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Development and Validation of a Multidimensional Body Image Model in Iranian Adolescents: The Influence of Physical, Cognitive-Behavioral, and Sociocultural Factors

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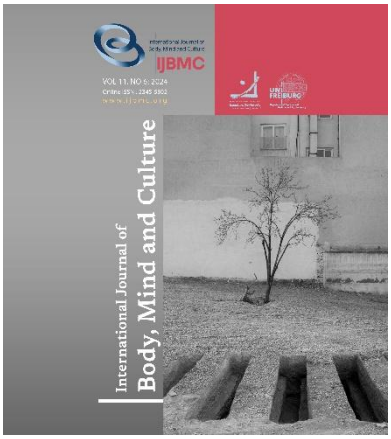

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ABSTRACT

Objective: As adolescence is a sensitive period of development and the onset of hormonal, physical, psychological, and social changes, teenagers face numerous challenges in this period. the present research aimed to develop and validate a body image model in Iranian adolescents.

Methods and Materials: The current study employed a cross-sectional mixed-methods design, with recruiting 1750 students selected through simple random sampling and 13 counselling psychologists selected through purposive sampling for quantitative and qualitative parts of the research respectively. Data collection involved measuring body mass index, using questionnaires, and semi-structured interview. MaxQDA software, structural-interpretive modeling, MicMac software, and Partial Least Squares was used for data and thematic analysis, and Smart PLS software was used for the validation of the model.

Findings: Having analyzed and categorized descriptive codes obtained from interview texts, 3 global themes, 11 organizing themes, and 42 basic themes were identified. The relationships of the variables were then examined and they were partitioned. The results revealed that multidimensional body-self relations is at the 7th level and BMI at the 1st level have the least and the most impact on body image. The intial nodel was designed and the relationsips between the variables were confirmed (95% CI). The model also had a satisfactory model fit.

Conclusion: The findings of this study demonstrate that body image in Iranian adolescents is influenced by the interaction of physical, cognitive-behavioral, and sociocultural factors. The constructed model enhances our understanding of the intricate biological and psychological development of body image in Iranian adolescents.

Keywords: adolescent, cognition, body weight, body mass index.

Introduction

Adolescence is a critical period of development when the onset of hormonal, physical, psychological, and social changes occur simultaneously; this confronts adolescents with numerous challenges (Andrews et al., 2020). Puberty, rapid physical growth, physiological changes, and sexual awareness that occur during this period can significantly affect the identity and body image of adolescents. Body image is a crucial aspect of self-description and self-assessment in adolescence (Bijan & Behzadipour, 2022; Seyed Alitabar & Goli, 2024) and the period when one experiences most challenges with his/her body image (Alikhah et al., 2023; Mehdi Abadi, 2023; Nazarpour & Khazai, 2012; Rizzo et al., 2024). Studies have shown there exists a significant relationship between Body Mass Index (BMI) and body image in 9 to 12-year-old boys and girls (Leppänen et al., 2022). It has also been shown that an increase in BMI, especially in adolescents, may lead to their dissatisfaction with their body image (Abbasi Sarcheshmeh et al., 2016). A study conducted on American women using the Multidimensional Body-Self Relations Questionnaire (MBSRQ) revealed that about 50% of American women negatively assess their appearance or have concerns about being overweight (Mousavi et al., 2016)

On the other hand, the physical changes in puberty may affect adolescents' schema and beliefs about their appearance in a body-centered social context and consequently widen the gap between their adolescents' perception of what they are and what they have to be. Research has shown that sociocultural attitudes toward appearance and self-acceptance are correlated with body image (Spangler, 2002). Spangler & Stice (2001) also state that dysfunctional beliefs about appearance and dissatisfaction with body image are correlated with each other. As such, adolescents who are influenced by these beliefs and dysfunctional attitudes may follow compensatory behaviors such as surgery or non-scientific diets and may develop eating disorders (Spangler, 2002). McLean & Paxton (2019) indicate that body image dissatisfaction is a risk factor for the development of eating disorders and is indicative of psychopathological features of eating disorders (McLean & Paxton, 2019). Furthermore, studies show that beliefs related to eating disorders may increase one's susceptibility to eating disorder symptoms (Palmieri et al., 2021). Nemat, Borjali, & Dortaj (2015) also report that BMI, appearance schemas and beliefs correlate significantly with body image (Nemat et al., 2015).

All of the above-mentioned challenges and concerns which adolescents face in puberty and adolescents' perceptions of their bodies may make them vulnerable **to** anxiety, depression, and stress. This highlights the importance of body image in adolescents and its impact on their mental health. Studies have shown that changes in bodily sensations are associated with the six basic emotions (sadness, anger, surprise, disgust, happiness, and fear) and anxiety (Molaeinezhad et al., 2021). Vannucci & Ohannessian (2018) also show that there exists a positive correlation between body image dissatisfaction and anxiety (Vannucci & Ohannessian, 2018). Song et al. (2023), in a study on 6261 Korean adolescents, demonstrate that the prevalence of depression, suicidal thoughts, and suicide attempts among participants who have perceived obesity were higher compared to those who have a normal body image (Song et al., 2023).

Regarding the bidirectional relationship between body image and mental health, interventions used for improving one's mental health may lead to his/her satisfaction with his/her body image. For example, Abbasi et al. (2016) investigated the effectiveness of acceptance and commitment therapy (ACT) on improving body image in female students with bulimia nervosa (Abbasi Sarcheshmeh et al., 2016). The results of their research show that ACT may lead to a reduction in binge eating and improvement in body image. Similarly, Givehki et al. (2018) demonstarated in their study that using ACT for patients with psychosomatic disorders positively affects body image flexibility and body awareness (Givehki et al., 2018). A study done by Ghassemi, Vahedi, Tabatabaei, & Alivandi-Vaf (2020) also show that the bioenergy economy program significantly affects body self-concept in women with obesity (Ghassemi et al., 2020).

Considering the above and regarding the importance of body image in adolescents' mental health, research in the field of body image models in Iran is not abundant. Therefore, the aim of the present study is to develop and validate a body image model in Iranian adolescents based on three factors of physical, cognitive-behavioral, and sociocultural so that by providing a comprehensive

understanding of how Iranian adolescents perceive their body image, laying the groundwork for further studies in this area.

Methods and Materials

Study Design and Participants

To conduct the present fundamental research, a non-experimental (descriptive) cross-sectional mixed-methods (qualitative-quantitative) design was used. Having had the necessary permissions for the research and been approved by the relevant authorities, the researcher visited schools and initially provided information about the research and its objectives to the participants (students) to obtain their consent to participate in the study. Each participant attended the school healthcare room individually where their height, weight, and hip circumference were measured using a digital scale and a non-stretching measuring tape. Subsequently, questionnaires and scales were completed by the participants. The BMI for participants was calculated by dividing their weights in kilograms by the square of their heights in meters.

For the qualitative data collection, counselling psychologists were interviewed individually. Each interview lasted around 45 minutes to one hour. The data obtained from interviews were recurrently reviewed searching for meanings and patterns and the texts were broken down into meaningful segments in the form of sentences and paragraphs relevant to the main meaning. These meaningful segments were then reviewed multiple times and appropriate codes were assigned to based on their semantic similarity. This process was repeated with the addition of each interview text until the theoretical saturation was achieved. The criterion for reaching the theoretical saturation was recurrence of the extracted codes.

The statistical population in the quantitative section of the research included 13 to 18-year students (both girls and boys) in middle and high schools; including public, private, Shahed, those for gifted students, and those directed by the board of trustees, in Alborz province. The sample size was estimated to be 1750 based on power analysis at 95% confidence level with a coefficient of determination of 35% and a power of test of 0.8. Simple random sampling was used for participant selection. Due to possibility of experimental attrition, 2000 questionnaires were distributed that ultimately resulted in 1821 questionnaires after excluding incomplete and unusable ones. School selection at the provincial level was done by using a multi-stage sampling method.

Given that the sample size in qualitative studies is suggested be between 5 and 25 individuals, the study sample in the qualitative part of the study included 13 counselling psychologists selected through purposive sampling.

Data Collection Tools

Semi-Structured Interview: The data collected for the qualitative part of the study was done using semi-structured interview. This interview included 5 open-ended questions focusing on body image. During the interview process, as expected, new questions were added to encourage the participants to give more explanation.

Body Mass Index (BMI): The Body Mass Index was obtained for each participant by calculating the ratio of weight in kilograms to height in square meters. Weight was measured using a digital scale, and height was measured with a non-stretching measuring tape to an accuracy of 0.5 centimeters.

Multidimensional Body-Self Relations Questionnaire (MBSRQ): This 46-item self-report questionnaire was designed by Cash et al. (1986) to assess body image. The questionnaire consists of six subscales including appearance evaluation, appearance orientation, fitness evaluation, fitness orientation, overweight preoccupation, and self-classified weight. Participants respond to each item on a five-point Likert scale ranging from 1 (definitely disagree) to 5 (definitely agree). Items 7, 11, 12, 15, 17, 21, 22, 23, 26, 28, 29, 31, and 32 are reverse scored (Cash et al., 1986). Cash (1997), having examined questionnaire validity through factor analysis, reports the internal consistency of the subscales to be ranging from 0.79 to 0.94, and questionnaire reliability to be 0.81 using Cronbach's alpha (Cash et al., 2004). In Iran, Rahmati (2008) reported a correlation of 0.55 ($p \leq 0.001$) between body image and self-esteem and Cronbach's alpha values of 0.88, 0.67, 0.79, 0.57, 0.57, 0.83, 0.83, and 0.84 for the mentioned subscales. Having used concurrent criterion validity, Payandeh and Nemat Tavousi (2021) compared this questionnaire with the Multidimensional Self-

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Esteem Inventory and reported correlation coefficient of 0.522 which is the indicator of a good validity for MBSRQ. In the present research, the reliability of the instrument was obtained 0.83 using Cronbach's alpha.

Body Dysmorphic Metacognitive Questionnaire (BDMCQ): This 31-item questionnaire was designed by Rabiei et al. (2011) to measure four factors: Metacognition control strategies, thought-action fusion, positive and negative metacognitive beliefs about appearance, and safety-seeking behaviors (Rabiei et al., 2011). Participants respond to thoughts and perceptions about their appearance over the past two weeks on a five-point Likert scale from 1 (completely disagree) to 5 (completely agree). In a study, the concurrent validity of this questionnaire with the Modified Yale-Brown Obsessive-Compulsive Scale for Body Dysmorphic Disorder has been reported to be 0.74 ($p \leq 0.001$) and diagnostic validity in distinguishing respondents with body dysmorphic disorder with those without body dysmorphic disorder has been reported to be 0.74. The reliability of the questionnaire, assessed through Cronbach's alpha, ranges from 0.70 to 0.94, which is the indicator of a good reliability (Rabiei et al., 2011). In the current study, the reliability of the tool was calculated to be 0.71 using Cronbach's alpha.

Body Image Concern Inventory (BICI): This questionnaire, developed by (Littleton et al., 2005), consists of 19 items. Each item has five options scored from never (1) to always (5). It assesses two factors: Body dissatisfaction, checking and camouflaging behavior (factor 1), and interference due to symptoms - such as discomfort with and avoidance of social activities (factor 2). Littleton et al. (2005) reported Cronbach's alpha coefficients of 0.93, 0.92, and 0.76 for the overall questionnaire, factor 1, and factor 2 respectively (Littleton et al., 2005). The reliability of the tool in Iran has been reported to be 0.72 (Basak Nejad & Ghafari, 2007)) and 0.84 (Mohammadi & Sajadinezhad, 2007). In the current study, the reliability of the tool was 0.73 using Cronbach's alpha.

Sociocultural Attitudes toward Appearance Questionnaire Scale-3 (SATAQ-3): This questionnaire was designed by Heinberg et al. (1995). In its third edition, it consists of 30 questions and four factors. The first factor, internalization-general, relates to media influence. The second factor, which reflects internalization of sports and athletic figures, is internalization-athlete. The third one - called pressures - reflects media pressures and the factor named information sees media as an informational source (Heinberg et al., 1995). The scoring is based on a Likert scale from 1 to 5 (strongly disagree to strongly agree). Questions 3, 6, 9, 12, 13, 19, 27, and 28 are reverse-scored. Researchers, in various countries, have reported adequate validity and reliability for this questionnaire (Sánchez-Carracedo et al., 2012). A study reported a validity of 0.77 and 0.55 for internal consistency through split-half reliability for the Persian version (Mohammadpanah Ardakan & Yousefi, 2011). Dehghani et al. (2013) obtained a content validity of 0.80 in their research for the questionnaire (Dehghani et al., 2013). The reliability of the instrument in the current study was 0.73 using Cronbach's alpha.

The Physical Self-Description Questionnaire (PSDQ): The PSDQ was designed to measure individual's physical self-concept. The original form of this questionnaire consists of 70 questions, developed by Marsh (1996), and later, a shorter and newer form with 47 questions was designed. The questionnaire measures 9 specific factors including activity, appearance, body fat, coordination, endurance, flexibility, health, sport, strength, and two global scales – global physical and global esteem (Marsh, 1996). Respondents answer each question on a 6-point Likert scale from 1 to 6 ranging from false to true respectively. In terms of reliability, Marsh et al., (2002), in a study in which 156 athletes completed the short version of the questionnaire, estimated its Cronbach's alpha to be 0.80 (Marsh et al., 2002). In Iran, Bahram & Shafizadeh (2004) normalized the questionnaires in a study on athletes and reported its reliability to be 0.88 . The reliability of the instrument in the current study was also obtained as 0.87 using Cronbach's alpha.

Appearance Schema Inventory-Revised (ASI-R): This questionnaire, revised by Cash et al. (2004), consists of 14 questions assessing image investment in relation to certain assumption and beliefs of one about the importance and concept of appearance and its impact on his/her life. It has two factors: Self-evaluative salience and motivational salience. ASI-R focuses on the items which reflect individuals' beliefs about the importance and cognitive effects of appearance on life. Higher scores indicate a greater belief in the centrality of appearance in self-evaluation and greater vulnerability to messages

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related to attractive-unattractive appearance. Cash et al. (2004) examined the internal consistency of this tool in a study on 171 male and female students and report it to be 0.82 and 0.79 respectively (Cash et al., 2004). In Iran, Asadi et al. (2013) conducted a study on 54 students and obtained reliability coefficients of 0.75, 0.82, and 0.78 for Cronbach's alpha, representation, and split-half reliability respectively (Asadi et al., 2013). The reliability of the tool in the current study was also calculated as 0.75 using Cronbach's alpha.

Body Image Acceptance and Action Questionnaire (BI-AAQ): This questionnaire, designed by Sandoz et al., (2013), consists of 46 questions rated on a 7-point Likert scale (from 1 to 7 anchoring from never true and always true respectively). It assesses one's body image flexibility. Sandoz et al., (2013) reported test-retest reliability of 0.80 on the first administration, 0.68 on the second administration, and Cronbach's alpha of 0.93. The construct validity of the questionnaire was also confirmed (Sandoz et al., 2013). In Iran, Izadi et al. (2013) normalized this questionnaire in a study conducted on 354 students and reported reliabilities of 0.54, 0.33, 0.45, and 0.37 for satisfaction with weight, psychological flexibility, stress, and depression respectively (Izaadi et al., 2013). The reliability of the tool in the current study was obtained as 1 using Cronbach's alpha.

Depression Anxiety Stress Scales (DASS-21): Introduced by Lovibond and Lovibond (1995), this scale consists of 21 questions and three subscales: Depression, anxiety, and stress. Scores range from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time) for each question. Since there are both 42-item and 21-item forms, scores from the 21-item form are multiplied by two (Lovibond & Lovibond, 1995). The scale is widely used in English-speaking populations, and its validity and reliability have been confirmed (Crawford & Henry, 2003). In Iran, Ghafari et al. (2008) used a test-retest method to determine the reliability of the depression, anxiety, and stress scale, obtaining scores of 0.97, 0.71, and 0.74, respectively. The reliability of the tool in the current study was also calculated as 0.76 using Cronbach's alpha (Ghafari et al., 2008).

Beliefs about Appearance Scale (BAAS): Developed by Spangler & Stice (2001), this scale is a self-report instrument with 20 questions which measures dysfunctional attitudes about appearance and shows how appearance determines self-worth, self-view, feeling state, and success in achievements and interpersonal domains. The scale is scored on a 100-point Likert scale from 0 (definitely does not apply) to 100 (definitely applies). (Spangler & Stice, 2001) reported reliabilities of 0.96 to 0.94 for each factor using three independent samples. In Iran, the reliability of this scale was reported as acceptable in two samples of students (Talepasand et al., 2011) and clients attending beauty clinics (Mohammadpanah Ardakan & Yousefi, 2011). In the current study, the reliability of the tool was calculated as 0.82 using Cronbach's alpha.

Eating Disorder Beliefs Questionnaire (EDBQ): This questionnaire, designed by (Cooper et al., 1997), is a self-report measure developed to assess one's core beliefs about eating disorders. It includes four dimensions of negative self-beliefs, weight and shape as a means to acceptance by others, weight and shape as a means to self-acceptance, and control over eating. Each question is scored on a 100-point scale from 0 to 100 anchored from I do not usually believe this at all and I am usually completely convinced that this is true respectively. Rose et al. (2006) reported internal consistency of the questionnaire to be between 0.47 and 0.71 and reliability using Cronbach's alpha to range from 0.86 and 0.94 for each factor (Rose et al., 2006). In Iran, Vafaee & Rasolzadeh Tabatabaye (2010), using the split-half reliability, reported reliabilities of 0.72 for the total test and 0.91 and 0.94 for the first and second halves (Vafae & Rasolzadeh Tabatabaye, 2010). The reliability of the tool in the current study was calculated as 0.75 using Cronbach's alpha.

Data analysis

In the qualitative section of the research, thematic analysis and the MaxQDA software were used for data analysis; and structural-interpretive modeling and the MicMac software were used to determine the pattern of relationships between variables and develop the initial model. Quantitative analysis for model validation was performed using Partial Least Squares and the Smart PLS software.

Findings and Results

In the qualitative section, 13 experienced counselling psychologists (8 females and 5 males) working at schools were interviewed; five of them were 35-45 years old and

8 of them were above 45 years. In terms of education, 5 of the counsellors held master's degree, and the rest held doctorate degree. Finally, 7 had 10 to 20 years and 6 had over 20 years of experience. The quantitative section included 1821 students (41% male and 59% female) from middle and high school, aged from 13 to 18.

Identification of Underlying Factors of the Iranian Adolescents' Body Image Model

In the first step, thematic analysis was used to identify the factors underlying the Iranian adolescents' body image model. Since the aim was to construct a native model, counselling psychologists' perspectives were gathered through semi-structured interviews, using a protocol of 5 open-ended questions. As it was expected, additional questions were added during the interviews due to the new themes emergence. The collected data was recurrently read and examined actively in search of meanings and patterns.

To assess the reliability of the interview results, the Holsti was employed; the percentage of agreement was reported as 0.719 which is acceptable.

Content analysis using the Attride-Stirling method (2001) involved identifying global, organizing, and basic themes. Using thematic analysis, the interview texts were reduced by dissecting the text into meaningful segments in the form of sentences and paragraphs related to the main topic. These meaningful segments were reviewed multiple times and appropriate codes were assigned to each segment based on the semantic similarity. The coding process was repeated with the addition of each interview, and interviews continued until the theoretical saturation was reached. The criterion for achieving the theoretical saturation was the repetition of the codes extracted. The interview texts were entered into the MAXQDA software, and a total of 521 codes were identified. Finally, through axial coding, 3 global themes, 11 organizing themes, and 42 basic themes were extracted; the results of which are presented in Table 1.

Table 1

Extracted themes of Iranian adolescents' body image model

Global themes	Organizing themes	Basic themes
Physical	Body mass index (BMI)	Height
		Weight
		Hip-circumference
	Physical self-description	Sport competence
		Body fat
		Appearance
		Flexibility
		Health
		Physical activity
		Coordination
		Esteem
	The multidimensional body–self relations (MBSR)	Appearance evaluation
		Appearance orientation
		Fitness Evaluation
		Fitness orientation
		Self-classified weight
		Body satisfaction
Cognitive Behavioral	Body image-acceptance and action (BI-AA)	Body image-acceptance and action
	Beliefs about appearance (BAA)	Interpersonal Relationships
		Success in achievements
		Self-concept
		Emotions
	Body dysmorphic metacognition (BDM)	Metacognition control strategies
		Thought-action fusion
		Positive and negative meta cognitive beliefs
		Safety-seeking behaviors
	Depression anxiety stress (DASS)	Depression
		Anxiety
		Stress
	Appearance schema (AS)	Body image vulnerability
		Self-investment

		Appearance stereotyping
	Eating disorder belief (EDB)	Negative self-beliefs
		Weight and shape as a means to acceptance by others
		Weight and shape as a means to self-acceptance
		Control over eating
Sociocultural	Sociocultural attitude toward appearance (SATA)	Internalization-general
		Internalization-athlete
		Information
		Pressures
	Body image concern (BIC)	Body dissatisfaction
		Avoidance of social activities

Developing the initial model of Iranian adolescents' body image

In the second step, structural interpretive modelling was applied. A Structural Self-Interaction Matrix (SSIM) was employed to develop the initial Iranian adolescents' body-image model. The relationships between the global themes are indicated by four symbols: V (variable i affects j), A (variable j affects i), X (mutual influence), and O (unrelated) (Azar et al., 2018). Transforming the structural interaction matrix into a binary matrix of zeros and ones builds the Reachability Matrix (RM). In the reachability matrix, the main diagonal elements are all one. Moreover, to ensure consistency, secondary relationships need to be controlled. This means that if A leads to B and B leads to C, then A have to lead to C. In other words, if, based on secondary relationships, direct effects are considered, but in practice, this does not happen, the table needs to be revised and the secondary relationships should be taken into account. After building the reachability matrix to determine the relationships and partitioning the Iranian adolescents' body image model, the "reachable set" and "antecedent set" need to be identified. For the variable C_i, the reachable set (outputs or affecting) includes variables that can be reached through the variable C_i. The antecedent set (inputs or affected) also consists of variables through which the variable C_i can be reached. The reachable and antecedent sets and their intersection are presented in Table 2.

Table 2

Reachable and antecedent sets for Iranian adolescents' body image model

intersection	antecedent set	reachable set	factors
C01	C01,C02,C04,C05,C06,C07,C08,C10,C11	C01,C03	C01
C02	C02,C04,C05,C06,C07,C08,C10,C11	C01,C02,C03,C09	C02
C03	C01,C02,C03,C04,C05,C06,C07,C08,C09,C10,C11	C03	C03
C04	C04,C05,C10,C11	C01,C02,C03,C04,C06,C07,C08,C09	C04
C05,C10	C05,C10,C11	C01,C02,C03,C04,C05,C06,C07,C08,C09,C10	C05
C06	C04,C05,C06,C10,C11	C01,C02,C03,C06,C09	C06
C07	C04,C05,C07,C10,C11	C01,C02,C03,C07,C09	C07
C08	C04,C05,C08,C10,C11	C01,C02,C03,C08,C09	C08
C09	C02,C04,C05,C06,C07,C08,C09,C10,C11	C03,C09	C09
C05,C10	C05,C10,C11	C01,C02,C03,C04,C05,C06,C07,C08,C09,C10	C10
C11	C11	C01,C02,C03,C04,C05,C06,C07,C08,C09,C10,C11	C11

Based on the results of Table 2, the multidimensional body–self relations (C03) is at the first level. Physical self-description (C01) and appearance schema (C09) are at the second level. Body dysmorphic metacognition (C02) is at the third level. Eating disorder beliefs (C06), body image-acceptance and action (C07), and depression anxiety stress (C08) are at the fourth level. Body image concern (C04) is at the fifth level. Sociocultural attitudes toward appearance (C10) and beliefs about appearance (C05) are at the sixth level. Finally, Body mass index variable (C11) is at the seventh level and the basic element of the model. The power of influence-dependency of the studied variables is presented in Table 3.

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Table 3

Power of penetration and degree of dependence of Iranian adolescents' body image model

Research variables	Degree of dependence	Power of penetration	level
Physical self-description (C01)	9	2	2
Body dysmorphic metacognition (C02)	8	4	3
Multidimensional body-self relations (C03)	11	1	1
Body image concern (C04)	4	8	5
Beliefs about appearance scale (C05)	3	10	6
Eating disorder beliefs (C06)	5	5	4
Body image-acceptance and action (C07)	5	5	4
Depression anxiety stress (C08)	5	5	4
Appearance schema (C09)	9	2	2
Sociocultural attitudes toward appearance (C10)	9	2	2
Body mass index (C11)	8	4	3

Having determined the relationships and levels of the mentioned indices, they were developed in the form of a model. For this purpose, the indices were arranged according to their level in order from top to bottom resulted in the initial model of Iranian adolescents' body image shown in Figure 1.

Figure 1

Iranian adolescents' body image model

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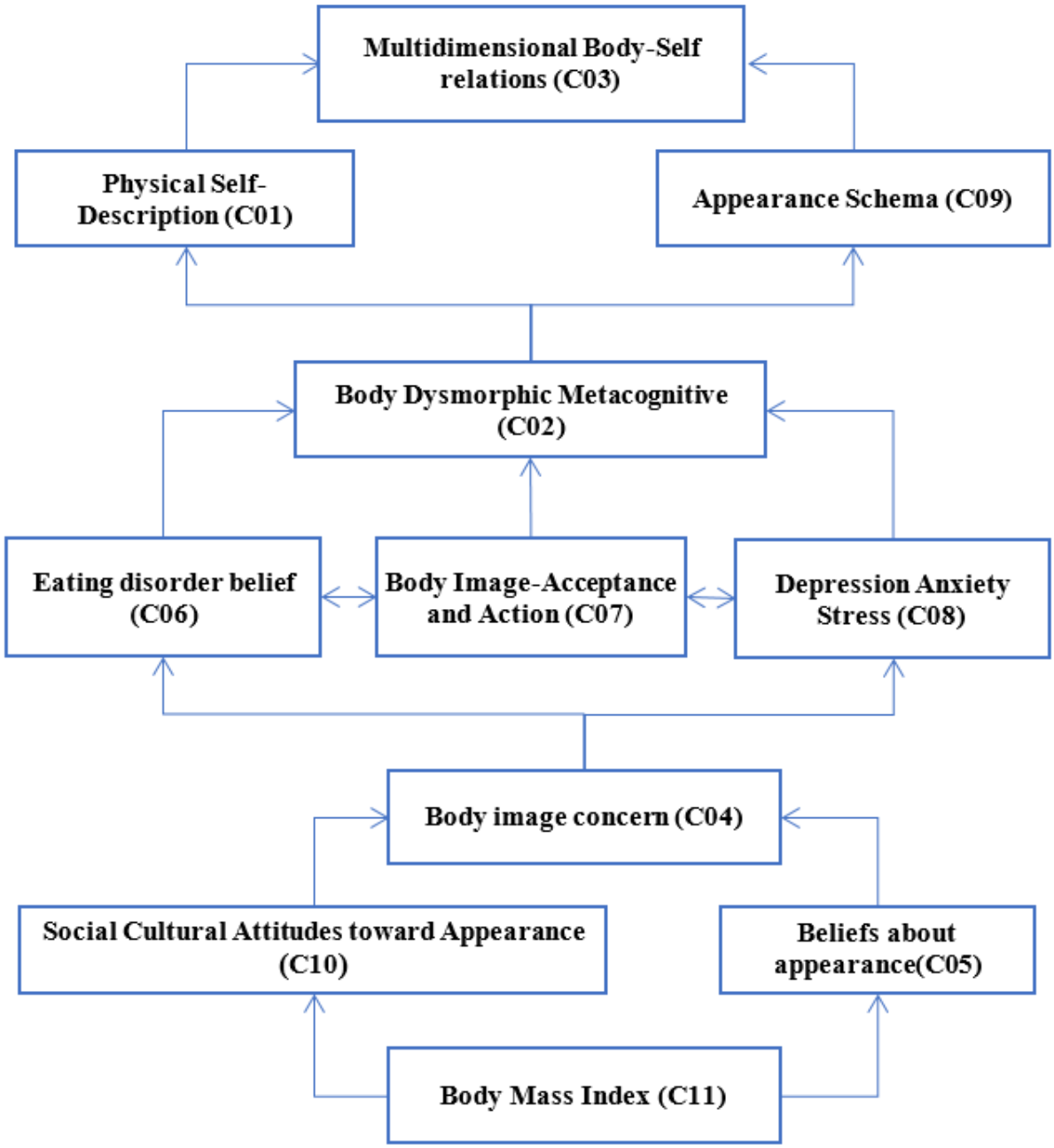

Based on the initial model depicted in Figure 1, it is evident that the body mass index has the most significant impact on the body image of Iranian adolescents. In the same order, the level of influence decreases in the subsequent levels, and variables at the same level interact with each other. Body mass index affects beliefs about appearance and sociocultural attitudes towards appearance and leads to body image concern. Body image concern, in turn, results in depression anxiety stress, adversely affecting body image acceptance and action and eating disorder beliefs. These factors, in turn, influence the body dysmorphic metacognition. At last, appearance schema and physical self-description interact to develop multidimensional body-self relations.

Validation of the Iranian Adolescents' body image model

For validating the model, the Partial Least Squares Regression (PLS) method was employed using the Smart PLS software, the results of which are presented in Figure 2.

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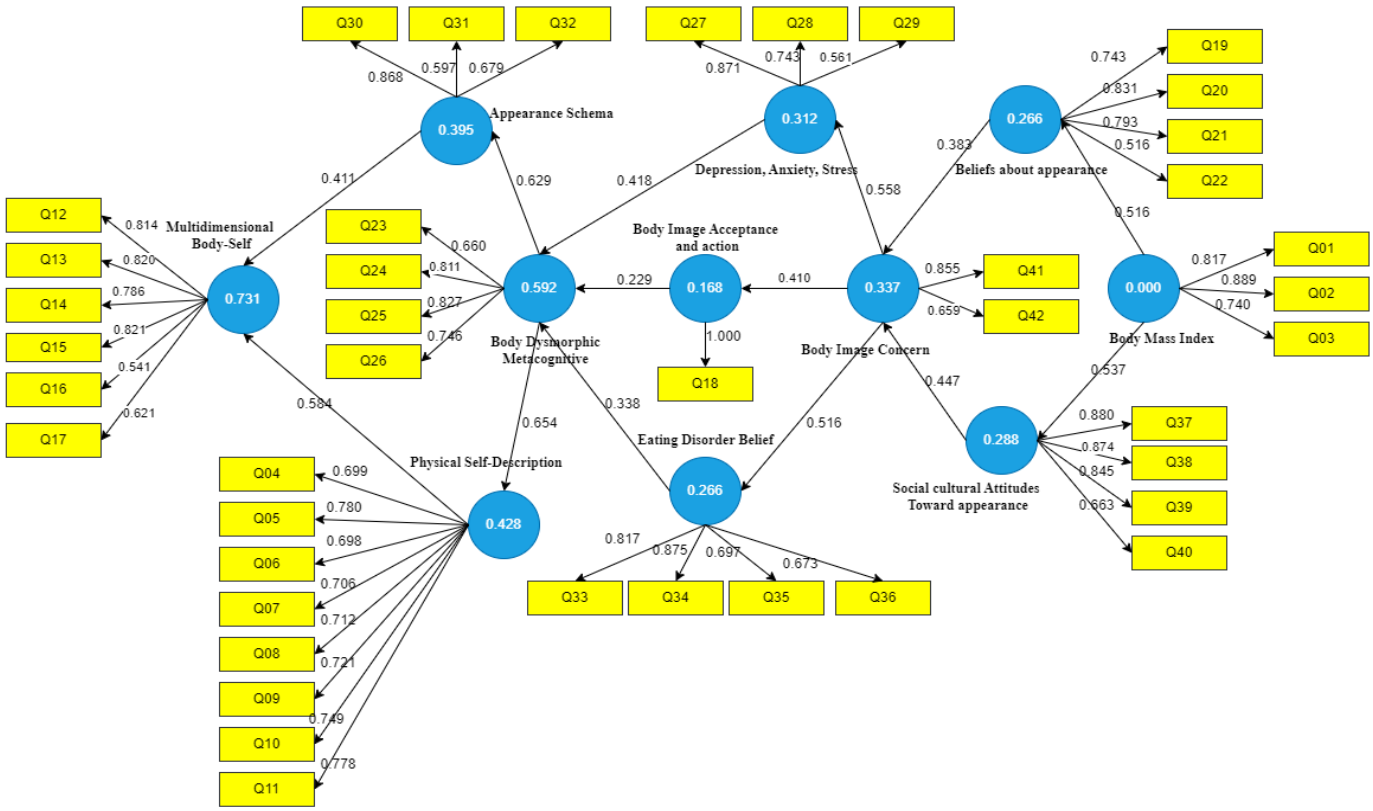
Figure 2

Validation of variable relationships using the Partial Least Squares method



As it is evident in Table 4, it can be claimed that the body mass index significantly affects sociocultural attitudes toward appearance (IF=0.537, t=8.264, 95% CI). The influence of body mass index on beliefs about appearance is also significant (IF=0.516, t=7.873, 95% CI). The influence of the beliefs about appearance (0.383, t=4.528) and sociocultural attitudes toward appearance (IF:0.447, t=6.416) on body image concerns can also be regarded as significant (95% CI). Body image concern significantly influences depression anxiety stress (IF=0.558, t= 8.406), body image-acceptance and action (IF=0.410, t=5.637), and eating disorder beliefs (IF=0.516, t=8.483, 95% CI). Body dysmorphic meta-cognition is influenced significantly by depression anxiety stress (IF=0.418, t=5.023, 95% CI), body image-acceptance and action (IF=0.229, t=2.064, 95% CI) as well as eating disorder beliefs (IF=0.338, t=4.882, 95% CI) and significantly influences appearance schema (IF=0.629, t=8.909, 95% CI) and physical self-description (IF=0.654, t=9.432, 95% CI). Multidimensional body-self relations is influenced significantly by body schemas (IF=0.411, t=6.030, 95% CI) and physical self-description (IF=0.584, t=8.666, 95% CI).

Table 4

Summary of the results for the structural model

Relationships	Impact factor	t statistic	Result
Body mass index on beliefs about appearance	0.516	7.873	confirmed
Body mass index on socio-cultural attitudes toward appearance	0.537	8.264	confirmed
Beliefs about appearance on body image concern	0.383	4.528	confirmed
Sociocultural attitudes toward appearance on body image concern	0.447	6.416	confirmed

Body image concern on depression anxiety stress	0.558	8.406	confirmed
Body image concern on body image-acceptance and action	0.410	5.637	confirmed
Body image concern on eating disorder belief	0.516	8.483	confirmed
Depression anxiety stress on body dysmorphic metacognition	0.418	5.023	confirmed
Body image-acceptance and action on body dysmorphic metacognition	0.229	2.064	confirmed
Eating disorder belief on body dysmorphic metacognition	0.338	4.882	confirmed
Body dysmorphic metacognition on appearance schema	0.629	8.909	confirmed
Body dysmorphic metacognitive on physical self-description	0.654	9.432	confirmed
Body schema on multidimensional body schema	0.411	6.030	confirmed
Physical self-description on multidimensional body-self relations	0.584	8.666	confirmed

In the next step, the final model fit was examined. For this purpose, three indices of convergent validity, composite reliability, and Cronbach's alpha were used for external fit model, and three indices of coefficient of determination (R^2), Stone-Geisser (Q^2), and effect size (F^2) were used for internal fit model. According to the experts, the convergent validity (average variance extracted, AVE) should be greater than 0.5, and Cronbach's alpha and composite reliability should be greater than 0.7. A summary of the results for the assessment of model fit is presented in Table 5.

Table 5

Redundancy values of cross-communality and cross-validity redundancy

Main constructs	Cross-validated communality	Cross-validated redundancy	Coefficient of determination
Eating disorder belief	0.198	0.218	0.266
Depression anxiety stress	0.177	0.134	0.312
Body image-acceptance and action	0.131	0.131	0.168
Beliefs about appearance	0.167	0.421	0.266
Body mass index	0.335	0.335	-
Physical self-description	0.191	0.396	0.428
Multidimensional body-self relations	0.378	0.370	0.731
Appearance schema	0.154	0.120	0.395
Body dysmorphic metacognition	0.228	0.184	0.593
Body image concern	0.140	0.176	0.337
Sociocultural attitudes toward appearance	0.144	0.366	0.288

According to the results shown in Table 5, the convergent validity for all constructs are greater than 0.5. The Cronbach's alpha and the composite reliability for all constructs are also greater than 0.7, indicating sufficient external validity. The coefficient of determination (R^2) is a measure which indicates the amount of variance explained by the model for dependent variables. Therefore, the higher it is, the better the model fit is. The values of 0.19, 0.33, and 0.67 represent weak, moderate, and strong fits respectively (Chin, 1998). The R2 for the structural relationships of multidimensional body-self relations indicates that the independent variables were able to explain 71% of the variance in this construct, which is a considerable amount.

The Stone-Geisser or Q^2 index can be examined by Cross-validated communality and Cross-validated redundancy. According to the experts, positive values are desirable (Henseler et al., 2015). Cross-validated communality and Cross-validated redundancy for all research constructs indicate the model's good predictive power. The most important indicator of model fit in Partial Least Squares (PLS) method is the Goodness of Fit (GOF) index (Tenenhaus et al., 2005; Wetzels et al., 2009) suggested values of 0.01, 0.25, and 0.36 as weak, moderate, and strong for GOF respectively. This index is calculated using the geometric mean of the R^2 index, the mean of cross-validated communality, and cross-validated redundancy indices. The GOF index was found to be 0.48 indicating that the model has a satisfactory fit.

Discussion and Conclusion

The aim of the present study was to develop a body image model in Iranian adolescents considering three physical, cognitive-behavioral, and sociocultural factors and validate it. The results of the research demonstrated that there is an interrelated relationship between body image variables (physical variables such as body mass index, physical self-description, and the

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multidimensional body–self relations), cognitive-behavioral variables (body image-acceptance and action, beliefs about appearance, body dysmorphic metacognition, depression anxiety stress, appearance schema, eating disorder beliefs), and sociocultural variables (sociocultural attitude towards appearance, body image concern) in adolescents. All these variables at different levels have different degrees of influence on body image in Iranian adolescents. In fact, it can be stated that the formation of an adolescent's body image is influenced by various physical, cognitive-behavioral, and sociocultural factors. These findings are consistent with those of previous studies (Leppänen et al., 2022; Molaeinezhad et al., 2021; Palmieri et al., 2021; Song et al., 2023) (McLean & Paxton, 2019; Nemat et al., 2015; Spangler, 2002).

In explaining the developed model, it can be argued that body mass index can influence adolescents' beliefs about their appearance and their sociocultural attitudes toward their appearance. Especially when the majority of society is influenced by social networks, media, and exaggerated criteria and norms defined for appearance and body mass index, those adolescents with a low or even very low body mass index are considered ideal by the society and those with a high body mass index and evern those with a normal BMI may be regarded as abnormal and may feel rejected. Ideal body image imposed by the society may lead adolescents to have concerns about their appearance which in turn may negatively affect their their appearance satisfaction and body image flexibility leading them to have depression, anxiety, stress, and eating disorder beliefs. All these influence adolescents' schemas and beliefs about their appearance and ultimately negative multidimensional body-self relations. Distorted body image may cause adolescents to have wrong compensatory behaviors to reach the appearance idealized by the society and this may have destructive effects on adolescents' personal and social life that may continue to their adulthood.

Considering the results of the present study, various physical, cognitive-behavioral, and sociocultural variables can be closely and intricately related and influential in the formation of body image in Iranian adolescents and how they perceive themselves. The dysfunctional beliefs and schemata imposed by the society and culture regarding the ideal body mass index and appearance can negatively affect adolescents' attitudes toward their appearance especially in puberty and even their mental health. It seems that one way to prevent and address these issues and problems is through educating adolescents at two levels of primary prevention and secondary prevention; that is, raising adolescents' awareness of the their physical and psychological changes during puberty and the differences girls and boys experience in this period, and providing them with a right understanding of body image and fixing its related issue. Considering the importance of body image and various psychosocial factors which affect this variable, it is recommended that future research focus on the role of psychological variables such as perfectionism, personal attributions, internal monologues, negative emotions and affects, and internalizations of certain body image schemata and the need for internal gratification in the development of body image.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this study.

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