

Ergogenic substances and drive for muscularity among gym users at different risk levels for muscle dysmorphia

Sustancias ergogénicas y motivación por la musculatura entre usuarios de gimnasio con diferente nivel de riesgo de dismorfia muscular

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SUMMARY

Many studies have investigated the association between ergogenic substance use and symptoms of eating disorders, but not with the muscle dysmorphia risk level. In this research, the practice of exercise, the use of anabolic steroids and nutrition supplements, among gym users at different risk levels for muscle dysmorphia, as well as the reasons for use were analyzed. The association between the use of supplements and steroids and the drive for muscularity was also investigated.

Participated 158 men gym users (age range: 16-58 years), who completed three questionnaires: 1) Substance use, 2) Drive for Muscularity Scale and 3) Muscle Appearance Satisfaction Scale. The results indicated that 12.0 % of the gym users had a high risk of muscle dysmorphia, of these, 52.6 % use steroids and 89.5 % dietary supplements. These substances are consumed mainly for cosmetic and physical appearance reasons. The most commonly used steroids are testosterone, boldenone, stanozolol, trenbolone, and nandrolone decanoate. The most popular supplements consumed are proteins, amino acids, glutamine, creatine and L-carnitine. The use of steroids and supplements is associated positively and significantly with age, BMI, some characteristics of exercise, and attitudes and behaviors inherent in the drive for muscularity. The importance of promoting measures that alert users to the consequences of the use and abuse of these substances, to contribute to risk-reduction of muscle dysmorphia is discussed.

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RESUMEN

Muchos estudios han investigado la relación entre el consumo de sustancias ergogénicas y síntomas de trastornos alimentarios, pero no con el nivel de riesgo de dismorfia muscular. En esta investigación, se analizó la práctica de ejercicio, el uso de esteroides anabólicos y de suplementos alimenticios, entre usuarios de

gimnasio con riesgo alto y riesgo bajo de dismorfia muscular, así como los motivos de uso. También se investigó la relación entre el consumo de suplementos y esteroides con la búsqueda de la musculatura. Participaron 158 hombres (rango de edad: 16-58 años), quienes completaron tres cuestionarios: 1) Uso de sustancias, 2) Escala de Motivación por la Musculatura y 3) Escala de Satisfacción con la Apariencia Muscular. Los resultados indicaron que 12.0 % de los participantes tenían riesgo alto de DM, de estos, 52.6 % consume esteroides y 89.5 % consumen suplementos alimenticios. Estas sustancias son consumidas, principalmente, por razones estéticas y de apariencia física. Los esteroides más consumidos son testosterona, boldenona, estanozolol, trembolona y decanato de nandrolona. Los suplementos de mayor consumo son proteína, aminoácidos, glutamina, creatina y L-carnitina. El uso de esteroides y suplementos correlacionó positiva y significativamente con la edad, el IMC, con algunas características del ejercicio y con actitudes y conductas inherentes a la búsqueda de la musculatura. Se discute la importancia de impulsar medidas que alerten a los usuarios sobre las consecuencias del uso y abuso de estas sustancias, para disminuir el riesgo de dismorfia muscular.

Palabras clave: *Esteroides androgénicos anabolizantes, suplementos alimenticios, levantamiento de pesas, dismorfia muscular.*

INTRODUCTION

Muscle dysmorphia (MD) is a mental disorder characterized by over-concern about one's size and body shape. Despite looking at a hyper muscular body, people with MD perceive themselves as smaller and insufficiently muscular and they want to continue to gain muscle mass (1). MD is more frequent in men (2,3), especially among those who do strength exercise, motivated to modify their physical appearance, the size and/or strength of the muscles (4). In the latest version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the MD is regarded as part of body dysmorphic disorder (5), nevertheless, many researchers have documented the similarities between MD and eating disorders (ED), and more specifically with anorexia nervosa (6-10). As well as in ED, also in MD, perceived social pressure is, directly and indirectly, related to driving for muscularity (DM), this is understood as the over-concern because one's own body is insufficiently muscular. DM is characterized by

an emphasis on the diet (11) and on the practice of exercise to gain muscle mass (12); at the same time, DM predicts MD symptoms (13).

Similar to what happens in ED, people with MD have altered eating behavior (11). This is characterized by the consumption of high amounts of protein and the intake of dietary supplements (DS), energizers, and illicit drugs such as anabolic-androgenic steroids (AAS), growth hormone, and thermogenic (14,15). AAS are variants of testosterone and are produced synthetically. AAS are used mainly by men, but not exclusively, since very early ages (16). Between 9.8 % and 29.3 % of those who practice strength exercise (17-25) have used AAS; and 95 % have combined several of these substances by cycles (26), mainly to achieve the desired cosmetic effects. AAS most commonly used by gym users are testosterone, testosterone decanoate, testosterone enanthate, nandrolone decanoate, boldenone undecylenate, boldenone, Dianabol, and growth hormone (18,20,21,25). On the other hand, DS is made with herbal products, plant extracts, dehydrated foods or fruit concentrates; and is used to increase the total dietary intake, to complement or supplement any component of it (27). Between 49.4 % and 84.7 % of gym users (28,29) consume at least four different DS (30).

The reasons given for the use of AAS and DS are, in the first place, cosmetic and physical appearance, to accelerate protein synthesis and improve athletic performance (19,20,23-24,31). Nevertheless, the use and consumption of DS are recommended by non-medical personnel (31,32): coaches, peers, gym personnel, and vendors. Common substances used include protein, amino acids, vitamins and minerals, meal replacements, L-carnitine, creatine, and sports/energy drinks. These substances are acquired, many times, from laboratories that have little control of them, and they can contaminate them with other substances such as AAS (33), which represents a risk to the health of consumers (31,34).

Due to medical (hepatic, cardiovascular, reproductive, endocrine, and dermatological) and psychiatric complications (increased aggressiveness, mood swings, and hostility), linked to the abuse of harmful substances used to build the muscles (31,34), researchers have

increased their interest in conducting studies related to the frequency of consumption, reasons for consumption, dose, and route of administration of DS and AAS, in different contexts: university students (24), gym users (17-18,20,23,35), bodybuilders (19,21,36) and other sports disciplines (25,37). Also, it has long been known the relationship between AAS use and the cognitive and behavioral characteristics of ED (38). Recently, this behavior has also shown an association with symptoms of MD (36). Likewise, consumption of DS has been linked to the desire to have a lean physical appearance and toned muscles (39). At the same time, MD can influence both the initiation and maintenance of AAS use (40).

Although there are studies that have investigated substance use and its link to MD, these present some areas of opportunity in terms of 1) the measurement of the consumption of AAS and DS, because consumption has been measured from few questions; 2) the construct validity of the instruments used in men because previous studies have used ED instruments, which were designed to measure drive for thinness and not drive for muscularity, a situation that threatens the validity of the results, because body image concern in men differs qualitatively from women's concern; 3) separate evaluation of substance use, since to our knowledge, studies have separately investigated the use of AAS and DS, in relation to MD; finally, 4) the AAS and DS consumed by people at high-risk and low-risk of MD have not been identified. In this sense, this study aimed to investigate the characteristics of exercise practice; the type, quantity, and reasons for use, both of AAS and DS, according to the risk of MD, in a group of men who practice strength exercise in Mexican gyms, which have traditionally been considered high-risk places, for the involvement in the consumption of substances to improve sports performance and the aesthetic and body appearance. Likewise, we investigate the association between the number of AAS and DS consumed with age, body mass index (BMI), the variables related to strength exercise, and the drive for muscularity.

Due to MD is linked to substance use (14,15) and exercise (12), we hypothesized that participants at high risk of DM would exercise more frequently, they would have a higher BMI,

and report higher use of AAS and DS, than participants at low-risk of MD.

METHODS

Participants

The non-probabilistic intentional sample consisted of 158 men gym users, aged 16 to 58 years old ($M= 26.23$, $DE= 8.12$), who practice strength exercise in ten gyms from Mexico State. Most of the participants had high school (52.9 %) or university studies (31.6 %), the rest of the participants had primary (0.7 %), secondary (5.9 %), and postgraduate (2.6 %) studies. Regarding marital status, most of the participants were single (83.8 %), 14.9 % were married or living together and 2.6 % were divorced. Inclusion criteria: 1) attend the gym at least twice a week, for at least six months; 2) do physical exercise, at least two hours a week.

Instruments

Substance Use Questionnaire

Substance Use Questionnaire was developed from those proposed by Moura et al. (41) and Rodríguez et al. (29). The questionnaire comprised 178 items divided into three sections: *sociodemographic data* (age, educational level, marital status, weight, and height); *characteristics of the training* (frequency, hours of training, reasons for exercising, participation in competitions); *consumption and reasons for use of AAS and DS*. The last section included a list of 40 DS (e. g. protein, vitamins, minerals) and 63 AAS (e. g. testosterone, oxandrolone).

Drive for muscularity

DM was measured using two subscales of the Drive for Muscularity Scale (DMS; 42) and five subscales of the Muscle Appearance Satisfaction Scale (MASS; 43). The DMS assesses the degree of concern of the people to increase their muscularity. This scale consists of 15 Likert-type items, with possible responses varying between

1 (always) to 6 (never), higher scores indicate a greater drive for muscularity. The DMS has demonstrated satisfactory internal consistency reliability and convergent validity with the desire for increased muscle mass (42). In this study, we used two subscales: Attitudes to muscularity ($w= 0.88$) and Supplement consumption ($w= 0.75$) from Mexican version (44). The MASS measures the cognitive, behavioral, and affective domains of MD (43). The Mexican version consists of 17 Likert-type items, with possible responses varying between 1 (strongly agree) to 5 (strongly disagree). Three items (1, 4, and 14) are inversely coded, with high scores reflect a tendency towards MD (45). The MASS has demonstrated acceptable internal consistency reliability for full scale ($w= 0.88$) and its subscales: muscle checking ($w= 0.77$), which examines mirror checking and reassurance-seeking behavior to evaluate muscle appearance; substance use ($w=0.81$), assesses the willingness to use substances to gain muscle; bodybuilding dependence ($w= 0.89$), it evaluates excessive strength, exercise activity, and compulsive tendency to work out; muscle dissatisfaction ($w= 0.80$), it refers to individual's dissatisfaction with the own muscle size and shape; injury risk ($w= 0.86$), it assesses the symptoms of overtraining and beliefs related to unsafe, during strength exercise behavior. To identify the level of risk of MD, we used the cut-off point (\geq to 58) proposed for the Spanish-speaking population by González-Martí et al. (36). In this study, the internal consistency of the scale ($w= 0.85$) and its subscales ($w= 0.67$ to 0.85) was adequate.

Procedure

First, the gym managers were contacted and their permission to carry out the investigation was requested. Later, the gym users were contacted individually, they were informed about the aims of this study and they were invited to participate, guaranteeing the confidentiality of their data. All participants gave informed consent and the protocol was approved by the Research Department of the Autonomous University of the State of Mexico. In the case of two adolescents, who had not reached the age of consent, this was given by their parents and the adolescents gave informed assent. Gym users

answered the instruments individually, in gym facilities, during one or two sessions. When the questionnaires were delivered, the researchers checked them to make sure that the instruments were fully answered. Data were collected before the gyms closed their doors to the public, due to the SARS-CoV-2 pandemic, from August 2019 to November 2019. Participation was voluntary, and respondents did not receive any kind of compensation.

Data analysis

Data analysis was performed with the Statistical Package for the Social Sciences (SPSS, version 19 for Windows). Descriptive statistics were used for all variables. Due to the nonparametric nature of the data, discrete variables were compared using the Mann-Whitney-U-test and Chi-square test. The Spearman correlation was used to evaluate the association between the number of AAS and DS consumed with age, BMI, the variables related to strength exercise, and the drive for muscularity.

RESULTS

Prevalence of high risk of MD

Based on the MASS cut-off point of the MASS (\geq to 58) proposed by González-Martí (36), gym users were classified into two groups (high-risk and low-risk of MD). Of the 158 participants examined, 12.0 % ($n = 19$) were at high risk of developing MD. Subsequent analyzes were performed based on this classification.

Sociodemographic and anthropometric characteristics, according to the risk of MD

Gym users in both groups (high-risk and low risk of MD) did not differ in their level of education ($X^2= 0.98$, $P= .96$), marital status ($X^2= 0.95$, $P= .81$), age ($z= 0.23$, $P= .82$) and BMI ($z= 1.72$, $P= .09$). According to the World Health Organization classification (46), of the 19 participants in the high-risk group, 14 (73.7 %) were overweight and five (26.3 %) were normal weight. Contrary to it, more than

a third of the participants in the low-risk of MD group were normal weight ($n= 51, 36.70 \%$), only one participant was underweight (0.72%) and the rest were overweight (62.58%). No statistically significant differences were found in the proportion of BMI categories by the level risk of MD ($X^2 = 1.24(3), P= .74$).

Characteristics of the practice of exercise, according to the risk of MD

U Mann-Whitney test shows that the high-risk MD group obtained significantly higher scores in the training frequency ($z= 2.14, P= .03$) and the number of competitions ($z= 2.45, P= .01$), but not in the number of hours of training per week ($z= 1.65, P= .10$). Likewise, most of the participants in both groups reported feeling uncomfortable when they missed their training (high-risk= 84.2% and low-risk= 67.6%).

AAS use, according to the risk of MD

More than half (52.6%) of the participants at high risk of MD and almost a quarter (23.1%) of those at low risk use AAS. Statistically significant differences were found in the proportion of gym users who use AAS by the level risk of MD ($X^2= 7.04(1), P= .008$). Participants at high-risk of MD use more AAS than those at low risk ($z= 2.12, P= .007$; Table 1). The most commonly used steroids are testosterone, boldenone, stanozolol, trenbolone, and nandrolone decanoate. For each one of the AAS, the percentage of gym users who consume them is higher in the group at high risk of MD (Table 2). With respect to the reasons for consumption, 100% of the participants in the

high-risk group and 31.3% of the low-risk group said that they use AAS to improve aesthetics and physical appearance.

DS use, according to the risk of MD

A high percentage of participants in both groups consumed DS (high-risk= 89.5% and low risk= 66.4%). Statistically significant differences were found in the proportion of gym users who use DS by the level risk of MD ($X^2= 4.03(1), P= .045$). Participants at high-risk of MD use more DS than those at low risk ($z= 2.81, P= .005$; Table 1). The most popular supplements consumed are proteins, amino acids, glutamine, creatine, and L-carnitine. For each one of the DS, the percentage of gym users who consume them is higher in the group at high risk of MD (Table 2). Most of the participants, both at high and low risk for MD, used DS for aesthetic and physical appearance reasons.

Association between the use of AAS and DS with age, BMI, strength exercise and drive for muscularity

As can be seen in Table 3, the use of AAS and DS was positively and significantly associated with age, BMI, hours of training per week, and participation in competitions. The number of DS consumed also correlated with the training frequency. Regarding the drive for muscularity, the number of AAS used correlated positively with the attitude towards the musculature, while the number of DS used correlated with the Injury risk and bodybuilding dependence (Table 3).

Table 1

Descriptive statistics of the number of AAS and DS used, according to the level risk of MD

Level risk of MD	Range	AAS used <i>M</i> (<i>SD</i>)	<i>Md</i>	Range	DS used <i>M</i> (<i>SD</i>)	<i>Md</i>
Hight ($n = 19$)	0-13	2.79 (4.04)	1	0-17	7.0 (4.64)	8
Low ($n = 139$)	0-10	0.99 (2.18)	0	0-21	4.11 (5.17)	2

Notes: MD= muscle dysmorphia; AAS= anabolic androgenic steroids; DS= dietary supplements; *M*= median; *SD*= standard deviation; *Md*= median.

Table 2
Comparison in the use of AAS and DS, according to the level risk of MD

Type of substance		Use	Level risk of MD		χ^2 (<i>df</i> = 1)	<i>P</i>	<i>ES</i> (phi)			
			High	Low						
			%	%						
AAS	Testosterone	Yes	53.3	15.3	11.60	.001	0.32			
		Not	46.7	84.7						
	Boldenone	Yes	40.0	11.2				8.43	.004	0.27
		Not	60.0	88.2						
	Stanozolol	Yes	33.3	8.2				8.10	.004	0.27
		Not	66.7	91.8						
Trenbolone	Yes	26.7	9.2	3.91	.048	0.19				
	Not	73.3	90.8							
Nandrolone decanoate	Yes	26.7	2.0	15.69	.001	0.37				
	Not	73.3	98.0							
DS	Proteins	Yes	80.0	54.1	3.58	.05	0.18			
		Not	20.0	45.9						
	Amino acids	Yes	66.7	32.7				6.45	.01	0.24
		Not	33.3	67.3						
	Glutamine	Yes	66.7	23.5				11.74	.001	0.32
		Not	33.3	76.5						
	Creatine	Yes	66.7	27.6				9.04	.003	0.29
		Not	33.3	72.4						
	L-carnitine	Yes	60.0	26.5				6.82	.009	0.25
		Not	40.0	73.5						

Notes: MD= muscle dysmorphia; AAS= anabolic androgenic steroids; DS= dietary supplements; *df*= degrees of freedom; *ES*= effect size.

Table 3
Association between AAS and DS use with age, BMI, strength exercise, and drive for muscularity

	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	.34****	.36****	.01	.19*	.35****	.26***	-.11	.19*	-.16*	-.22**	.23**	-.04	-.15
2. Body Mass Index		.22**	.16*	.35****	.41****	.34****	.07	.22**	.06	-.06	.35****	.17*	.12
3. Training frequency			.12	.07	.09	.17*	.06	.07	.11	.02	.08	.23**	.18*
4. Hours of training per week				.38****	.43****	.39****	.07	.35****	.02	-.12	.41****	.25***	.13
5. Participation in competitions					.39****	.34****	.04	.23**	-.03	-.04	.34****	.21**	.08
6. Number of AAS used						.46****	.19*	.36****	.05	-.07	.40****	.13	.02
7. Number of DS used							.14	.43***	.13	-.08	.54****	.28****	.27***
8. Attitudes to muscularity								.55****	.45****	.47****	.50****	.36****	.40****
9. Supplement consumption									.20**	.17*	.69****	.27***	.32****
10. Muscle checking										.24**	.36****	.34****	.50****
11. Muscle dissatisfaction											.13	.13	.20*
12. Substance use												.40****	.36****
13. Injury risk													.47****
14. Bodybuilding dependence													

Notes: AAS= anabolic androgenic steroids used; DS= dietary supplements used; * = *P* < .05; ** = *P* < .01; *** = *P* < .001; **** = *P* < .0001.

DISCUSSION

This study aimed to investigate the characteristics of exercise practice; the type, quantity, and reasons for use, both of AAS and DS, according to the risk of MD, in a group of men who practice strength exercise in Mexican gyms. First, we identified that 12 % ($n = 19$) of the participants were at high risk for DM. Results showed that participants at high risk of MD engage in strength exercise more frequently and have participated in more competitions, than participants at low risk of MD.

The prevalence of AAS use was 52.6 % in users at high-risk of MD, this percentage was higher than that identified in previous studies with people who train with weight-lifting; in turn, the percentage of use in participants at low-risk (23.1 %) was similar to that reported in these studies (17-25). Probably, this difference in consumption prevalence is because, in Mexico, no law regulates the prescription and sale of AAS, so those who consume them easily acquire them in the gym (sellers, instructors, and colleagues), online or pharmacies, even without a medical prescription. These findings support the law initiative to reform Article 181 of General Health Law, proposed by the Veracruzana University, regarding the AAS prescription and use (47).

As in the international context (18,20,21,25), the most commonly used AAS are testosterone, boldenone, stanozolol, trenbolone, and nandrolone decanoate. The reasons given by gym users at high-risk of MD were improving aesthetics/physical appearance, which is consistent with other studies that have investigated the reason for consuming AAS in bodybuilders without MD symptoms (38). Although AAS promote the development of physical capacities, it must be recognized that the use of these substances carries serious consequences, in the short, medium, and long term, putting at risk people's health (34,48-50).

Regarding the prevalence of use DS, a high percentage of the participants in this study had consumed at least one DS (high-risk of MD = 89.5 %; low risk of MD = 66.4 %). This percentage is higher than that identified in Mexican gym users (32) and university students (51). Probably, gyms are scenarios that

enhance the DS use and the people are influenced or modeled by others. At an international level, DS use among people who do strength exercise, the percentage of consumption ranges between 54.5 % and 84.7 %. The prevalence of DS use found in this study is slightly higher than that identified in other countries Chile, Spain, United States, and England (28-30,52). Variability in the distribution of use DS may be due to variables such as the characteristics of exercise (e. g. time, type, hours spent) and of the participants (e. g. socioeconomic level, age, participation in competitions) and how collects the information (e. g. application of questionnaires during training, online surveys).

It should be noted that 50 % ($n = 55$) of users DS consume 5 or more of them. Considering that many athletes unknown about adverse effects of DS use (53), it is important to implement strategies to monitor their consumption and warn people that the inappropriate use of these substances can have harmful effects on their health (e. g. liver toxicity, gastrointestinal disorders), especially when these are used in high doses (54). In general, the most popular DS consumed are proteins, amino acids, glutamine, creatine, and L-carnitine. Other studies have also identified proteins as the most frequently DS used in men (e. g., 30).

Similar to the results of research previous (30), in the present study, the main reasons given for DS use were to improve aesthetics and physical appearance, sports performance, and health; however, the National Institutes of Health (55) warns of the scant scientific evidence that supports the DS use to increase physical performance, development and muscle strengthening, etc. Furthermore, the existing literature about DS use has demonstrated several potential medical problems related to consumption. The solution to this problem is to improve the information on the effects and consequences (positive and negative aspects) of its use.

Finally, AAS and DS use were associated with BMI and hours of training per week; in turn, the use of these substances was associated with the drive for muscularity, injury risk, and bodybuilding dependence. Due to the consequences associated with substance use (48-50), as well as those associated with muscle dysmorphia (56), is important to promote strategies that contribute

to the psychological health of gym users.

Some strengths of the present research should be noted. First, this research was focused on characterizing the exercise, the AAS and DS use in gym users, classified into high and low-risk of MD. Second, we used measures designed and intended for use with men. However, a limitation is the low number of people at high risk of MD, which limits the generality of the findings. In this regard, it should be considered that the identification of gym users at high and low-risk of DM was derived from the cut-off point of the MASS proposed by González-Martí et al. (36); however, the Mexican version of this instrument consists of 17 items, while the proposed cut-off point was based on a 19-item version, so future studies should investigate the cut-off point for the Mexican MASS version.

CONCLUSION

Participants at high risk of DM do exercise more frequently and report higher use of AAS and DS, than participants at low risk of MD. It is important to implement strategies to monitor their consumption and warn people that the inappropriate use of these substances can have harmful effects on their health.

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