cornelius AE. Development of the Muscle Dysmorphia Inventory (MDI). J Sports Med Phys Fitness 2004; 44(4): 428-35.

[24] McCreary DR, Sasse DK, Saucier DM, Dorsch KD. Measuring the Drive for Muscularity: Factorial Validity of the Drive for Muscularity Scale in Men and Women. Psychol Men Masc 2004; 5: 49-58.

[25] Stunkard AJ, Sørensen T, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. Res Publ Assoc Res Nerv Ment Dis 1983; 60: 115-20.

[26] Thompson MA, Gray JJ. Development and validation of a new body-image assessment scale. J Pers Assess 1995; 64(2): 258-69.

[27] Thompson J, Tantleff KS. Female and male ratings of upper torso: Actual, ideal, and stereotypical conceptions. J Soc Behav Pers 1992; 7: 345-54.

[28] Hildebrandt T, Langenbucher J, Schlundt DG. Muscularity concerns among men: development of attitudinal and perceptual measures. Body Image 2004; 1(2): 169-81.

[29] Kouri EM, Pope HG Jr, Katz DL, Oliva P. Fat-free mass index in users and nonusers of anabolic-androgenic steroids. Clin J Sport Med 1995; 5(4): 223-8.

[30] Schlundt DG, Woodford H, Brownlee A. Muscle dysmorphia in male weightlifters: Psychological characteristics and practices 2000.

[31] Garner DM, Garfinkel PE. The Eating Attitudes Test: an index of the symptoms of anorexia nervosa. Psychol Med 1979; 9(2): 273-9.

[32] Savaşır I, Erol N. Yeme Tutum Testi: Anoreksiya nervoza belirtileri indeksi. Turk Psikol Derg 1989; 23: 19-25.

[33] Foster AC, Shorter GW, Griffiths MD. Muscle dysmorphia: could it be classified as an addiction to body image? J Behav Addict 2015; 4(1): 1-5.

[34] Pope HG Jr, Phillips KA, Olivardia R. The Adonis Complex: The Secret Crisis of Male Body Obsession. New York: NY Press 2000.

[35] Goodale KR, Patti Lou W, Bradley C. Muscle Dysmorphia: A New Form of Eating Disorder? J Health Educ 2001; 32: 260-66.

[36] Santarnecchi E, Dèttore D. Muscle dysmorphia in different degrees of bodybuilding activities: validation of the Italian version of Muscle Dysmorphia Disorder Inventory and Bodybuilder Image Grid. Body Image 2012; 9(3): 396-403.

[37] Hitzeroth V, Wessels C, Zungu-Dirwayi N, Oosthuizen P, Stein DJ. Muscle dysmorphia: a South African sample. Psychiatry Clin Neurosci 2001; 55(5): 521-3.

[38] Hildebrandt T, Schlundt D, Langenbucher J, Chung T. Presence of muscle dysmorphia symptomology among male weightlifters. Compr Psychiatry 2006; 47(2): 127-35.