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Review Article

Muscle dysmorphia and associated psychological features of males in the Middle East: A systematic review

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ABSTRACT

Muscle dysmorphia (MD) is a mental health disorder characterized by a preoccupation with muscularity and is linked to excessive exercise and dieting, and using anabolic steroids. There is a global interest in the study of MD, however, the literature has yet to collect and synthesize the evidence base in the Middle East. The aim of this systematic review was therefore to understand the status of MD and its associated psychological features of males in the Middle East. A systematic search in PubMed, Web of Science, and Scopus was performed on February 4th, 2023 to identify the cross-sectional survey-based studies conducted in the ME using well-established assessments directly related to MD and its associated psychological features in males. The risk of bias was assessed using the Risk of Bias Instrument for Cross-Sectional Surveys of Attitudes and Practices. A total of ten eligible studies were included in this review. These studies were conducted in Turkey ($n = 5$), Iran ($n = 2$), Lebanon ($n = 1$), Kuwait ($n = 1$), and North Cyprus ($n = 1$). Participants in the included studies were mainly bodybuilders ($n = 1958$, 55.4%) and university students ($n = 1510$, 42.7%). Results suggest that disordered eating attitudes, obsession with healthy eating, perfectionism, vulnerable narcissistic disposition, low self-esteem, muscle dissatisfaction, need frustration, and low family income may contribute to or trigger MD symptoms in bodybuilders and male university students in the Middle East. Healthcare professionals should be mindful of the associated psychological correlates in treating MD symptoms in men living in the Middle East.

Registration: The protocol of this systematic review was registered at the Open Science Framework (10.17605/OSF.IO/N58UZ).

1. Introduction

Muscle dysmorphia (MD) is a mental health disorder characterized by a pathological preoccupation with muscularity (Pope et al., 2005; Pope et al., 1997). Drive for muscularity can often be confused with MD, however, while both drive for muscularity and MD involve a preoccupation with muscularity, MD is a serious mental health disorder whereby drive for muscularity is only one, but arguably the most prominent, feature of MD. Two other key features of MD include appearance intolerance and functional impairment (i.e., being high on a drive for muscularity does not constitute MD) (Pope et al., 1997). With the publication of the fifth revision of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) in 2013, MD was classified as a specifier for body dysmorphic disorder under diagnostic criteria 300.7 (F45.22); which was considered a breakthrough year for MD as a recognized disorder (American Psychiatric Association, 2013). Recent systematic

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reviews have shown that symptoms common to the disorder include an obsession with muscle mass, size and leanness, a distorted body image, fixation on body image, anxiety and stress, and excessive exercise and weight training (Martenstyn et al., 2022; Sandgren & Lavallee, 2018). These symptoms are likely to cause significant impairment to the person's daily functioning and can result in serious health consequences if not identified and treated early (American Psychiatric Association, 2013). For example, recent evidence suggests a link between MD, body dysmorphic disorder and synthol abuse (a synthetic substance composed of oil, alcohol and lidocaine which is injected straight into the muscle) (Puiu et al., 2021).

Both men and women experience MD symptoms, yet research reveals that males typically report far higher levels of symptomatology (Lechner et al., 2019) than their female counterparts. Recent empirical research suggests MD symptoms are becoming increasingly prevalent among adolescents (Mitchison et al., 2022) and anecdotal reports suggest practitioners are experiencing a growing number of men with clinically severe symptoms of MD (Griffiths & Murray, 2018). Exact figures for the prevalence of MD are, unfortunately, still to this date difficult to obtain due to methodological issues with existing MD symptomatology measurements which continue to limit our understanding of how many people are affected by MD, or at risk of developing MD (e.g., self-report measures lack validated cut-off scores) (Tod et al., 2016). Moreover, the development of MD is complex and longitudinal research has yet to confirm the causal risk factors for the disorder. Nevertheless, research to date has largely focused on identifying potential risk factors and has succeeded in the identification of several psychological and social associations with MD. For example, most recently it was reported that personality characteristics such as pre-existing perfectionistic attitudes and vulnerable narcissism are associated with elevated levels of MD symptoms (Boulter & Sandgren, 2022; Dryer et al., 2016). Others have reported social media addiction and eating disturbances (Imperatori et al., 2022), parental control, authority, and resentment (Olave et al., 2021; Pace et al., 2019) and other relational victimization such as the father-child object relation (Wooldridge, 2022) to all be associated with MD symptoms. The use and misuse of anabolic androgenic steroids (AAS) is one feature of MD which is now well established in the literature (Harris et al., 2019), however, research has yet to establish whether AAS use is predominantly a trigger (risk) or maintenance (consequence) factor in the development of MD symptoms.

MD could be a concern in the Middle East region due to several inappropriate behaviors related to health, image, and performance enhancement. A recent scoping review reported that the use of AAS has significantly increased in the Middle East in the past decade (Hearne et al., 2020). A cross-sectional study conducted in Yasuj, Iran in 2012, involving 214 athletes, reported that 72.8% of the participants used AAS (Rezaei, 2017). A similar study conducted in another Iranian city, Jahrom, in 2012, involving 299 bodybuilders reported that 51.5% of the individuals use AAS (Sobhanian et al., 2013). Another study conducted in Busher, Iran in 2015, involving 453 male bodybuilders, reported that 51.7% of the participants used AAS (Haerinejad et al., 2016). The main purpose of AAS use was to increase muscle mass as reported by 70.1% of the participants. In Saudi Arabia, a cross-sectional study performed in 2017, involving 541 male gym users reported that 21.3% commonly used AAS (Albaker et al., 2021). Most participants were not aware of the adverse side effects of using AAS and 75.2% of the participants reported that their trainers and friends were the providers of AAS. Similarly, it was reported that 22.7% of 150 Kuwaiti males visiting gyms in Kuwait city use AAS (Allafi et al., 2019). Overall, this surge in AAS use, combined with a lack of knowledge and awareness, is dangerous and likely to be associated with MD symptoms. In addition, the use of dietary and sports supplements in this region is not based on clinical recommendations and is associated with concerns. In Lebanon, for example, a cross-sectional study that included 455 athletes reported that 74% of athletes consumed dietary supplements of which half of them predominately used sports supplements (Sadek et al., 2022). Interestingly, 34% of athletes reported using supplements without a recommendation from specialists, and 69% admitted that they consumed supplements without reading their nutritional facts. It is worth mentioning that the wide variation in culture and social status in the Middle East region can affect these attitudes, thus considering these differences while evaluating the data from this region is important.

MD has primarily been studied in Western populations (Tod et al., 2016) and was for long viewed a 'Western male phenomenon'. However, recently there has been a surge in published MD research from non-Western countries, particularly with male samples from countries in the Middle East. This suggests MD is a growing, global mental health concern (Sandgren & Lavallee, 2022) and a systematic review of the MD research conducted in the Middle East is now warranted to (a) broaden the geographical evidence base and synthesis on MD and (b) increase our understanding of MD symptomatology and associated features in non-Western countries. Therefore, the aim of this systematic review is to critically review and synthesize the empirical studies on MD and associated psychological features conducted with males in the Middle East.

2. Methods

The systematic review was conducted based on the recommendations of The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The protocol of this systematic review was registered at the Open Science Framework (10.17605/OSF.IO/N58UZ).

2.1. Literature search

Three electronic databases (PubMed, Web of Science, and Scopus) were searched for all relevant studies on February 4th, 2023. The search strategy was conducted based on: ("bigorexia" OR "muscle dysmorphia") AND ("Armenia" OR "Azerbaijan" OR "Bahrain" OR "Georgia" OR "Iran" OR "Iraq" OR "Israel" OR "Jordan" OR "Kuwait" OR "Lebanon" OR "Oman" OR "Qatar" OR "Saudi Arabia" OR "KSA" OR "Syria" OR "Turkey" OR "United Arab Emirates" OR "UAE" OR "Yemen" OR "Algeria" OR "Egypt" OR "Libya" OR "Morocco" OR "Sudan" OR "Tunisia" OR "Western Sahara"). A manual search was also conducted in Google Scholar to identify eligible articles. Two reviewers (RZ and AAR) independently screened each article's title, abstract, and full text. A third reviewer (ADL) arbitrated when needed.

2.2. Study selection

The study selection was based on the inclusion criteria comprising (i) cross-sectional survey-based studies, (ii) studies conducted in the Middle East region, (iii) studies that involved male participants, (iv) surveys based on well-established assessment tools, (v) surveys used in the study were directly related to muscle dysmorphia and associated psychological features, and (vi) studies that were peer-reviewed and written in English. Exclusion criteria comprised of (i) non-cross-sectional survey-based studies, (ii) studies not performed in the Middle East region, (iii) studies involving only female participants in the Middle East region, (iv) sole survey validation-based studies, (v) non-English studies, and (iv) book chapters, protocols, comments, editorials, and reviews.

2.3. Data extraction

Two reviewers (RZ and AAR) independently extracted the data. The following information was extracted: country in which the study was conducted, year, number of participants, gender of participants, age of participants, the target group of individuals, assessment methods/tools, and scores.

2.4. Risk of bias assessment

Two reviewers (RZ and AAR) independently assessed the risk of bias for each included study according to the "Risk of Bias Instrument for Cross-Sectional Surveys of Attitudes and Practices" contributed by the CLARITY Group at McMaster University. A third reviewer (ADL) arbitrated when needed. This tool is based on five domains that have the following defined questions:

1 Is the source population representative of the population of interest?
2 Is the response rate adequate?
3 Is there little missing data?
4 Is the survey clinically sensible?
5 Is there any evidence for the reliability and validity of the survey instrument?

The responses were definitely yes (low risk of bias), probably yes, probably no, and definitely no (high risk of bias) according to the tool instructions.

3. Results

3.1. Study selection

The systematic search identified $n = 46$ records by searching the three databases of which $n = 10$ were duplicates. After screening $n = 36$, a total of $n = 18$ records were excluded since they were not original research articles (literature reviews ($n = 10$), letters ($n = 1$), comments ($n = 1$), book chapters ($n = 1$), and protocols ($n = 5$)). The remaining $n = 18$ were retrieved and assessed for eligibility. A total of $n = 10$ were excluded because the studies were not conducted in the Middle East region, and $n = 1$ was excluded because the study was not based on reliable assessment tools. A total of $n = 8$ eligible articles were identified from the systematic search, and $n = 2$ eligible articles were found by a manual search in Google Scholar. Finally, a total of $n = 10$ articles were eligible and included in the qualitative synthesis of the current systematic review. The details of the study selection process are shown in Fig. 1.

3.2. Study characteristics

All the identified eligible studies were conducted in the Middle East. These countries include Turkey ($n = 5$) (Arslan et al., 2022; Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020; Selvi & Bozo, 2020), Iran ($n = 2$) (Angoorani & Halabchi, 2015; Nonahal et al., 2014), Lebanon ($n = 1$) (Merhy et al., 2023), Kuwait ($n = 1$) (Ebrahim et al., 2019), and North Cyprus ($n = 1$) (Harmancı & Okray, 2021). The characteristics and findings of these studies were extracted and presented in Table 1.

The total number of participants in all the studies is $n = 4255$. The participants of all the studies are males, except for one study that included males and females (Arslan et al., 2022). In this study, a total of

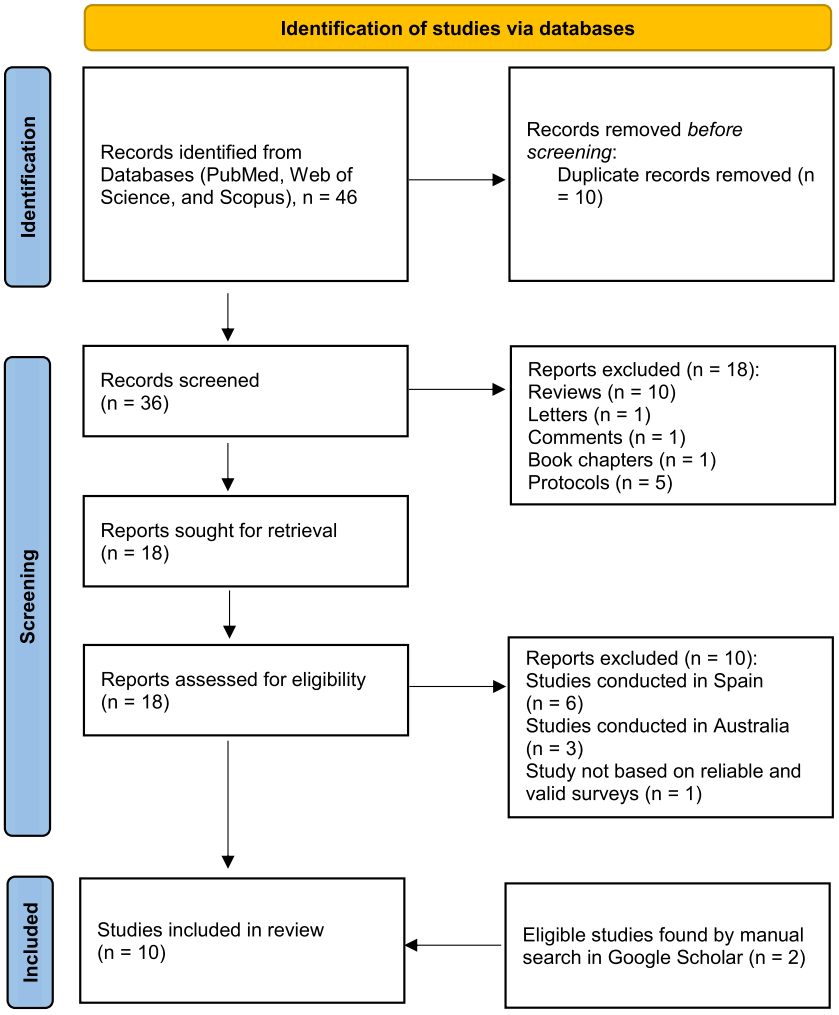


Fig. 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram.

Table 1
Summary of cross-sectional survey-based studies conducted in the Middle East evaluating muscle dysmorphia conditions and associated psychological features.

Study	Country	Year	Number of participants	Gender	Age	Target group	Assessment	Average scores ±standard deviation
Duran and Öz, 2022	Turkey	2020	384	Males	18–27 years: 238 participants (62%) ≥ 28 years: 146 participants (38%)	Bodybuilders	MDDI	**MDDI: 26.46 ± 7.30; 5.7%** Drive for size: 10.53 ± 4.06 Appearance intolerance: 7.09 ± 3.18 Functional impairment: 8.82 ± 3.61
							SPAS	33.07 ± 5.12
Duran et al., 2020	Turkey	2019	430	Males	21.31 ± 2.60 years	University students	MDDI	**MDDI: 26.69 ± 9.07; 11.2%** Drive for size: 10.42 ± 4.47 Appearance intolerance: 7.39 ± 3.54 Functional impairment: 8.87 ± 4.21
							ORTO11	25.31 ± 3.81
							SCS	129.58 ± 20.81
Devrim and Bilgic, 2018	Turkey	Not reported	120	Males	28.25 ± 9.17 years	Bodybuilders (competitive, $n = 62$ and non-competitive, $n = 58$)	MDDI (and EAT-40)	**Bodybuilders with ED** ($n = 81$; EAT-40 score 36.71 ± 6.48) **MDDI: 39.53 ± 4.97** Drive for size: 16.51 ± 4.97 Appearance intolerance: 8.33 ± 3.20 Functional impairment: 14.77 ± 3.12 **Bodybuilders without ED** ($n = 39$; EAT-40 score 17.53 ± 5.81) **MDDI: 28.87 ± 6.01** Drive for size: 12.61 ± 4.21 Appearance intolerance: 6.05 ± 2.58 Functional impairment: 10.20 ± 3.54 All scores of the two groups were significantly different ($p < 0.01$).
							BIG (BIG-O and BIG-S)	**BIG-O** **Body fat mass score** Current: 47.06 ± 22.32 Ideal (desired): 28.96 ± 19.61 The scores of the two groups were significantly different ($p < 0.01$). **Muscle mass score** Current: 54.31 ± 20.09 Ideal (desired): 72.24 ± 14.63 The scores of the two groups were significantly different ($p < 0.01$). **BIG-S** **Body fat percentage** Current: Most participants selected options representing a BFP of 16.5%. Ideal (desired): Most participants selected options representing a BFP of 10%. Most attractive: Most participants selected options representing a BFP of 10%. Most attractive to the opposite sex: Most participants selected options representing a BFP of 16.5%. **Muscle attractiveness** Current: Most participants (35.4%) selected options representing an FFMI of 22.3%. Ideal (desired): Most participants (52.5%) selected options representing an FFMI of 23.6%. Most attractive: Most participants (59.2%) selected options representing an FFMI of 25.6%. Most attractive to the opposite sex: Most participants (64.7%) selected options representing an FFMI of 25.6%.

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Table 1 (*continued*)

Study	Country	Year	Number of participants	Gender	Age	Target group	Assessment	Average scores ±standard deviation
Arslan et al., 2022	Turkey	2021–2022	1006	Males (28.2%) and females (71.8%)	22.58 ± 2.87 years	University students	EAT-40†	**Males** **EAT-40: 155 (41–240)** Obesity anxiety: 16.5 (4–24) Dieting behavior: 28 (7–42) Social pressure: 12 (3–18) Preoccupation for weakness: 12 (3–18) Females EAT-40: 162 (59–240) Obesity anxiety: 16 (4–24) Dieting behavior: 28 (8–42) Social pressure: 12 (3–18) Preoccupation for weakness: 12 (3–18)
							MASS†	**Males** **MASS: 55 (21–88)** Bodybuilding dependence: 14 (5–24) Muscle checking: 11 (4–19) Substance use: 11 (4–20) Injury: 8 (3–15) Muscle dissatisfaction: 10 (3–15) Females MASS: 46.5 (19–90) Bodybuilding dependence: 11 (5–25) Muscle checking: 8 (4–20) Substance use: 8 (4–20) Injury: 7 (3–15) Muscle dissatisfaction: 9 (3–15)
							IPAQ†	**Males: 522.5 (0–10,533)** Females: 502.5 (0–9763.5)
Selvi and Bozo, 2020	Turkey	Not reported	245	Males	22.73 ± 3.86 years	Bodybuilders	BSNSFS	Autonomy frustration: 2.69 ± 0.91 Relatedness frustration: 1.88 ± 0.72 Competence frustration: 2.09 ± 0.81
							DMS	3.43 ± 0.87
							MASS	Bodybuilding dependence: 2.82 ± 0.83 Muscle checking: 2.22 ± 0.83 Substance use: 2.01 ± 0.81 Injury: 3.34 ± 0.94 Muscle dissatisfaction: 2.59 ± 0.80
Nonahal et al., 2014	Iran	Not reported	240	Males	25.25 ± 6.39 years	Bodybuilders	MDDI	29.78 ± 7.41
							MPS	82.16 ± 11.43
							SATAQ-3	83.30 ± 20.02
							DERS	81.44 ± 18.11
Angoorani and Halabchi, 2015	Iran	2011	906	Males	22.58 ± 2.87 years	Bodybuilders	GHQ28	**AAS users** (n = 150, 16.6%) **GHQ (total): 2.54** Physical symptoms: 0.57 Anxiety and insomnia: 0.66 Social dysfunction: 0.59 Depression: 0.63 **AAS non-users** (n = 756, 83.4%) **GHQ (total): 2.31** Physical symptoms: 0.48 Anxiety and insomnia: 0.55 Social dysfunction: 0.75 Depression: 0.52 All scores of the two groups were non-significantly different (p > 0.05).
							MBSRQ-AS	**AAS users** Appearance evaluation: 27.6 Appearance orientation: 41.2 Overweight preoccupation: 7.8 Self-classified weight: 41.0 Body areas satisfaction: 6.1 **AAS non-users** Appearance evaluation: 27.4 Appearance orientation: 41.0 Overweight preoccupation: 7.9

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Table 1 (*continued*)

Study	Country	Year	Number of participants	Gender	Age	Target group	Assessment	Average scores ±standard deviation
								Self-classified weight: 41.4 Body areas satisfaction: 6.0 All scores of the two groups were non-significantly different ($p >$ 0.05). Standard deviation was not reported.
Merhy et al., 2023	Lebanon	2021–2022	396	Males	25.39 ± 4.96 years	University students	MDDI	26.88 ± 7.64, with $n = 26$ (6.6%) of the participants showing MDD (scores ≥ 39)
							DOS	20.31 ± 6.30, with 58 (14.6%) students having possible orthorexia nervosa tendencies, whereas 40 (10.1%) had orthorexia nervosa tendencies
							EAT-26	33.14 ± 23.17, with 254 (64.1%) of the sample showing inappropriate eating attitudes (scores ≥ 20)
							BTPS	Complete data was not reported, only mediation analysis was reported.
Harmancı and Okray, 2021	Northern Cyprus	Not reported	128	Males	Bodybuilders: 26.60 ± 4.40 years Sedentary individuals: 22.71 ± 2.08 years	Bodybuilders ($n =$ 63) and sedentary individuals ($n = 65$)	MDDI	**Bodybuilders** **MDDI: 31.81 ± 9.41** Drive for size: 13.22 ± 4.67 Appearance intolerance: 7.40 ± 3.29 Functional impairment: 11.19 ± 4.58 **Sedentary individuals** **MDDI: 24.02 ± 6.76** Drive for size: 9.62 ± 4.03 Appearance intolerance: 7.37 ± 3.10 Functional impairment: 7.03 ± 3.21 All scores of the two groups were significantly different ($p < 0.05$) except for the appearance intolerance score.
							NPI	**Bodybuilders:** 9.49 ± 2.02 **Sedentary individuals:** 8.66 ± 1.53 The scores were significantly different ($p < 0.05$).
							BIS	**Bodybuilders:** 164.51 ± 24.12 **Sedentary individuals:** 156.20 ± 21.78 The scores were significantly different ($p < 0.05$).
Ebrahim et al., 2019	Kuwait	2015–2016	400	Males	21.9 ± 3.2 years	University students	EAT-26	**EAT-26 (total score): 20.4 ± 14.1** Dieting: 10.99 ± 8.0 Bulimia: 3.85 ± 3.9 Oral control: 5.6 ± 4.28
							BIG	**Body fat satisfaction** Satisfied: $n = 124$ (31%) Desire to increase: $n = 45$ (11.2%) Desire to decrease: $n = 231$ (57.8%) Current body fat levels: 3.5%: $n = 71$ (17.8%) 10%: $n = 77$ (19.3%) 16.5%: $n = 99$ (24.8%) 23%: $n = 95$ (23.8%) 29.5%: $n = 48$ (12.0%) 35%: $n = 9$ (2.3%) Ideal body fat levels: 3.5%: $n = 122$ (30.5%) 10%: $n = 169$ (42.2%) 16.5%: $n = 77$ (19.2%) 23%: $n = 31$ (7.8%) 29.5%: $n = 0$ (0.0%) 35%: $n = 1$ (0.2%) **Muscle mass satisfaction** Satisfied: $n = 131$ (32.8%)

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Table 1 (*continued*)

Study	Country	Year	Number of participants	Gender	Age	Target group	Assessment	Average scores ±standard deviation
								Desire to increase: $n = 230$ (57.5%) Desire to decrease: $n = 39$ (9.8%) Current muscle mass (FFMI) 15.5: $n = 99$ (24.8%) 18.9: $n = 128$ (32.1%) 22: $n = 123$ (30.8%) 25.6: $n = 33$ (8.3%) 29: $n = 16$ (4.0%) Ideal muscle mass (FFMI) 15.5: $n = 27$ (6.8%) 18.9: $n = 43$ (10.8%) 22: $n = 210$ (52.6%) 25.6: $n = 93$ (23.3%) 29: $n = 26$ (6.5%)

Abbreviations: AAS - anabolic-androgenic steroids, BFP - body fat percentage, BIG - Bodybuilder Image Grid, BIG-O – Original Bodybuilder Image Grid, BIG-S – Scaled Bodybuilder Image Grid, BIS - Body Image Scale, BSNSFS - Basic Psychological Needs Satisfaction and Frustration Scale, BTPS - Big Three Perfectionism Scale, DERS - Difficulties in Emotion Regulation Scale, DMS - Drive for Muscularity Scale, DOS - Düsseldorf Orthorexia Scale, ED - eating disorder, EAT-26 - Eating Attitude Scale-26, EAT-40 - Eating Attitude Scale-40, FFMI – Fat-Free Mass Index, GHQ28 - General Health Questionnaire, IPAQ - International Physical Activity Questionnaire, MASS - Muscle Appearance Satisfaction Scale, MBSRQ-AS - Multidimensional Body-Self Relations Questionnaire Appearance Scales, MDDI - Muscle Dysmorphic Disorder Inventory, MPS - Multidimensional Perfectionism Scale, NPI - Narcissistic Personality Inventory, ORTO11 - Orthorexia Nervosa Inventory, SATAQ-3 - The Sociocultural Attitudes Toward Appearance Questionnaire-3, SCS - Self-confidence Scale, and SPAS - Social Physique Anxiety Scale.

† Scores given in terms of the median (minimum-maximum).

$n = 1006$ participants were involved, of which 722 of 1006 participants were females. The study was eligible since the outcomes for males and females were reported separately. Thus, the total of male participants included in the current results of the systematic review is $n = 3533$, from which $n = 1463$ are from Turkey (41.4%), $n = 1146$ are from Iran (32.4%), $n = 396$ are from Lebanon (11.2%), $n = 400$ are from Kuwait (11.3%), and $n = 128$ are from North Cyprus (3.6%).

Majority of the participants in the included studies were identified as bodybuilders ($n = 1958$, 55.4%) and university students ($n = 1510$, 42.7%). The remaining participants were sedentary individuals ($n = 65$; 1.8%). Only one study (Devrim et al., 2018) identified competitive ($n = 62$) and non-competitive ($n = 58$) bodybuilders. The rest of the studies did not consider any classifications for bodybuilders.

In terms of outcomes, the current studies can be classified under five groups based on the focus area: (1) muscle dysmorphia (Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020; Harmancı & Okray, 2021; Merhy et al., 2023; Nonahal et al., 2014), (2) appearance and image (Angoorani & Halabchi, 2015; Arslan et al., 2022; Devrim et al., 2018; Duran & Oz, 2022; Ebrahim et al., 2019; Harmancı & Okray, 2021; Nonahal et al., 2014; Selvi & Bozo, 2020), (3) eating disorders (Arslan et al., 2022; Devrim et al., 2018; Duran et al., 2020; Ebrahim et al., 2019; Merhy et al., 2023), (4) personality characteristics (Duran et al., 2020; Harmancı & Okray, 2021; Merhy et al., 2023; Nonahal et al., 2014; Selvi & Bozo, 2020), and (5) physical health and fitness (Angoorani & Halabchi, 2015; Arslan et al., 2022). MD was assessed based on Muscle Dysmorphic Disorder Inventory (MDDI). Appearance and image-associated psychological features were assessed based on different surveys, they include Social Physique Anxiety Scale (SPAS), Bodybuilder Image Grid (BIG), Original Bodybuilder Image Grid (BIG-O), Scaled Bodybuilder Image Grid (BIG-S), Body Image Scale (BIS), Muscle Appearance Satisfaction Scale (MASS), Drive for Muscularity Scale (DMS), The Sociocultural Attitudes Toward Appearance Questionnaire-3 (SATAQ-3), and the Multidimensional Body-Self Relations Questionnaire Appearance Scales (MBSRQ-AS). Eating disorders (EA) were assessed by the Eating Attitude Scale-26 (EAT-26), Eating Attitude Scale-40 (EAT-40), Orthorexia Nervosa Inventory (ORTO11), and Düsseldorf Orthorexia Scale (DOS). Personal characteristics were assessed by the Self-confidence Scale (SCS), Basic Psychological Needs Satisfaction and Frustration Scale (BSNSFS), Big Three Perfectionism Scale (BTPS), Difficulties in Emotion Regulation Scale (DERS), Multidimensional Perfectionism Scale (MPS), and Narcissistic Personality Inventory (NPI). Physical health and fitness were assessed by the General Health Questionnaire (GHQ28), and International Physical Activity Questionnaire (IPAQ).

3.3. Key findings

3.3.1. Turkey

Five studies identified the mechanism of MD on the associations between disordered eating attitudes, social physique anxiety, frustrated basic needs, body image perception and physical activity in Turkey (Arslan et al., 2022; Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020; Selvi & Bozo, 2020). All studies applied validated scales to determine MD symptoms. Three of the studies determined the MD symptoms using the MDDI form (Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020), whereas the others applied MASS to evaluate MD presence and muscle dissatisfaction (Arslan et al., 2022; Selvi & Bozo, 2020). Studies using the MDDI form have shown a high prevalence of MD symptoms in bodybuilders between 5.7% in recreational bodybuilders (Duran & Oz, 2022), 58.3% in professional bodybuilders (Devrim et al., 2018), and 11.2% in university students (Duran et al., 2020). In good agreement with these findings, research applying the MASS revealed that drive for muscularity positively predicted each facet of MD in male bodybuilders (Selvi & Bozo, 2020), and MD symptoms and bodybuilding dependence were commonly linked to male students (Arslan et al., 2022).

3.3.2. Iran

Two studies were conducted in Iran on male recreational bodybuilders to evaluate muscle-oriented patterns and related psychopathological and sociodemographic conditions (Angoorani & Halabchi, 2015; Nonahal et al., 2014). One of the studies indicated a positive weak relationship between the role of media (determined using SATAQ-3) and MD (determined using MDDI) ($r = 0.26$), and positive moderate interaction between MD and perfectionism (determined using MPS) ($r = 0.308$) and difficulties in emotional regulation ($r = 0.47$) (Nonahal et al., 2014). The regression analysis also showed that the role of media, perfectionism and the difficulties in emotional regulation predict 26.9% of the variance in MD symptoms in male recreational bodybuilders.

3.3.3. Lebanon

Only one study has been conducted in Lebanon evaluating MD and

associated psychological indicators. Investigating the MD symptoms and their interaction with eating attitudes, orthorexia nervosa (ON), and perfectionism in male university students, the study findings revealed that 6.6% of the participants had MD symptoms (determined via MDDI) (Merhy et al., 2023). Rigid perfectionism and self-critical perfectionism were found to be negatively linked to eating attitudes ($r = -0.56$ and -0.47, respectively). In addition, ON was suggested to be a main mediator of all subdivisions of perfectionism, revealing that perfectionism may result in healthy eating attitudes by the fear of imperfection.

3.3.4. Kuwait

In Kuwait, one study was performed to determine the prevalence of disordered eating and body dissatisfaction based on current body composition among male university students (Ebrahim et al., 2019). The findings showed that a higher percentage of participants had disordered eating attitudes (46.2%) determined using EAT-26, and most participants (67.3%) were dissatisfied with their current muscle mass and 57.5% wanted to increase their muscle mass, evaluated using BIG.

3.3.5. North Cyprus

Harmancı and Okray (2021) conducted a cross-sectional study in North Cyprus (Turkish Republic of Northern Cyprus) aiming to evaluate MD symptoms, narcissistic personality traits and body image perception in male recreational bodybuilders compared to sedentary individuals (Harmancı & Okray, 2021). Results showed that a narcissistic tendency was positively associated with functional impairment and narcissistic tendency, MD symptoms, and body dissatisfaction was higher in bodybuilders compared to sedentary individuals.

3.4. Risk of bias assessment

The risk of bias assessment evaluated the representation of the sample population in the studies, the adequacy of the response rate, data availability, clinical sensibility of the survey, and using reliable and valid survey instruments (Table 2).

None of the studies selected their target population from a representative population roster such as a national association database, and thus none of the studies had a definite representative sample. Nevertheless, most studies had a probably representative sample since the selection of participants was random and from a single center/city/region. Only one study was associated with some risk of bias (Nonahal et al., 2014), in which participants were randomly selected from five specific gyms in a single city.

The response rate of all the studies was definitely adequate, due to a high enough response rate that ensured that any differences would be unlikely to affect results. Most of the studies fully reported their findings and results, without any missing data. However, some risk of bias was associated with the study by Arslan et al. (2022) which did not report the mean and standard deviation of outcomes, instead only the median, maximum, and minimum values were reported. The study by Angoorani and Halabchi (2015) did not report the standard deviations associated with the means. In addition, two studies (Merhy et al., 2023; Nonahal et al., 2014) did not fully report the results of MDDI in terms of the subscales assessing Drive for Size, Appearance Intolerance, and Functional Impairment; instead, the overall MDDI score was reported only.

In terms of the clinical sensibility of surveys, four of the ten studies were based on questionnaires which have been formally assessed for their comprehensiveness, clarity, and face validity in a similar population (Angoorani & Halabchi, 2015; Duran & Oz, 2022; Duran et al., 2020; Selvi & Bozo, 2020), while the other studies were assessed in a different population. The reliability and construct validity of most of the studies were well-established in a similar population, with an exception of three studies which were established in a different population (Ebrahim et al., 2019; Harmancı & Okray, 2021; Nonahal et al., 2014).

4. Discussion

The current systematic review explores the potential effects and associated psychological characteristics of MD in individuals living in the Middle East. A total of ten studies met the inclusion/ exclusion criteria. In this section, we critically summarize the current results on MD and associated psychological features based on country, population and the surveys employed to participants.

4.1. Country-based evidence of muscle dysmorphia and associated psychological features

As there are many differences between countries in terms of urbanization, family structure, socioeconomic factors, religious requirements, and sociocultural characteristics (Dryer et al., 2016; Grieve et al., 2009), the underlying factors in triggering the development of MD may also be affected by these determinants. Therefore, we evaluated the current findings on MD based on country. Five of the studies were conducted in Turkey (Arslan et al., 2022; Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020; Selvi & Bozo, 2020), two in Iran (Angoorani & Halabchi, 2015; Nonahal et al., 2014), one in Lebanon (Merhy et al., 2023), one in Kuwait (Ebrahim et al., 2019), and one in North Cyprus (Harmancı & Okray, 2021).

4.1.1. Turkey

Studies conducted in Turkey presented a high rates of MD symptoms in both professional and recreational bodybuilders and university students (58.3, 5.7 and 11.2%, respectively). International Obsessive-Compulsive Disorder Foundation indicates that 0.5% of men may meet MD criteria (Olivardia et al., 2023). However, literature on MD research

Table 2
Results of risk of bias assessment performed according to the "Risk of Bias Instrument for Cross-Sectional Surveys of Attitudes and Practices" contributed by the CLARITY Group at McMaster University.

Study	Is the source population representative of the population of interest?	Is the response rate adequate?	Is there little missing data?	Is the survey clinically sensible?	Is there any evidence for the reliability and validity of the survey instrument?
Duran and Öz, 2022	Probably yes	Definitely yes	Definitely yes	Definitely yes	Definitely yes
Duran et al., 2020	Probably yes	Definitely yes	Definitely yes	Definitely yes	Definitely yes
Devrim et al., 2018	Probably yes	Definitely yes	Definitely yes	Probably yes	Definitely yes
Arslan et al., 2022	Probably yes	Definitely yes	Probably yes	Probably yes	Definitely yes
Selvi and Bozo, 2020	Probably yes	Definitely yes	Definitely yes	Definitely yes	Definitely yes
Nonahal et al., 2014	Probably no	Definitely yes	Probably no	Probably yes	Probably no
Angoorani and Halabchi, 2015	Probably yes	Definitely yes	Probably yes	Definitely yes	Definitely yes
Merhy et al., 2023	Probably yes	Definitely yes	Probably no	Probably yes	Definitely yes
Harmancı and Okray, 2021	Probably yes	Definitely yes	Definitely yes	Probably yes	Probably no
Ebrahim et al., 2019	Probably yes	Definitely yes	Definitely yes	Probably yes	Probably no

reported a higher prevalence of MD symptoms in bodybuilders such as 3.4% in Southern Italy (Cella et al., 2012), 25% in Northern Italy (Longobardi et al., 2017), and 58.6% in South Africa (Hitzeroth et al., 2001). In line with the literature (Cella et al., 2012; Hitzeroth et al., 2001; Longobardi et al., 2017), the current findings indicated a high level of MD symptoms in Turkey. These results reveal that the preoccupation with being more muscular could be a serious psychopathological problem, especially among professional bodybuilders. Researchers and health professionals should work together to develop measures and/or validate clinical cut-off scores on existing measures to detect MD symptoms and the severity of symptoms, as it is well known that MD symptoms can trigger many psychopathological problems (Murray et al., 2019).

In contrast to existing literature (Thomas et al., 2014; Zheng et al., 2021), one study showed a positive but weak correlation between social physique anxiety and MD in male bodybuilders and stated that bodybuilders had low levels of MDDI scores (Duran & Oz, 2022). However, they included bodybuilders who participated in bodybuilding sports for at least one month and one month may not be enough to develop MD symptoms and social physique anxiety related to MD.

Literature on MD provided a stronger relationship between MD and ED psychopathology (Badenes-Ribera et al., 2019; Mitchell et al., 2017), indicating that people with MD symptoms may develop disordered eating attitudes to achieve more muscle mass. Disordered eating attitudes include behaviours such as having more protein in their diets than recommended, constantly thinking about what to eat throughout the day and preferring to eat alone (Devrim et al., 2018). In line with the literature (Badenes-Ribera et al., 2019; Mitchell et al., 2017), one study included in the review indicated that disordered eating attitudes are positively associated with MD symptoms in male bodybuilders ($r = 0.614$, $p < 0.001$) (Devrim et al., 2018). In addition, bodybuilders with ED had higher body image and muscle mass dissatisfaction. An interesting finding showed that bodybuilders with MD symptoms pay more attention to their own opinions, even if their partners don't like their body image (Devrim et al., 2018). This may be related to childhood secure attachment problems and their perspectives on emotional relationships. One study noted a significant interaction between MD and insecure-avoidant attachment style in early childhood (Fabris et al., 2018). It shows that individuals with an insecure-avoidant attachment in childhood also avoid attachment to their partners in adulthood (Fabris et al., 2018; Mohd Hasim et al., 2018).

Studies have mainly been conducted on young adults in Turkey. With the sociocultural changes, migration problems and economic crisis experienced in Turkey in recent years, many young adults cannot find the opportunity to meet their basic psychological needs. This may lead them to preoccupy their body to become more muscular and develop MD and associated psychopathologic problems in the long term.

4.1.2. Iran

Two studies in Iran on male recreational bodybuilders to evaluate muscle-oriented patterns and related psychopathological and sociodemographic conditions (Angoorani & Halabchi, 2015; Nonahal et al., 2014). Studies on MD and media noted that media triggers the desire to be thinner in women and a more muscular body type in men (Calogero et al., 2004; Imperatori et al., 2022). In addition, one study presented a significant link between social media addiction, MD, and EA (Imperatori et al., 2022). The role of media on the ideal body internalization may enhance body image-related concerns and disordered eating attitudes, causing undesirable psychologic consequences in Iran.

Another study investigated the prevalence of anabolic androgenic steroid use and its interaction with psycho-socioeconomic factors and body image perception; however, researchers did not evaluate MD symptoms since there is no validated questionnaire to determine MD symptoms in Iran (Angoorani & Halabchi, 2015). Therefore, further studies are needed to make a reliable prediction about MD and associated determinants in Iran.

Investigating the prevalence of AAS use and its interaction with psycho-socioeconomic factors and body image perception, Angoorani and Halabchi (2015) showed that 16.6% of bodybuilders used AAS, and AAS use in bodybuilders was higher in those with low family income and younger age groups. Researchers explained these results as difficulties in reaching healthy foods may trigger the use of AAS in order to achieve the desired body shape and size, and experienced athletes may not report all supplements administered correctly due to doping/ethical concerns (Angoorani & Halabchi, 2015). Research on MD has highlighted that bodybuilders with MD tend to use more AAS to achieve desired body shape, and muscle dissatisfaction may be a triggering factor in using AAS to achieve the ideal body image (Nogueira et al., 2014; Rohman, 2009). In contrast to these claims, no association was detected between body image perception and AAS use among male recreational bodybuilders in the study (Angoorani & Halabchi, 2015). However, although they included high numbers of participants, they did not add bodybuilding experience as an inclusion criterion. Therefore, it is hard to predict how long participants participated in bodybuilding sports. As we know that MD is a type of condition that worsens along with time and experience (Cafri et al., 2005; Grieve et al., 2009), we could not generalize these results to all male recreational bodybuilders in Iran.

4.1.3. Lebanon

The only study about MD in Lebanese male university students showed that disordered eating attitudes can mediate MD symptoms and body dissatisfaction in rigid individuals and self-perfectionists with a predominant sense of dissatisfaction (Merhy et al., 2023). Along with the findings, although perfectionism may trigger more healthy eating, the preoccupation with the perfect eating model may worsen MD psychopathology. These findings are in accordance with the current literature (Arji et al., 2016; Dryer et al., 2016; Dunkley & Blankstein, 2000; Perkins, 2019), suggesting that perfectionism may be an important contributor to the development of MD symptoms and associated psychological problems including anxiety disorders, and depression. Since MD and related psychological problems may be severe in individuals who are chronically concerned about disapproval and rejection from others and constantly making self-criticism (Dunkley & Blankstein, 2000), experts may primarily focus on the underlying perfectionism problem prior to treating MD symptoms.

4.1.4. Kuwait

The only study on body dissatisfaction and disordered eating in Kuwaiti male university students showed high levels of disordered eating attitudes (46.2%) and body dissatisfaction (67.3%) (Ebrahim et al., 2019). Researchers highlighted that one of the main reasons for body dissatisfaction and disordered eating attitudes is due to the high rates of being overweight (33%) and obese (17.8%) (Ebrahim et al., 2019). Although researchers did not determine MD symptoms, higher rates of disordered eating attitudes, body dissatisfaction, personality characteristics and desiring a more muscular body shape may contribute to the development MD (Boulter & Sandgren, 2022; Devrim et al., 2018; Suffolk et al., 2013). To our knowledge, no study determined the MD symptoms in either clinical or non-clinical samples and no validated questionnaires were present in Kuwait. Therefore, the MDDI is the most widely used measure of MD symptoms (Sandgren & Lavallee, 2018) and this should first be validated in Kuwait. There is a need for future studies in which self-esteem, mental health and body dissatisfaction and MD symptoms are determined together in Kuwaiti individuals.

As the researchers highlight, Kuwaiti young adults may have cultural adjustments compared to Western countries, and collectivism as the prevailing cultural framework in Kuwait can lead to lower self-esteem and mental health problems such as anxiety, depression, and pessimism (Ebrahim et al., 2019). In accordance with this prediction, a meta-analysis on body dysmorphic disorder and self-esteem showed a stronger link between low self-esteem and body dysmorphic disorders (Kuck et al., 2021). this meta-analysis underlined the importance of

treating basic psychological needs in improving self-esteem, as these can trigger co-occurring psychological problems such as severe depression.

4.1.5. North cyprus

The only study on MD symptoms of bodybuilders in North Cyprus presented that a narcissistic tendency was positively associated with functional impairment and narcissistic tendency, MD symptoms, and body dissatisfaction was higher in bodybuilders compared to sedentary individuals. The existing literature on MD and narcissism provided controversial results (Christopher et al., 2018; Collis et al., 2016; Littrell et al., 2020). Some researchers suggested a positive link between MD and narcissistic tendency (Christopher et al., 2018; Littrell et al., 2020), while others showed no correlation (Collis et al., 2016). One study that well illustrates the reason for these controversial results determined the relationship between narcissism and MD by identifying both dimensions of narcissism (vulnerable and grandiose) (Boulter & Sandgren, 2022). Results showed that vulnerable narcissism, reflecting being insecure, and hypersensitive to rejection, was linked to MD, while no association was found between grandiose narcissism and MD. These findings suggest that vulnerable narcissism and MD psychopathology shared the same facets of negative emotionality. Therefore, health professionals should consider vulnerable narcissism as a risk factor for MD symptoms in North Cyprus.

4.2. Population-based evidence of muscle dysmorphia and associated psychological features

Body image and muscle dissatisfaction are quite common in bodybuilders where muscularity plays a very important role and the main goal is to have a more muscular figure (Devrim et al., 2018; Dryer et al., 2016). Previous research evaluating the prevalence of MD revealed that MD has been extremely widespread among bodybuilders compared to other sports (Mitchell et al., 2017). In addition, literature on MD reported that the average age of MD onset is 19–20 years (Rubio-Aparicio et al., 2020). Therefore, consistent with the sample in the previous literature (Babusa & Túry, 2012; Bo et al., 2014; Cella et al., 2012; Fabris et al., 2018; Gorrasi et al., 2020; Longobardi et al., 2017; Mitchell et al., 2017; Santarnecchi & Dettore, 2012), studies on MD have generally been conducted on bodybuilders and college students in the Middle East.

4.2.1. Bodybuilders

Six studies included in the systematic review were conducted on bodybuilders ($n = 1958$) (Angoorani & Halabchi, 2015; Devrim et al., 2018; Duran & Oz, 2022; Harmancı & Okray, 2021; Nonahal et al., 2014; Selvi & Bozo, 2020), and only the male gender was included. Two of four studies determining MD symptoms presented a high level of MD symptoms in bodybuilders, 5.7% in recreational (Duran & Oz, 2022) and 58.3% in professional bodybuilders (Devrim et al., 2018). On the other hand, although other studies did not define the exact percentage of bodybuilders with MD symptoms, they showed the mediator role of media, difficulties in emotion regulation, narcissistic tendency and body dissatisfaction on MD symptoms (Harmancı & Okray, 2021; Nonahal et al., 2014; Selvi & Bozo, 2020), inconsistent with literature (Christopher et al., 2018; Dryer et al., 2016; Grieve, 2007; Littrell et al., 2020). Only one study involved both professional and recreational bodybuilders (Devrim et al., 2018); however, it compared MD symptoms by the presence of an EA rather than comparing them within groups. These findings indicated that MD is an emerging problem common among bodybuilders in the Middle East and is influenced by many psychological and sociocultural factors. In addition, one study determining MD symptoms in accordance with the Basic Psychological Needs showed that MD symptoms may worsen when individuals' basic psychological needs are not met (Selvi & Bozo, 2020). As previously known, the main issue in MD is to diagnose the individual rather than treatment (Leone et al., 2005; Soler et al., 2018). Therefore, health professionals should use the cause/mediation factors found to be associated with MD in bodybuilders in the Middle East.

Only one study determined the potential interaction between EA and MD disorders, indicating that MD disorders were highly associated with disordered eating attitudes in both professional and recreational male bodybuilders ($r = 0.614$, $p = 0.001$) (Devrim et al., 2018). This data is consistent with the literature showing a stronger link between ED and MD psychopathology, indicating that bodybuilders' efforts to become more muscular can cause them to follow restrictive diets and disrupt their eating behavior (Babusa & Túry, 2012; Badenes-Ribera et al., 2019; Dryer et al., 2016; Mitchell et al., 2017). Thus, paying attention to eating attitudes could provide a significant clue in detecting MD symptoms in bodybuilders. In addition, since both ED and MD problems are very difficult to diagnose (Leone et al., 2005; Murray et al., 2019; Soler et al., 2018; Strother et al., 2012), it is recommended that when one is diagnosed, the other should be evaluated at the same time.

Although the potential interaction between AAS use and MDD is commonly discussed in MD literature (Babusa & Túry, 2012; Rohman, 2009), it is not known exactly whether AAS use may trigger MD symptoms or vice versa. One study determining the relationship between AAS use and body image perception found no association between AAS use and body dissatisfaction in bodybuilders in Iran (Angoorani & Halabchi, 2015). However, they did not evaluate MD symptoms. Since AAS use may be a life-threatening factor beyond being unethical, AAS use, MD and body image disorder should be determined together in studies to be conducted in the Middle East. In addition, clinical studies should be conducted to ascertain the exact rate of AAS use, as bodybuilders tend not to mention current AAS use due to doping and ethical concerns.

4.2.2. University students

MD research on university students in the Middle East was mainly focused on MD symptoms and its interaction with EA, in particular, disordered eating attitude and orthorexia, body image disturbance, perfectionism, self-confidence, and body and muscle dissatisfaction (Arslan et al., 2022; Duran et al., 2020; Ebrahim et al., 2019; Merhy et al., 2023). Although they use different scales to evaluate muscle dysmorphic disorder and body image, all articles showed that MD symptoms, muscle dissatisfaction and body image disturbance were common among male university students. The prevalence of MD is found to be higher in university students (6.6 to 11.2%), similar to university students in Argentina (6.9%) (Compte et al., 2015), and Italy (5.9%) (Gorrasi et al., 2020). One reason may be that most young male adults dream of having big arms, broad shoulders, developed chest muscles, and V-shape. In order to achieve this image, they do intense bodybuilding exercises and regulate their nutrition. Although it does not cause a problem in the beginning, it can be triggered by socio-cultural pressure such as the media and environment over time, and this situation can trigger the development of MD and associated psychological problems including anxiety, depression, compulsive behaviours like staring at their muscles on the mirror for hours (Begin et al., 2019; Grossbard et al., 2011; Zheng et al., 2021). Thus, health professionals should be aware of the common mediators observed in individuals with MD and determine potential co-existing psychological problems including self-esteem, perfectionism, and body image perception to provide appropriate treatment.

Only one study included the female gender ($n = 722$) and showed that muscle dissatisfaction, bodybuilding dependence and obesity anxiety are higher in males compared to females, implying that males are more prone to muscle-oriented preoccupation and MD symptoms (Arslan et al., 2022). This is consistent with the literature suggesting that norms are heavily gender-dependent, such as men wishing to have more muscle mass while women idealize a thinner body image (Grossbard et al., 2011). In addition, all studies examined EA symptoms. Results showed either a high level of disordered eating attitudes (46.2 to 64.1%) (Arslan et al., 2022; Ebrahim et al., 2019; Merhy et al., 2023) or participants with health eating obsession presented more MD symptoms

(Duran et al., 2020). Previous research on ON, an EA, and MD revealed contradictory results. Some studies found a meaningful interaction between ON tendency and MD symptoms (Cerea et al., 2018; Gorrasi et al., 2020), while others stated that the relationship between ON and MD in university students was unclear (Bo et al., 2014). Individuals with MD may tend to eat more planned and healthier foods compared to their counterparts, and this may evolve as a preoccupation with healthy eating eventually. In addition, one should be noted that some research presented healthy eating obsession as a potential risk factor for eating disorders (Parra-Fernandez et al., 2018). Studies on orthorexia have also reported that when orthorexia overlaps with perfectionism this may trigger the psychopathology of MD (Merhy et al., 2023). Therefore, it may be helpful for health professionals to determine ON tendency in individuals with MD or ED potential.

Surprisingly, in a cross-sectional study on university students presented a positive weak correlation between MD and physical activity (Arslan et al., 2022). However, this result may not represent real conditions, as they collected the data during the COVID-19 outbreak.

4.3. Survey-based evidence of muscle dysmorphia and associated psychological features

As the literature on MD has gradually increased, several measurement tools were developed to determine MD symptoms, appearance and body image perception (Mitchell et al., 2017). This section discusses the applied measurement tools and related findings in studies conducted in the Middle East.

4.3.1. Muscle dysmorphia

As suggested in the literature (Badenes-Ribera et al., 2019), studies included in the systematic review applied the MDDI (Hildebrandt et al., 2004), and the MASS (Mayville et al. 2002) to detect MD symptoms. Six of the ten studies applied the MDDI (Devrim et al., 2018; Duran & Oz, 2022; Duran et al., 2020; Harmancı & Okray, 2021; Merhy et al., 2023; Nonahal et al., 2014). Of the studies, four of them defined the cut-off value of MDDI and indicated a high level of MD symptoms in both professional and recreational bodybuilders (5.7 and 58.3%) (Devrim et al., 2018; Duran & Oz, 2022), and male university students (6.6 and 11.2%) (Duran et al., 2020; Merhy et al., 2023). Other two studies showed that perfectionism, media, emotional dysregulation in recreational bodybuilders (Nonahal et al., 2014), and body dissatisfaction and functional impairment in recreational bodybuilders may be the main mediators of MD symptoms (Harmancı & Okray, 2021). Studies applying MASS have also revealed the implicit interaction between the drive for muscularity and MD symptoms in recreational bodybuilders (Selvi & Bozo, 2020) and between muscle dissatisfaction and bodybuilding addiction in male university students (Arslan et al., 2022). Only two studies (conducted in Iran and Kuwait) did not include any questionnaires to determine MD symptoms due to the lack of valid measurement tools in their country (Angoorani & Halabchi, 2015; Ebrahim et al., 2019). As most of the studies applied the highly-recommended tools in detecting MD symptomatology (Badenes-Ribera et al., 2019), we can interpret these results as both bodybuilders and male university athletes in the Middle East presented a noticeable level of MD symptoms.

4.3.2. Appearance and image

Research on MD has noted body image perception as one of the main mediators in MD research (Dryer et al., 2016; Hildebrandt et al., 2004; Suffolk et al., 2013), as a possible first step in MD development may be body and muscle dissatisfaction. Therefore, most studies include measurement tools to detect body appearance and image perception to determine its predicted effect on MD symptoms (Hildebrandt et al., 2004; Santarnecchi & Dettore, 2012). The BIG (both original and scaled forms) (Hildebrandt et al., 2004), BIS, DOS (McCreary et al., 2004), SPAS (Hart et al., 1989), MBSRQ (Cash, 1990), and the SATAQ-3 (Thompson et al., 2004) were used to detect body image concerns and satisfaction in studies included in this systematic review. Seven studies including the measurement tools on body appearance and image perception provided conflicted results (Angoorani & Halabchi, 2015; Devrim et al., 2018; Duran & Oz, 2022; Ebrahim et al., 2019; Harmancı & Okray, 2021; Nonahal et al., 2014; Selvi & Bozo, 2020). Four of the seven studies (57.1%) showed high muscle dissatisfaction with the current body and a desire for a more muscular body shape (Devrim et al., 2018; Ebrahim et al., 2019; Harmancı & Okray, 2021; Selvi & Bozo, 2020). In addition, drive for muscularity and body dissatisfaction were found to be positively associated with MD psychopathology (Selvi & Bozo, 2020).

All studies found meaningful interaction between MD and body image perception administered validated measurement tools and two of the studies conducted on bodybuilders set inclusion criteria as doing bodybuilding for at least one year (Devrim et al., 2018; Harmancı & Okray, 2021; Selvi & Bozo, 2020). Other three studies found weak or no correlation between body image dissatisfaction and MD symptoms (Angoorani & Halabchi, 2015; Duran & Oz, 2022; Nonahal et al., 2014). However, one of them included participants doing bodybuilding for at least one month (Duran & Oz, 2022). Therefore, considering the study methodologies, body image dissatisfaction and the desire of being more muscular may trigger MD symptoms in male university students and both professional and recreational bodybuilders living in the Middle East. These findings are consistent with the literature (Begin et al., 2019; Cafri et al., 2005); individuals try to achieve an ideal body image such as being more muscular by exercising more and restricting their diets because they are not satisfied with their current body, thus this goal may trigger MD. It seems that MD and body image disorder have a bidirectional interaction, MD can be triggered when the person is not satisfied with their current body shape, and body image perception may deteriorate further as MD develops. Therefore, determining both MD and body image perception together can help in determining the severity of MD in individuals, which can be decisive when determining the treatment approach.

4.3.3. Eating disorders

As studies suggested EA as a potential mediator for MD symptoms (Badenes-Ribera et al., 2019; Dryer et al., 2016), five studies (one in bodybuilders (Devrim et al., 2018) and four in male university students (Arslan et al., 2022; Duran et al., 2020; Ebrahim et al., 2019; Merhy et al., 2023) administered questionnaires related to eating behaviours. To determine eating attitudes associated MD symptoms, studies used the EAT (both the long (EAT-40) and short form (EAT-26)) (Garner & Garfinkel, 1979), ORTO-11 (Donini et al., 2004) and DOS (Barthels et al., 2015). Four (80%) of the studies showed that disordered eating attitudes or healthy eating obsession may trigger MD psychopathology and body dissatisfaction in both bodybuilders and male university students (Devrim et al., 2018; Duran et al., 2020; Ebrahim et al., 2019; Merhy et al., 2023), in consistent with the studies on MD and ED (Badenes-Ribera et al., 2019; Dryer et al., 2016; Mitchell et al., 2017). A systematic review on bodybuilders showed that bodybuilders consumed a high-protein (1.9–4.3 g/kg/day), low-carb diet (<6 g/day, <30 of total energy) (Spendlove et al., 2015). In addition, studies have indicated that bodybuilders do not pay attention to micronutrient intake when accounting for macronutrients in their diets (Amanda et al., 2018; Ismaeel et al., 2017; Spendlove et al., 2015). Bodybuilders should be informed about the long-term consequences of consuming more protein than recommended to increase muscle hypertrophy, the importance of carbohydrates for recovery after resistance exercises, and the importance of micronutrients for energy metabolism and muscle physiology.

In a meta-analysis on determining ED and MD psychopathology suggested the Eating Disorder Examination Questionnaire (EDE-Q) modified form is the more sensitive measurement tool in determining eating attitudes in studies on MD as the form comprises muscularity-related questions (Badenes-Ribera et al., 2019). In addition, Since the MOET consisted of questions about muscle-oriented disordered eating, it

has been considered a good measurement tool for assessing MD symptoms (Murray et al., 2019). However, none of the studies conducted in the Middle East applied these questionnaires. One reason might be that these tools are not validated in their country. Therefore, since EA are so difficult to diagnose (Strother et al., 2012) and can be extremely problematic in every aspect of well-being, validating more appropriate tools for MD research could be a great addition to future research.

4.3.4. Personal characteristics

The BPNSFS (Chen et al., 2014), MPS (Frost et al., 1990), BTPS (Smith et al., 2016), SCS (Akin, 2007), and NPI (Raskin & Hall, 1979) were the measurements tools in defining personal characteristics in the MD studies. All studies on personal characteristics and MD symptomatology indicated that perfectionism, narcissistic tendency and low self-confidence may be one of the indicators triggering or worsening MD psychopathology (Duran et al., 2020; Harmancı & Okray, 2021; Merhy et al., 2023; Nonahal et al., 2014; Selvi & Bozo, 2020). In addition,Selvi & Bozo, 2020 determined MD psychopathology within the scope of the Basic Psychological Theory in bodybuilders. Researchers presented a new perspective, revealing that MD symptoms may develop or worsen if one's basic psychological needs are not met. It has been emphasized that basic psychological needs such as autonomy, competence, and relatedness are the main predictors of psychological health and well-being. The frustration of any of those needs may have negative consequences on psychopathology that cause body image-related concerns and associated psychopathologic problems. In the study, findings showed that both frustrated relatedness and need frustration had indirect links to all aspects of MD and positively predicted drive for muscularity (Selvi & Bozo, 2020). To be more precise, bodybuilders may develop muscle dissatisfaction due to their inability to achieve their desired goals in life, their inability to decide freely, and their lack of belonging in relationships, which may lead to creating a preoccupation to have more muscle mass to compensate for their frustration needs.

4.3.5. Health and fitness

The GHQ 28 (Goldberg & Hillier, 1979) and IPAQ (Craig et al., 2003) were applied to determine the general health and physical activity levels of participants in the studies. One study on bodybuilders revealed that low family income and younger age may cause more AAS use in recreational bodybuilders (Angoorani & Halabchi, 2015). However, they applied a self-administered questionnaire, therefore, all bodybuilders may not inform about their AAS use frankly. Another study on male university found a weak association between physical activity and MD symptoms ($r = 0.249$, $p < 0.001$) (Arslan et al., 2022). As the data collected during the COVID-19 pandemic, results may not present the actual condition.

4.4. Limitations and future perspectives

While this systematic review provides a detailed insight into the current MD literature and associated psychological features in males in the Middle East, it has several limitations. Studies included in the systematic review applied a variety of measurement tools to evaluate MD and associated factors. Measuring tools, inclusion/exclusion criteria, and sample size varied widely between studies. Therefore, it is quite difficult to compare the studies within themselves due to the differences in the methodology. Half of the studies were conducted in Turkey, which may limit the generalization of the findings. Due to the location, regime, sociocultural and socioeconomic differences, it may not reflect the actual situation in the Middle East. In addition, few studies identified individuals with MD. The cut-off value of 39 was confirmed for bodybuilders living in Turkey (Devrim et al., 2018). However, the researchers who conducted the study in Lebanon did not mention whether this cut-off value was also confirmed in the Arabic version of the MDDI in their previous work on the validation of MDDI in Lebanon (Fekih--Romdhane et al., 2023). Studies on MD have determined the prevalence of MD either based on the criteria used for muscle dysmorphia in the DSM-IV (Cella et al., 2012; Hitzeroth et al., 2001) or using either the cut-off values of the MDDI (Longobardi et al., 2017; Santarnecchi & Dettore, 2012) or DFS scales (Compte et al., 2015) confirmed in their country. Therefore, future studies should clarify the validation of cut-off scores in different samples, particularly in at-risk groups such as bodybuilders and university students, thus MD risk can be accurately assessed. All studies included in the systematic review are cross-sectional studies, which means that we cannot provide causal inferences about MD and associated psychological factors. All studies included non-clinical samples, resulting in non-clinical evidence-based information about MD in the Middle East. Some studies administered non-validated measurement tools, which makes their findings questionable. In addition, some studies interpreted weak correlation (correlation coefficients between 0.2 and 0.4) as a meaningful interaction, thus may lead to misinterpretation of the results of the study.

Future studies should include both clinical and non-clinical samples to enrich the MD literature, compare these groups, and strengthen the clinical utility of MD measurements. All measurement tools must be validated before being applied, and clinical cut-off scores should be developed and evaluated to enable the calculation of more accurate prevalence rates. A large multicentre study conducted in the Middle East to identify MD symptoms and associated psychological factors will make a major contribution to the MD literature. In addition, future studies should identify and recruit individuals who self-identify with MD and clinically diagnosed participants with MD to explore their views and preferences surrounding support, future interventions and treatment approaches, which is identified to be an important area for future MD research (Sandgren & Lavallee, 2022). Another point to consider is that studies should question whether participants have had psychological problems before. As previously mentioned above, since the modified form of EDE-Q is recommended in studies evaluating MD and ED symptoms together, future studies should apply this questionnaire after the validation process. Finally, as it has been found that MD can affect female bodybuilders, further studies should include both genders to investigate any gender-based treatment differences.

5. Conclusions

This is the first systematic review of the psychopathology and associated psychological characteristics of MD in men in the Middle East. The findings presented within this review has broadened the geographical evidence base and synthesis on MD and increased our understanding of MD symptomatology and associated features in non-Western countries. Results revealed that disordered eating attitudes, healthy eating obsession, perfectionism, narcissistic tendency, low self-confidence, muscle dissatisfaction, need frustration and lower family income may be important contributors or triggers to MD symptoms in both bodybuilders and male university students in the Middle East. As MD is hard to diagnose, paying attention to these potential contributors can help clinicians identify people with MD symptoms in the Middle East. It is also worth noting that countries in the Middle East have many differences such as regime, ethnicity, the effect of religion on society and sociocultural factors. Therefore, since the Middle East is a more heterogeneous region compared to the more homogeneous Western countries, this article compiling studies conducted in the Middle East allowed us to understand the perspectives on MD symptoms in these Middle Eastern countries. In addition, validation of recommended measurement tools for MD and ED for all Middle Eastern countries, including MDDI, DFM, MASS, EDE-Q modified, and MOET, is important to accurately identify potential disorders and develop effective treatment strategies for at-risk groups. Moreover, the current studies conducted in this region are very limited and further studies are required to have a clear overview of the MD status in this region.

Both male bodybuilders and university students showed a high level of body dissatisfaction and MD symptoms, and since it is well-known

that it is quite difficult to diagnose MD, close follow-up of these at-risk groups is necessary to make the appropriate diagnosis. Psychologists and psychiatrists play a very important role in the healthcare group that monitors individuals at risk, since individuals with MD symptoms may also have psychological problems, especially eating disorders and deterioration in body image. It is crucial to compensate for the basic psychological needs for individuals' adjustment, integrity, and growth. Therefore, in addition to diagnostic tests related to eating and body image, individuals' psychological aspects such as autonomy, relatedness, competence, self-confidence and narcissism should be also addressed to detect possible psychological problems earlier.

Availability of data and material

All data generated or analysed during this study are included in this article.

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CRediT authorship contribution statement

Asli Devrim-Lanpir: Formal analysis, Writing – original draft, Writing – review & editing. **Reza Zare:** Conceptualization, Methodology, Data curation, Validation, Visualization, Software, Writing – original draft, Writing – review & editing. **Ali Ali Redha:** Data curation, Validation, Writing – original draft, Writing – review & editing, Project administration. **Sebastian S. Sandgren:** Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

All authors declare that they have no conflict of interest relevant to the content of this review.

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