Muscle dysmorphia: detection of the use-abuse of anabolic androgenic steroids in a Spanish sample

Dismorfia Muscular: detección del uso-abuso de esteroides anabolizantes androgénicos en una muestra española

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Abstract

People who suffer from muscle dysmorphia due to a distorted body image perceive themselves as less muscular than they actually are. With the aim of increasing their muscular development, they resort to the use of anabolic androgenic steroids (AAS). The purpose of this study is to know the prevalence of the use of AAS in a Spanish sample affected by muscle dysmorphia. The study sample was comprised of 562 male and 172 female bodybuilders and weightlifters who were applied anthropometric measurements, Fat-Free Mass Index equation, Escala de Satisfacción Muscular, and Somatomorphic Matrix software. The results show the creation of decision trees and a regression model was used to create explanatory models for muscle dysmorphia ($R = .78$ and $R2 = .62$). The main conclusion is that almost 50% of both male and female participants affected by this disorder use this kind of AAS.
Key words: muscle dysmorphia; steroids; bodybuilders.

Resumen

Las personas que padecen Dismorfia Muscular (DM) debido a una distorsión en la imagen corporal, se perciben menos musculosas de lo que son en realidad. Para paliar este problema y con el fin de aumentar su musculatura, algunas de estas personas hacen uso de hormonas ilegales, como son los esteroides anabolizantes androgénicos (EAA), cuya función principal es aumentar la musculatura. El objetivo de este estudio es conocer la prevalencia del uso de EAA en personas afectadas por Dismorfia Muscular. La muestra de este estudio estaba compuesto de 562 hombres y 172 mujeres fisicoculturistas y levantadores de pesas, a los que se le administraron medidas antropométricas, la ecuación Fat-Free Mass Index, el cuestionario Escala de Satisfacción Muscular y el test informatizado Somatomorphic Matrix. Como resultado se crearon diferentes modelos de regresión de la DM, empleando las técnicas estadísticas de árboles de decisión ($R = .78$ y $R2 = .62$) de minería de datos. La principal conclusión es que el 50% de participantes afectados por este trastorno usa EAA.
Palabras clave: dismorfia muscular; esteroides; fisicoculturistas.

The people affected by muscle dysmorphia (MD) suffer from a mental disorder in which a distortion of the body image in the form of its underestimation prevails (Pope, Phillips, & Olivardia, 2000), recently this disorder has been introduced as an Obsessive Compulsive Disorder in DSM-V (Rodríguez-Testal, Senín-Calderón, & Perona-Garcelán, 2014). As a consequence, one of the prevalent features in this disorder is obsessive weight training, looking for the improvement of the perception of the physical appearance due to the changes that this kind of practice produces in the physique. That is why bodybuilders and weightlifters are the group of sport people most affected by this disorder, because they find in the sport a solution for boosting their muscular development (Barrientos, Escoto, Bosques, Enríquez, & Juárez, 2014; González-Martí, 2012).

But the increase in the musculature is not only the consequence of exhausting training. There are artificial methods that enhance the size of the muscles in a faster and more effortless way. These artificial methods rely on the use of anabolic androgenic steroids (AAS) (Kanayama, Barry, Hudson, & Pope, 2006). They are "drugs of the body image", as Kanayama et al. (2006) named them, because they are not used for their psychoactive action, but for their effect on the body image (Coomber et al., 2014; Van Hout & Kean, 2015) by the people affected by MD (Rohman, 2009). These exogenous substances are illegal in the sport without a prescription due to their harmful side effects on the sport person´s health. But the wish to be muscular turns into an end in itself, and the sport person feels the temptation of using illegal substances that improve his/her performance and level of muscularity (Rocha, Aguiar, & Ramos, 2014). Workouts can be more intense and frequent because the recovery between them is quicker.

The detection of these substances can be made by means of direct or indirect methods. The most common of the former are urine analysis and/or blood analysis, whereas the indirect ones are the indicators derived from the formula of the Fat-Free Mass Index (FFMI; Kouri, Pope, Katz, & Oliva, 1995), which provide information about the level of a person´s lean muscle mass, and whether this level has been achieved by the use of AAS.

In the case of people affected by MD, the use of performance enhancing drugs such as growth hormone and testosterone is the most requested. Testosterone is a natural steroid which is synthesized by the interstitial cells of the testicles in men, and in the ovary and the adrenal cortex in women (De la Torre, 1995). Its androgenic function stimulates the masculine sexual characteristics such as the appearance of soft hair and the hypertrophy of the larynx, which causes the voice to be deep and virile. The anabolic effect increases muscularity. The daily production of testosterone in a man is between 5 and 10 mg. The testosterone concentrations in an adult and healthy man are between 12 and 28 nmol/l and in a woman is 5% of the one generated by a man (De la Torre, 1995). The hypogonadism is a hormonal disorder in which the person does not produce the amount of testosterone of a healthy individual. A research by Bhasin et al. (1997) demonstrates that if the treatment with testosterone applied to patients with hypogonadism increases in 6% their muscular body weight, being 9% their fat free mass, the use of testosterone in healthy individuals would double these percentages. That is why it is not surprising that people affected by MD resort to this hormone in an exogenous way seeking to increase their muscular development (Pipet, Halpern, Woody, & Szobot, 2014).

Testosterone can be administered orally or injected because it is biodegraded by the organism (De la Torre, 1995). That is why its chemical structure is subjected to changes in the laboratory, producing in this way the AAS. The AAS are the hormones to which bodybuilders and weightlifters resort more often due to the increase of muscularity and reduction of body fat they produce (Jampel, Murray, Griffiths, & Blashill, 2016).

In Spain there are not any studies about the influence of the AAS on individuals affected by MD, and the negative health consequences of AAS use-abuse is associated with psychiatric, hepatic, endocrine, neurologic, cardiovascular, mortality risks (Pope et al., 2014, Thiblin et al., 2015) and smaller brain volume and cortical thickness (Bjørnebekk et al., 2017). In consequence the goal of this research is to establish the prevalence of the use of AAS in Spanish men and women, bodybuilders and weightlifters, affected by MD by means of the indirect method of Fat-Free Mass Index. We depart from the hypothesis that the use of these hormones which increases the musculature in the participants with this disorder will be high since the distortion they have and their wish to be bigger and stronger takes them to the use of these illegal substances.

Method

Participants

The sample was composed by 734 bodybuilders and weightlifters, 562 men and 172 women. The age of the male group was between 16 and 63 years ($M = 29.38$, $SD = 8.45$), while in the women was between 16 and 61 ($M = 32.07$, $SD = 9.04$). The average height in the males was 1.74 m. ($SD = 6.63$), and in the females 1.61 m. ($SD = 5.82$). The average weight of the men was 78.06 kg. ($SD = 10.46$) and of the women 59.58 kg. ($SD = 8.34$). The reported time of weekly weight and cardio training was 8.22 hours ($SD = 3.58$) in men and 6.56 hours ($SD = 4.15$) in women.

Instruments

For detecting muscle dysmorphia. An abridgement of the questionnaires was used and their answers were asses-

Table 1. *Instruments used to detect MD*

Instruments	Variables/factors and coefficient of reliability
Demographic Questionnaire	Sex, Use of supplements and/or hormones, and Sport habits
Escala de Satisfacción Muscular (ESM; González-Martí, Fernández, Contreras, & Mayville, 2012)	Bodybuilding Dependence, Substance Use, Injury, Muscle Dissatisfaction, and Muscle Checking ($a = .90$)
Somatomorphic Matrix (SM; Gruber, Pope, Borowiecki, & Cohane, 1999)	Perceived and desired FFMI, and perceived and desired Body Fat.

Table 2. *Categorization of FFMI according to sex*

Category	Men (Kg/m²)	Women (Kg/m²)	Muscularity level
1	16.5-19.9	11.5-14.9	Slight
2	20-22.9	15-17.9	Noticeable
3	23-24.9	18-19.9	Notable
4	25-25.9	20-20.9	Muscular (likely use of AAS)
5	≥ 26	≥ 21	Very muscular (product of use-abuse of AAS)

sed by a group of experts to categorize an individual with MD. These instruments are compiled in Table 1.

For detecting the use of AAS. A group of direct questions in relation to the use of these substances was used within the demographic questionnaire. Three kinds of answers were possible: never, sometimes and always. Also, the aim of taking them, their function and an open question about the type of hormones taken by the participant. The equation Fat-Free Mass Index (FFMI) was administered. This formula was conceived by Kouri et al. (1995) in order to know the degree of muscularity of a participant and whether this muscularity had been achieved by the intake of steroids. With this aim and following the standardized protocol of the International Society for the Advancement of Kinanthropometry (ISAK), six skinfolds in men and three in women were anthropometrically measured. These measurements along with the participant´s age were applied to the formula conceived by Jackson & Pollock (1978) in order to know the body fat percentage. The resulting data was introduced in the FFMI equation, which is different for each gender. For the female gender it is: [(weight (100-% body fat) /100) height²] and for the male one: [[(weight (100-% body fat) 100) height²] + 6.1 (1.8 – height)]]. The height is represented in meters and the weight in kilograms. To know whether the muscle mass obtained through the FFMI equation was the result of the use of steroids, a categorization was established. It is based on the categories proposed by Kouri et al. (1995), Pope et al. (2000) and Kyle, Schutz, Dupertuis, & Pichard (2003). In Table 2 the FFMI categorization proposed in this research is shown.

Procedure

For the management of the instruments. After initial contacts, the managers of the gymnasiums were addressed to obtain their authorization to carry out this research in their sport centers. After explaining them the objective of the work, some Spanish gyms decided not participate in this study for the reason of AAS detection, finally thirteen gyms took part in the study, in the provinces of Albacete, Murcia, Valencia and Madrid, in Spain. Once the necessary material was located in a room ready for this aim, the participants with an apparently muscular physique were explained the purpose of the research, the anonymity of the results and the voluntary nature of the participation. If they agreed, they had to sign the document of informed consent. The under-age participants had to come with their father/mother or legal tutor, who authorized them to partake in the research by signing both the document of informed consent. This procedure never exceeded twenty-five minutes. The study was approved by the Ethical Committee of the University of Castilla - La Mancha.

For detecting if the participant suffered from MD. In order to find hidden patterns and research which factors influence most on muscle dysmorphia, decision trees trained with M5P and REPTree algorithms was used. Moreover, different explanatory models of MD were created with regression models analyses (González-Martí, 2012; González-Martí, Fernández, & Contreras, 2012; Sokolova, González-Martí, Contreras, & Fernández, 2013) and the best one explaining this disorder was selected as having the highest values of $R = .786$ and $R2 = .62$, which means that the explanatory variables described 62% of the target variable.

Bodybuilding Dependence = − 0.016 Age − 0.027 Desired Body Fat + 0.466 Muscle Checking + 0.281 Substance Use + 0.467 Injury − 0.059 Physical Atractiveness + 0.092 Strength− 0.032 General Physical Self-concept + 3.714.

The attributes of the model were selected with the help of the questionnaire Escala de Satisfacción Muscular (ESM: González-Martí et al., 2012) and their categorizations (González-Martí, Fernández, Hernández-Martínez,

Table 3. *Classification of muscle dysmorphia according to the ESM and SM categorizations*

Instrument	Puntuation	Category	Categorization	MD
ESM (González-Martí et al., 2014)	19-38	1	Muscular Satisfaction	No
	39-57	2	Slight Muscular Dissatisfaction	No
	58-76	3	Moderate Muscular Dissatisfaction	Yes
	77	4	Severe Muscular Dissatisfaction	Yes

Instrument	Discrepancy between current, perceived and ideal	Category	Categorization	DM
SM (Pope et al., 2000)	Body fat of 1-15%	1	Not suffering from any distortion in the body image	No
	Body fat over 15%	2	Distortion in the body image like Anorexia or MD	Yes
	FFMI of 0-2.9 kg/m²	1	No suffering from any distortion in the body image	No
	FFMI ≥ 3 kg/m²	2	Distortion in the body image MD	Yes

& Contreras, 2014) as well as with that of the Somatomorphic Matrix (SM; Gruber et al.; 1999; Pope et al., 2000). These categorizations provide us with the necessary information to know whether a participant suffers from this disorder or not, according to the answers obtained in the questionnaire and the classification models. Table 3 shows the likelihood of suffering from MD in relation to these categorizations.

Thus, it was considered that a participant was affected by the disorder of MD if his/her results were classified in the categories 3 or 4 of ESM (González-Martí, 2012; González-Martí et al., 2014) and in the category 2 of body fat and the category 2 of FFMI of SM (Pope et al., 2000).

Results

Categorization of current FFMI based on the statement of having used AAS.

Thirty-two per cent of the male participants who recognize using AAS occasionally for their muscular development belong to the category 5 of FFMI, that is to say, their muscularity is a consequence of the use of these substances, as well as the 21.4% of the men who use AAS on a regular basis. Nevertheless, 3.1% of the male participants said that they never used illegal substances without prescription and their FFMI reveals the opposite. Regarding females, all the women in this research denied using AAS, whereas according to their FFMI (Kouri et al., 1995), 11% of them are using these substances and 4.7% could be using them, by belonging to the categories 5 and 4 of FFMI, respectively (Kouri et al., 1995; Pope et al., 2000).

One hundred percent of the sample who stated being consuming this kind of hormones did it with the aim of enhancing muscularity. The AAS (Hildebrandt et al., 2011) most used by the males who recognized being ingesting them occasionally or usually were Deca-Durabolin, with 78%, and Dianabol (22%), and by the females they were Androgel (47%), Dianabol (33%) and Deca-Durabolin (20%).

Categorization of FFMI according to gender.

We perform an analysis of frequency to notice the distribution of the participants based on the established categories. In this way we learn that 5.9% of the men owned a muscular physique suspicious of the use of AAS (category 4), while 4.8% of the men had a lean muscle mass higher than 26 Kg/m², a consequence of having used AAS. On the females side, 4.7 % of them were very muscular, with a development very difficult to achieve in a natural way (category 4), and 11% had a high FFMI, consequence of the use of AAS (category 5) (Kouri et al., 1995; Pope et al., 2000).

Detection of the use of AAS in participants affected by muscle dysmorphia.

The detection of MD found in this study, according to the classification of Table 3 based on decisions tree of data mining, is 18.3% (N = 734). Out of the total affected by the disorder (N = 134), 70.1% corresponded to the male group (n = 94), whilst 29.9% represented the females group (n = 40). Regarding the participants suffering from MD and using AAS, this group makes up the 44.4 %, while

Table 4. *Detection of the use of AAS in participants affected by muscle dysmorphia*

FFMI categories	MD	Sex	
		Men	Women
		Frequency (%)	Frequency (%)
1	No	76 (90.5)	11 (100)
	Yes	8 (9.5)	-----
2	No	252 (87.5)	91 (84.3)
	Yes	36 (12.5)	17 (15.7)
3	No	102 (78.5)	16 (61.5)
	Yes	28 (21.5)	10 (38.5)
4	No	23 (69.7)	4 (50)
	Yes	10 (30.3)	4 (50)
5	No	15 (55.6)	10 (52.6)
	Yes	12 (44.4)	9 (47.4)

Note. Men FFMI Categories: 1 = 16.5-19.9 Kg/m²; 2 = 20-22.9 Kg/m²; 3 = 23-24.9 Kg/m²; 4 = 25-25.9 Kg/m²; 5 = ≥ 26 Kg/m²; Women FFMI Categories: 1 = 11.5-14.9 Kg/m²; 2 = 15-17.9 Kg/m²; 3 = 18-19.9 Kg/m²; 4 = 20-20.9 Kg/m²; 5 = ≥ 21Kg/m².

30.3 % of the male participants with MD were suspicious of using the substances, as it is shown in Table 4. Regarding the female group who suffers from MD, we can notice in this Table that the detection of the use of AAS is of 47.4 %, and of 50 % in the female participants whose muscularity is suspicious of the use of these illegal substances.

As shown in Table 5, considering only those athletes who had been classified with DM, in the applied of multivariate analysis of the different variables studied (ESM scales and current FFMI-perceived FFMI scales) we can notice how the categories 4 and 5 of FFMI, that is, the sample whose muscle mass index points out having ingested AAS for the increase of the muscles size, and those who obtain a muscularity suspicious of being the result of the use of AAS are the group most affected by MD in comparison with other endowed with a more discreet FFMI (categories 1, 2, and 3) and obtained significantly higher scores ($p < .05$ - .001) in all of the variable comparison.

Discussion

The objective of this research is to release the detection of the use of AAS by the side of the Spanish sample affected by MD, because there is not any study for establishing this relationship in this cultural context nowadays. With this aim, we separate the results according to gender, since the instrument FFMI used for the detection of the use-abuse of AAS by this indirect method required it. Furthermore, a direct question was made to the participants in relation to the frequent use or hormones or not. The use of these illegal substances starts with the goal of increasing the muscle mass and quality and losing fat, and this fact is in direct relation to the MD disorder (Hildebrandt, Harty, & Langenbucher, 2012; Kanayama, Pope, Cohane, & Hudson, 2003; Kanayama et al., 2006; Kanayama, Hudson, & Pope,

2009; Olivardia, Pope, & Hudson, 2000; Pope et al., 2005). This is why the relation between the use of AAS and MD is bidirectional, in such a way that the use of steroids has been accepted as indicator of muscular development and MD (Kanayama et al., 2006; Murray, Griffiths, Mond, Kean, & Blashill, in press). And the people who suffer from this disorder are increasingly using these drugs (Pope et al. 2005).

The responses to the question made to the participants about their relation with the use of AAS reported over the prevalence of their use, corroborated by the sample in this research, of 21.4% in males. Although this figure could be higher, since the FFMI of 3.1 percent of the partakers shows that they are using AAS despite they do not confirm this fact. In women, none of them declared their use, however the FFMI of 15.7% disclosed that they did. These results can stem from the fact that using steroids in the sport without prescription is an illicit act. For this reason it is difficult to establish the exact prevalence of their consumption because the people who take do it in a clandestine way in secret most of the times without prescription, and getting them in the black market (Coomber et al., 2014; Pope et al., 2000; Van Hout & Kean, 2015).

According to the results found through the FFMI indirect method to know whether a participant uses steroids, the women in this research offer similar data to the men regarding the percentage of the sample with FFMI suspicious of having used AAS (4.7% and 5.9%, respectively), and higher results in the category 5, that is, in the case of having used AAS (11% in women and 4.8% in men).

Consequently, there is a high correlation between the use of anabolic androgenic steroids and the level of muscularity of a person and, also, the disorder of MD. The answers to the open question show, thus, than the participants who stated consuming AAS on a regular basis and

Table 5. *Descriptive results and MANOVA of ESM and current FFMI – perceived FFMI according to the addition of FFMI categories based on the possibility or not AAS use-abuse*

Variables	Σ FFMI categories 1,2,3 (not possibility of AAS use)		Σ FFMI categories 4,5 (possibility of AAS use)			
	(N = 99)		(N = 35)		MANOVA	
	M	SD	M	SD	F	p
Bodybuilding Dependence	11.46	4.43	14.69	6.42	10.64	.001(**)
Muscle Checking	7.95	3.93	10.91	5.54	11.71	.001(**)
Substance Use	6.86	3.70	10.17	5.64	15.43	.000(***)
Injury	6.76	3.03	8.74	3.57	10.07	.002(**)
Muscle Dissatisfaction	10.06	2.68	11.37	2.57	6.28	.013(*)
current FFMI - perceived FFMI	3.01	2.72	7.35	4.17	48.71	.000(***)

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

those who did occasionally had a current FFMI higher than the clean ones.

In this respect, Hildebrandt, Schlundt, Langenbucher, & Chung (2006) in a male sample suffering from MD, got a means of BMI of 27.46 Kg/m², which correspond to 24.5 Kg/m² of FFMI, which showed the use of AAS to get this superior level of lean muscular development. In a similar way, Kanayama et al. (2006) found in a study performed with weightlifters that the distortion in the body image related to MD was directly linked with the ingestion of anabolic androgenic steroids.

In this sense Kanayama et al., (2009) and Cole, Smith, Halford, & Wagstaff (2003) found a strong correlation between the consumers dependent on AAS and the disorder of MD. This correlation is corroborated again by Pope, Kanayama, & Hudson (2012), in whose study the weightlifters with MD also consumed AAS. Pope et al., (2005) stated that the vast majority of participants with MD used steroids to increase their muscle mass (Pope, Kanayama, Ionescu-Pioggia, & Hudson, 2004; Pope et al., 2005), and a high rate of consumption of other drugs was found as well.

In the present study the detection of the use of anabolic androgenic steroids by the part of the sample affected by MD is 44.4% in the men and 47.4% in the women, since it is within category 5 of FFMI. These results can be augmented if we add the participants whose level of FFMI is suspicious of the use of this sort of drugs and of those who are actually consuming them although their FFMI does not reveal it yet.

As we can notice, the detection of the use of steroids in the partakers in this research is slightly higher in the women´s group that in the males one. This fact can mean a discrepancy with the existing literature, where the percentage of men using AAS is larger (González-Martí, 2012). According to these authors three million sport people are the consumers of these substances, being 90% men bodybuilders and 80 percent of the female bodybuilders.

The superior detection of the use of AAS in the female population can be explained by the fact that this study has one of the wider samples of women, in comparison with previous investigations over MD and the use of steroids (González-Martí, Hernández-Martínez, Fernández, & Contreras, 2016). The only comparable results in relation to the prevalence of the use of steroids in female participants are those established by Pope, Gruber, Choi, Olivardia, & Phillips (1997), in which 38% of female bodybuilders used this kind of drugs, results that are inferior to ours. Regarding the male gender, we obtain similar results to the ones of Olivardia et al., (2000), who found that the prevalence of the use of steroids is of 46% of the sample who suffered MD. They are also close to the prevalence established by Pope et al. (1993), in which 51% of the male sample with MD used AAS.

It is necessary to assume that this study presents a limitation regarding the categorization of FFMI, which is the re-sult of the abridgement of the classifications set up by Kouri et al. (1995), Pope et al. (2000) and Kyle et al. (2003).

As a conclusion, and confirming the initial hypothesis, there is a high detection of the use of AAS among Spanish individuals who suffer from MD, reaching even 47% in women and 44% in men, consequently nearly 50% of the participants with this disorder use these drugs. This means that there is a strong correlation between the use of AAS and the disorder of MD. In both genders there is an overwhelming desire to be bigger and stronger, resorting to the use of steroids, in most of the cases even being aware of the fact they are not healthy. It is necessary, therefore, to deep in future works in the treatment of these people, in order to have a better understanding of the disorder and help them in every way we can in the Spanish cultural context.

Aknowledgement

Conflicts of interest

The authors have no conflicts of interest to declare.

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