

A Moderating Role of Gender Differences Model: The Relationship of Health-Related Fitness, Depressive Symptoms and Self-Esteem Among Adolescents

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ABSTRACT

The purpose of this research was to advance the existing knowledge to develop a conceptual model that depicts the moderating influence of gender in the association between health-related fitness, depressive symptoms, and self-esteem among adolescents. The research employed quantitative data collection techniques. In total, 158 adolescents who are between the ages of 12 and 15 are middle school students in the Sulaimani Region of Kurdistan/Iraq. The data was analyzed using partial least squares structural equation modeling (PLS-SEM) and calculated descriptive statistics employing SPSS software. The findings indicated a positive association between depressive symptoms and self-esteem for both male and female genders. Conversely, it was established that for both genders, muscular endurance has a positive relationship with self-esteem. Conversely, body composition correlates negatively with self-esteem among females. On the other hand, body composition and self-esteem showed no remarkable association for males. Notably, in females, there was no significant relationship between cardiorespiratory fitness and self-esteem; however, for males, a relationship proving a direct correlation was established. Finally, among either gender, flexibility did not display a significant association with self-esteem. The study's findings emphasize the relationship between health-related fitness, depressive symptoms, and self-esteem in adolescents, regardless of gender. The findings showed that the tested conceptual model was applicable, dependable, and practical within the school environment. This study highlights the significance of advocating for physical fitness and mental health promotion for adolescents' wellness.

KEY WORDS: Gender, Health-related fitness (HRF), Depressive Symptoms (DS), Self-Esteem (SE), adolescents.

INTRODUCTION

Adolescence is an essential phase of quick growth, indicating the transformation from childhood to adulthood stage. Nevertheless, encounters in this phase differ widely among individuals (Angeline Grace and Sujitha, 2023). The incidence rate, as well as the type of mental health issues, varies with gender. Understanding the distribution of individuals across all active behaviors may shed light on the underlying reasons for sex disparities in physical activity (Yoon et al., 2023; Kretschmer et al., 2023).

Nonetheless, it is important to observe that physical fitness is an aggregate of multiple components (cardiorespiratory fitness, muscular fitness, body composition, and flexibility) varying by their relationship with indicators of mental health among adolescents (Chen, 2016). Depression is the most widespread mental disorder, characterized by low mood, pessimism, and apathy present for a prolonged period (Bou-Sospedra et al., 2020). Adolescent depression affects approximately 5% of the population and has been on an uptrend lately. Fitness, especially cardiovascular fitness (CRF), has been revealed in recent studies as a promising characteristic of depression (Nixdorf et al., 2021). In comparison, other scientific studies illustrate that fitness is an important indicator of stable mental health (Cadenas-Sanchez et al., 2021). It has been proved by past researchers that there is a relationship between cardiovascular fitness (CRF) among female adolescents and SE and depression (risk). CRF had a positive connection with body satisfaction for

Koya University Journal of Humanities and Social Sciences (KUJHSS) Volume 8, Issue 1, 2025.

Received: 23 September 2024

Accepted: 19 November 2024

Regular research paper: 20 May 2025

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boys of the same age group (Greenleaf et al., 2010). The results also indicated that adolescents who were at higher risk of getting depression symptoms were those who had poor cardiovascular fitness levels (Rieck et al., 2013). It is already well known that high physical fitness (PF) levels among adolescents are important because reduced PF may predict future health issues in adult life. A lower risk of cardiovascular disease and cancer tends to be linked with elevated PF levels (Alahmad, 2021). Two common observations concerning sex differences in self-esteem (SE) are that males usually report greater SE levels in comparison to females during their teenage years (Bleidorn et al., 2016; Helwig & Ruprecht, 2017). Various studies, including these, show that depressive symptoms are widespread among adolescents, emanate from different causes, and have effects extending through adulthood (Rieck et al., 2013). According to another report, girls tend to score less on components related to physical fitness associated with health, including body fat percentage and cardiorespiratory fitness (CRF); additionally, the likelihood of them having a higher BMI is high, suggesting possible health problems among children as well as adolescents who are overweight or obese (Al-Asiri & Shaheen, 2015). PF levels are affected by obesity and increased weight, necessitating a range of health factors to be monitored. Additionally, it was reported that sex modifies the level of health-related fitness components (Hafsteinsson Östenberg et al., 2022; Liu et al., 2023). Adolescents' overall health and growth depend on their gender, thereby making it essential to identify how gender influences health-related fitness components and elicits depressive symptoms, and self-worth levels among them. As pointed out, boys had better mental health compared to their female counterparts if their PF was low. However, there is little information on sex dependence. Earlier research has tried to understand how health-related fitness, depression as well as self-esteem relate. Still, there are very minimal studies that have researched how gender influences this relationship. Understanding the elements that affect adolescents' general well-being is crucial, as evidenced by the rising incidence of health-related problems in this demographic. Depression, self-esteem, and health-related fitness are important factors that can affect the physical and mental health outcomes of adolescents. It is crucial to investigate these processes further because gender differences may mitigate these correlations. Previous research has shown the connections between depression, self-esteem, and health-related fitness separately. Adolescents who engage in more physical activities exhibit lower levels of depression and higher levels of self-esteem; research indicates. Moreover, such differences in these factors are gendered; some studies suggest that males and females have different responses to and experiences of depression and health-related fitness. Despite advances in this field,

the existing variables have not been integrated comprehensively in several models, particularly in their dimensions across gender. While the existing literature has developed expeditiously in offering explanations of such relationships, there still are shortcomings. Many researchers have not explored the impact of gender on the relationships between factors such as depression, self-esteem, and physical fitness. Also, the models used in previous works tend to overlook the complex interactions between these variables, thus limiting their applicability and self-esteem in directing interventions. This study is relevant, targeting a number of groups, including those in policymaking practices and research. In this regard, this study aims to investigate a novel model that looks at how gender variations moderate the associations between adolescents' self-esteem, depression, and health-related fitness. Therefore, the study intends to add to the body of knowledge already in existence and provide useful advice for enhancing the health and well-being of adolescents. Moreover, the current research sought to conceptualize a framework that demonstrates the interaction effect of gender on an adolescent's health-related fitness, depression, and self-esteem (SE).

1. LITERATURE REVIEW

The depressive symptoms and health-related fitness variable effects on the SE are not covered well in the literature. Especially the Middle Eastern gender needs to be given more attention, as a very poor study focused on the SE. The previous studies were conducted in European, American, British, Indian, UAE, and Iran contexts. The reviewed studies investigated the interplay between depressive symptoms, SE, and PF among adolescents across various contexts. The first study, conducted in the USA, examined rural adolescents and found that depressive symptoms were negatively correlated with peer and family social support, SE, and optimism. However, it did not address early adolescence or gender differences in the depression and SE relationship (Weber et al., 2010). Similarly, a UAE study reported an inverse relationship between SE and depressive symptoms (DS) in adolescents aged 12 to 18, identifying factors such as neglect and low family income as linked to higher depressive symptoms. This study also lacked a gender-stratified analysis (Id et al., 2020). Further research focused on psychosocial variables and PF. A USA study explored the impact of SE and depression on body composition and CRF in middle school students, finding that higher CRF was associated with better SE and body satisfaction but did not analyze gender differences (Greenleaf et al., 2010). A Spanish study found a positive link between physical self-concept and PF, with SE impacting aerobic endurance; however, it did not consider gender differences (Benitez-Sillero et al., 2023).

Another Spanish study found an inverse relationship between CRF and self-rated depression risk but did not examine gender-specific variations (Bou-Sospedra *et al.*, 2020). A German study explored the relationship between PF and mental health, revealing that lower physical strength was associated with higher anxiety and hyperactivity/inattention. This study did not analyze gender differences or include flexibility in its fitness assessment (Nixdorf *et al.*, 2021). In the UK, research on fitness, PA, and psychosocial problems in early adolescents (ages 11-13) indicated that higher fitness and PA were linked to fewer internalizing problems but did not generalize to other age groups (Wheatley *et al.*, 2020). In conclusion, research by (Hasanpour *et al.*, 2014; Ahmed *et al.*, 2017) measured Physical fitness components and SE among adolescents. Whereas the research by (Hasanpour *et al.*, 2014) reported that aerobic exercise enhanced self-esteem in adolescent girls from underprivileged backgrounds, the investigation by (Ahmed *et al.*, 2017) showed that active adolescents had greater SE and task direction compared to sedentary ones. Neither examination involved both genders in their analysis and explored the association between self-esteem and physical fitness components.

Despite research on the relationship between health-related fitness components with depressive symptoms and self-esteem, there is also an absence of studies addressing these issues with a specific emphasis on Iraq. There are likely many other factors, such as differences in the context of the research, target population, approach to research design, and types of sampling employed in previous studies, that might not be relevant to the case of Iraq, which is likely to have a major impact on the research findings. In contrast, two studies were conducted in the broader Middle East (Hasanpour *et al.*, 2014; Id *et al.*, 2020) and none of them particularly focused on the relationship between depression, self-esteem and health-related fitness in the Iraqi adolescent population. Moreover, most of the recent studies do not adequately explore how gender differences mediate or moderate these relationships or other relevant factors. There has yet to emerge an encompassing model in the available literature that would address the role played by gender in the correlation among various facets of health-related fitness, depression, and self-esteem, among others. This inconsistency highlights how specific findings are not widely applicable and calls for more studies on such issues within the Iraqi context.

2.1 Theoretical Model

The Psychological Well-Being Theory:

The theoretical description and explanation for the proposed hypotheses in this study have been supported by two theories, including the psychological well-being theory and the cognitive theory of depression. The

psychological well-being theory was primarily developed by (Ryff, 1989). The theory addresses various aspects of well-being, covering self-acceptance, interpersonal relationships, autonomy, environmental competence, life's purpose, and individual progress. Her work emphasizes that psychological well-being is a multifaceted construct, with physical health and fitness playing a crucial role in achieving overall well-being (Makeda, 2024; Blasco-Belled *et al.*, 2022). The Cognitive Theory of Depression was developed by Aaron T. Beck (Beck, 2007). He first introduced this theory in the early 1960s. Beck's Cognitive Theory posits that depression is characterized by pervasive negative thought patterns, including negative views about the self. These negative self-views can diminish SE. Beck suggested that individuals with depression often have a negative self-schema, which leads to and reinforces low SE. Research has shown that depressive symptoms can lead to decreased SE. For example, the study found that depressed individuals often hold negative self-beliefs that contribute to and exacerbate their low SE (Assari & Lankarani, 2018). However, the proposed hypotheses of this study will be discussed in detail in the below sections.

3. HYPOTHESES

The present study's hypotheses are grounded in the prior studies that suggest a strong correlation between these factors. By examining these correlations, this investigation searches to confirm whether the noticed relationship aligns with current proof or if additional insights can be gleaned from a more refined assessment.

3.1 Depressive symptoms

Depressive symptoms (DS) in adolescents encompass a diverse array of emotional and behavioural indicators that are indicative of depression. These symptoms typically include pervasive feelings of sadness, hopelessness, and worthlessness, which can significantly affect multiple facets of daily functioning and overall well-being (Korczak *et al.*, 2023). The present study specifically examines these DS through four distinct dimensions: emotional distress, behavioural changes, cognitive difficulties, and affective responses. This multidimensional approach provides a comprehensive understanding of the various ways in which depression manifests and impacts adolescent functioning. Previous studies (Masselink *et al.*, 2018; Weber *et al.*, 2010) have found a negative association between DS and SE. DS often leads to negative self-perceptions, which can decrease SE. For example, research shows that depressive symptoms are associated with diminished self-worth among adolescents, confirming this negative relationship (Masselink *et al.*, 2018). Gender-specific social expectations and norms can influence how depressive

symptoms affect SE. Girls may face more societal pressure related to appearance and social acceptance, which can magnify the negative impact of depressive symptoms on SE. Conversely, boys may experience different pressures that affect this relationship differently. Research indicates that the relationship between depressive symptoms and SE can vary by gender (Tiggemann & Slater, 2014). For instance, studies have found that girls are more likely to experience both higher levels of depressive symptoms and lower SE compared to boys (Hankin *et al.*, 2007; Nolen-Hoeksema, 2001). Girls are often more sensitive to social feedback and societal pressures regarding body image, which can amplify the impact of depressive symptoms on SE. Depression often involves pervasive negative thinking, where individuals view themselves in a harsh and critical light. Adolescents with depression may internalize their difficulties and failures, leading to poor self-image and diminished self-worth. Negative self-perceptions contribute to lower SE because the individual sees themselves as less capable, less deserving, or fundamentally flawed.

H1: Depressive symptoms are negatively associated with SE among adolescents.

3.2 Health-related fitness components

Achieving fitness goals boosts confidence and provides a sense of accomplishment, enhancing SE. Exercise releases endorphins that improve mood and reduce stress, positively impacting SE and helping manage anxiety and depression (Singh, 2024). For women, fitness goals often focus on body appearance, making body image and societal beauty standards significant factors in SE. For men, goals typically emphasize strength and performance, with SE influenced by indicators like muscle strength and endurance. Both genders benefit from improved SE through fitness, but it's important to manage expectations to avoid negative impacts on self-worth. Gender roles and body image issues are well-documented factors impacting how physical fitness affects psychological well-being. Examinations imply that women are often more concerned with body image and may experience different psychological effects from fitness activities compared to men (Tiggemann & Slater, 2014).

H2: Body composition is negatively associated with SE. Cardiorespiratory Fitness (CRF) is positively associated with SE due to multiple factors. Constant aerobic exercise enhances CRF and leads to enhanced physical health, mood, and energy levels, which collectively contribute to more confident self-worth and increased SE (Greenleaf *et al.*, 2010). Achieving fitness goals and experiencing physical improvements can also boost self-confidence and overall well-being. However, the relationship between CRF and SE varies by gender. Research suggests that females may experience greater psychological

benefits from improved CRF due to societal pressures and psychological factors related to body image and fitness expectations (Homan & Tylka, 2014).

Conversely, boys frequently emphasize performance and physical capabilities while gaining advantages from CRF (Frost & McKelvie, 2005). These gender differences are affected by varying community pressure, body image concerns, and exercise motivations. Overall, while both genders experience benefits from improved CRF, the nature and extent of the positive correlation with SE differ, reflecting distinct psychological and social influences.

H3: CRF is positively correlated with self-esteem among adolescents.

Previous studies (Greenleaf *et al.*, 2010; Baba & Balint, 2022; Benitez-Sillero *et al.*, 2023) reported that muscular endurance is positively associated with SE. Enhanced muscular endurance contributes to better functional performance in daily activities, reducing feelings of helplessness or inadequacy. When individuals feel physically capable in their daily lives, it can strengthen their SE (Craft *et al.*, 2014). The correlation between muscular endurance and SE can differ between genders due to varying societal expectations, body image concerns, and exercise motivation.

H4: Muscular endurance is positively associated with SE among adolescents.

Flexibility training, such as stretching, positively influences SE through mechanisms like enhanced body awareness, reduced discomfort, and better functional performance. These exercises also offer psychological benefits, such as stress reduction and improved mood, which contribute to higher SE (Benitez-Sillero *et al.*, 2023). Gender differences may affect how flexibility training impacts SE, with women potentially experiencing greater improvements in body image and SE due to societal beauty standards. Understanding these dynamics can help tailor fitness interventions to boost SE (Jimenez-Morcillo & Javier, 2024).

H5: Flexibility is positively correlated with SE among adolescents.

3.3 Gender moderates

H6: Gender moderator influences the connection between health-related fitness, SE, and depressive symptoms.

4. METHODOLOGY

4.1 Ethical Approval

The Institutional Review Board (IRB) of the University of Sulaimani approved the study. The study protocol was approved by the Ethics Commission Education Directorate of Sulaimani City through official letters with code number 2219. The study protocol was permitted in

all schools where it was carried out. Adolescents and their parents, with respect to the study's nature and characteristics, were given prior information with informed consent written by all. Their voluntary participation was documented with their written consent on the first page of the questionnaire. This study followed the APA ethical guidelines of psychologists and code of conduct, especially focusing on ethical agreement. Participant safety and privacy. Participants were well aware of the study's objective, procedures, dangers, and advantages before consent was acquired. The research also consists of a review session to offer participants further information and assistance.

4.2 Sampling Size

The sample size used in this study was based on the G*Power software, which was used to determine the total sample size needed for the research model. It is a widely used method in scientific studies for calculating the sample size necessary for the number of predictors or hypotheses. This software offers a variety of settings and features that cater to almost all kinds of analysis considerations (El Maniani *et al.*, 2016). Grounded on the G*Power software, the sample size was 74 for six prediction hypotheses. Therefore, in this study, the participants were 158 middle school pupils; this number can be considered enough for measuring the research model. Six public schools were selected using random sampling. The schools located in Sulaimani city in Kurdistan region/Iraq (86 girls, 72 boys) from grade 7 to grade 10 ranging in age from 12 to 15 years old (female SD = 13.38 (1.08) male SD = 13.65 (1.09) total = 13.51 (1.09) (Table 1). All participants' race/ethnicity were Kurdish.

4.3 Instruments Design

Considering the validity of the evaluation instruments and cognitive abilities of those who participated, all evaluations of depression and SE were utilized among all pupils. Therefore, (BMI, BF, VO2max, Curl-up, Sit-and-reach Flexibility) were assessed with all participants.

4.3.1 Health-related fitness components

The instruments of fitness components were designed based on the main standard tool, the Fitness Gram test. The FitnessGram test, which was developed by (Meredith and Welk, 2013), was the primary instrument used to evaluate fitness components. This tool is a valid, dependable, viable, and safe test battery to assess health-related physical fitness components in adolescents (Meredith & Welk, 2013). These instruments, based on a published review of their reliabilities, are suitable for adolescents (De Miguel-Etayo *et al.*, 2014; Saint-Maurice *et al.*, 2015). This physical fitness test is time efficient, inexpensive, and meets equipment requirements. Furthermore, it is easy to use and can be employed by a

large number of people concurrently. The test items utilized in the FitnessGram test battery have been applied to millions of students and have proven to be very safe (Meredith & Welk, 2013). The participants were classified into two zones: Healthy Fitness Zones™ and Need Improvement. For body composition assessment, the researcher measured body fat percentage and BMI. Electronic Body Fat Scale with Height Weight Body Composition Analyzer HW-700A was employed to measure body fat percentage, BMI, weight, and height. BMI scores to reach HFZ ranged between 15.8 and 23.0 for males and between 14.7-22.9 for females. For BF for males, 7.8-22.8, for females, 12.7-28.5. Other health-related fitness components (aerobic capacity, muscle endurance, and flexibility) were measured using the standardized formula of the FitnessGram test battery (Meredith & Welk, 2013). (CRF) was evaluated with the PACER shuttle run test, a valid test of CRF, and a reliable test for estimating VO2max in adolescents (Minatto *et al.*, 2016). The VO2 max scores to reach HFZ for males were 37.4-42.1, and for females, 37.4-39.7. The curl-ups are used to assess muscular endurance the minimum number of repetitions to reach HF strength is between 8 and 18 for females and between 8 and 24 for males. Sit-and-reach was used to assess Flexibility for males 19 cm -20.32 cm, for females 24.3 cm- 25.4 cm.

4.3.2 Depressive Symptoms

Depressive symptoms were assessed using the short mood and feelings questionnaire (SMFQ). The SMFQ was developed as a brief measure of depressive symptoms in children and adolescents 6-18 years old. The SMFQ is a 13-item questionnaire that measures the presence of depressive symptoms in the last two weeks (Angold *et al.*, 1995). For each question, responses are rated on a three-point scale: "not true" (scored 0), "sometimes" (scored 1), and "true" (scored 2). Each question is scored between 0 and 2. The resulting summary score of all the items can range between 0-26, with higher scores being more indicative of greater depression. This scale has four zones: emotional distress, behavioral changes, cognitive difficulties and affective responses. The total score ranges between 0 and 26. Each item is provided a score from 0 to 2. Greater scores point to higher levels of depressive symptoms. The reality is that a binary threshold of eight or elevated has been determined for severe depression with a sensitivity of 60% and a specificity of %85 is notable. Hence, numerous studies also used this binary threshold (Thapar *et al.*, 1998; Thapar *et al.*, 2012; Korcak *et al.*, 2023).

4.3.3 Self-esteem

Self-esteem was assessed by the Adolescent Self-Esteem Questionnaire (ASQ) is a 12-item scale to measure global SE in adolescents. It contains both positively and

negatively phrased items, which are rated on a 5-point Likert scale. The Scoring: Item scores are calculated with positively worded items encoded in reverse. A higher overall score points out greater SE. The answer Format for positive items spans from 1 (Hardly ever) to 5 (Almost all the time). For negative items: spanning from 1 (Almost all of the time) to 5 (Hardly ever). The ASQ was advanced as part of the Young Minds Matter project, which aimed to evaluate mental health and well-being in Australian children and adolescents (Hafekost et al., 2023).

4.4 Data Collection

The standard back-translation method was utilized during the language translation (Maneesriwongul & Dixon, 2004; Abu et al., 2023). Depressive symptoms were measured using a methodical translation approach. A number of crucial steps were involved in the translation process. First of all, a multilingual specialist used the translation forward approach to convert the scale from English to Kurdish. Based on (Carlson, 2000), the translator should be fluent in both languages and informed on the instrument objective. Nevertheless, this procedure required the use of three translators. A second bilingual expert translated Kurdish text back into English as a part of a backward translation procedure to guarantee accuracy and consistency. In addition, content validity has been utilized, which is a professional assessment evaluation to make sure the translation accurately conveys the original concept and assesses the instrument's validity. For the intended audiences, this multi-step process ensures that the translation tool is trusted and authentic.

5. DATA ANALYSIS

Writing the variables and questions in the code was the main step in the data analysis process. The data cleaning and preparation included checking for outliers, suspicious response patterns, missing data, and normalcy using the Statistical Package for the Social Sciences (SPSS) software version 29. Following data cleaning, the frequency analysis (for categorical variables) and the sample's central tendency (mean and standard deviations for continuous variables) were computed. To measure the hypotheses and model variables, the researchers applied the structural equation modelling (SEM) approach by using SmartPLS Software ver 4.1.0.6 to evaluate the validity of measurement and also the path model based on research objectives focused on the prediction and explanation of the difference among the constructs. SmartPLS is a strong tool for assessing model prediction

hypotheses and models as a result of its advanced PLS-SEM functionality. Among the features are an interface, a variety of tools for evaluating models, PLSpredict to evaluate predictive performance, and effective data processing. The summary of these traits ensures that they are optimal for accurate predictions and complex models; therefore, they are significant in disciplines as varied as computer science and digital marketing (Cheah et al., 2024).

6. RESULTS

6.1 Sample Description:

The descriptive statistics indicate significant disparities between male and female participants across multiple factors. Regarding age, males have a slightly higher average age of 13.65 years (standard deviation = 1.09) compared to females, who have an average age of 13.38 years (standard deviation = 1.08). The total average age is 13.51 years (standard deviation = 1.09). Furthermore, although there is a little disparity in average weight between males (48.94 kg, SD = 14.28) and females (48.35 kg, SD = 15.73), the combined average weight for both genders are 48.62 kg (SD = 15.04). Furthermore, there exists a significant disparity in average height between males (160.82 cm, SD = 9.17) and girls (154.87 cm, SD = 7.86), leading to an overall average height of 157.58 cm (SD = 8.96).

In addition, while examining the Body Mass Index (BMI), it is observed that girls have a slightly higher average BMI (20.16, SD = 6.53) compared to males (19.70, SD = 5.11), with an overall average BMI of 19.95 (SD = 5.91). Results for Sit-flex showed that females had a higher average (M = 19.70, SD = 5.19) compared to male students (M=17.79, SD = 6.98) with an overall average sit and reach flexibility (Sit-Flex) (M=18.74 (SD=6.08)). When it comes to fitness assessments, males had higher average values in variables like cardiorespiratory (VO2max) (41.25 ml/kg/min, SD = 5.88) compared to females (31.37 ml/kg/min, SD = 5.29), with an overall average of 35.87 ml/kg/min (SD = 7.42). In addition, males exhibit markedly higher average values in the muscular endurance (Curl-up) exercise (41.58 repetitions, SD = 16.73) compared to females (25.81 repetitions, SD = 10.28), resulting in an overall average of 33 repetitions (SD = 15.68). Regarding Body Fat (BF) percentage, there is little distinction between males (22.11%, SD = 9.12) and females (22.37%, SD = 9.09), with an overall average BF percentage of 22.25% (SD = 9.07).

TABLE 1
Results of descriptive analysis for research variables

Variable	Female- Mean(SD)	Male- Mean(SD)	Total- Mean(SD)
Age	13.38(1.08)	13.65(1.09)	13.51(1.09)
Weight _kg	48.35(15.73)	48.94(14.28)	48.62(15.04)
Height _cm	154.87(7.86)	160.82(9.17)	157.58(8.96)
BMI	20.16(6.53)	19.7(5.11)	19.95(5.91)
Flexibility (Sit flex)	19.04(5.19)	17.79(6.98)	18.47(6.08)
Cardiorespiratory (VO2max)	31.37(5.29)	41.25(5.88)	35.87(7.42)
Muscular endurance (Curl-up)	25.81(10.28)	41.58(16.73)	33(15.68)
BF	22.37(9.09)	22.11(9.12)	22.25(9.07)

Measurement model assessment

The initial phase of PLS-SEM analysis requires assessing the measurement model. The results indicate that two latent variables (depression and SE) have a high level of convergent validity for all constructs, as the items with low loading factors have been eliminated. Three items from SE and two items from depression constructs were removed due to low-loading factors. The research

indicates that both the composite reliability (CR) and average variance extracted (AVE) surpass the acceptable threshold. The HTMT criterion, established by Henseler et al., is crucial in evaluating discriminant validity. The variables have HTMT values below 0.90, ranging from 0.048 to 0.565. Therefore, the variables exhibit significant discriminant validity.

TABLE 2
Convergent validity and reliability assessment of measurements

Construct	No items	No of removed items	Loading	Cronbach's Alpha	CR	AVE
Depression	13	2	0.643- 0.780	0.895	0.912	0.487
Self-esteem	12	3	0.654-0.778	0.882	0.904	0.513

Path Model and Multigroup Analysis

The evaluation of the structural model occurs after the fitting of the measurement model and follows the establishment of the construct validity and reliability. The research hypotheses were evaluated using structural equation modelling. The study examined the relationship between all independent variables (BMI, BF, VO2max, Curl Up, Sit Flex and depression) with SE as dependent variables, considering gender (Female & Male) as moderator. Therefore, multigroup analysis was performed to test the research hypothesis. Figures 1 and

2 show the path model for both genders, and results showed that the coefficient of determination (R²) for the dependent variable of SE was 0.547 and 0.739 for females and males, respectively. These findings indicate that 54.7% of SE among female students and 73.9% of SE among male students can be accounted for by BMI, BF, VO2max, Curl Up, Sit Flex and depression. Results of the multicollinearity test also showed that there were not any collinearity issues since the VIF value for exogenous variables was below 10.

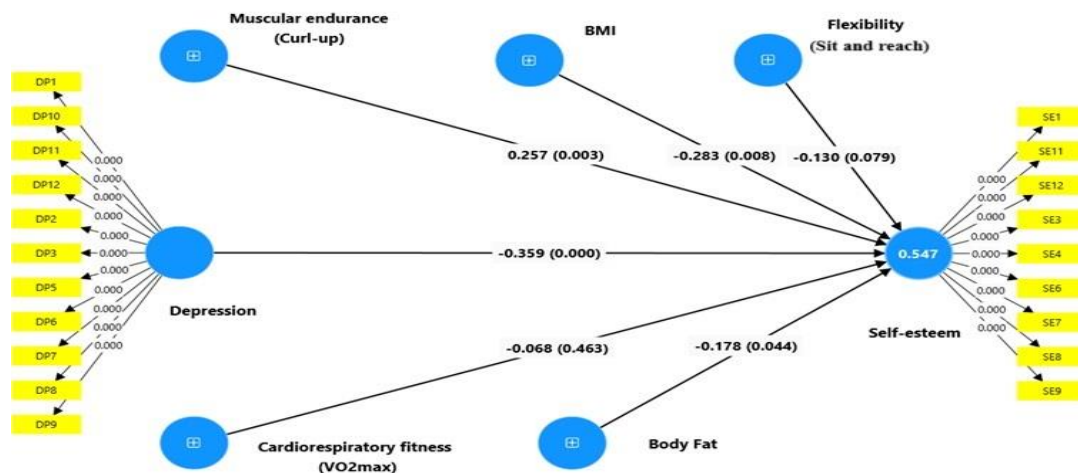


Fig.1. Structural model using bootstrapping methods (Female)

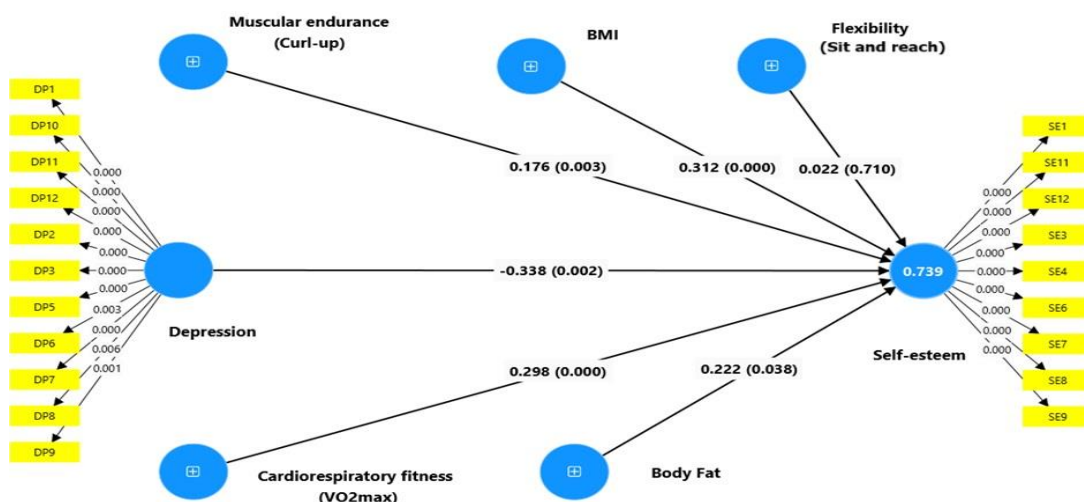


Fig.2. Structural model using bootstrapping methods (Male)

The regression analysis reveals strong correlations between several parameters and SE in the female sample. It is worth stating that there is a direct and negative correlation between depression (DP) and SE ($\beta = -0.359$, $p < 0.001$), which means when depression levels increase, SE decreases, particularly among females. Additionally, there is a negative relationship between body fat percentage (BF) and body mass index (BMI) with SE (BF: $\beta = -0.178$, $p = 0.043$; BMI: $\beta = -0.283$, $p = 0.007$). This indicates that higher body fat percentage and BMI are associated with lower SE in this group. Also, there is a significant and positive correlation between SE and (B = 0.257, $p = 0.003$). This means that girls who perform better in muscular endurance exercises tend to have greater levels of SE. The relationship between cardiorespiratory fitness ($\beta = -0.068$, $p = 0.470$) and flexibility ($\beta = -0.130$, p

= 0.081) with SE among female students was not statistically significant. Conversely, in the case of the male sample, significant relationships can be observed between factors and SE. The study revealed a significant and negative relationship between depression and SE among males. Specifically, higher levels of depression were shown to be associated with decreased SE ($\beta = -0.338$, $p = 0.003$). Moreover, there is a positive correlation between CRF and SE ($\beta = 0.298$, $p < 0.001$), indicating that higher levels of CRF are associated with greater SE in males. Furthermore, there is a positive correlation between Muscular endurance and SE ($\beta = 0.176$, $p = 0.003$). This suggests that male students who have greater performance in muscular endurance exercises tend to have higher levels of SE. Nevertheless, the data in this sample indicate that there is no significant correlation between flexibility and SE ($\beta = 0.022$, $p = 0.717$).

TABLE 3
Results of Path model assessment using bootstrap for both gender

	Path	β	SE	T value	P values
Female	BF -> SE	-0.178	0.088	2.022*	0.043
	BMI -> SE	-0.283	0.105	2.691*	0.007
	Depression -> SE	-0.359	0.087	4.141*	<0.001
	Cardiorespiratory (VO2max) -> SE	-0.068	0.095	0.723	0.47
	Muscular endurance (Curl-up) -> SE	0.257	0.088	2.938*	0.003
Male	flexibility (Sit flex) -> SE	-0.13	0.074	1.747	0.081
	BF -> SE	0.222	0.108	2.061*	0.039
	BMI -> SE	0.312	0.075	4.187*	<0.001
	Depression -> SE	-0.338	0.112	3.01*	0.003
	Cardiorespiratory (VO2max) -> SE	0.298	0.059	5.013*	<0.001
	Muscular endurance (Curl-up) -> SE	0.176	0.06	2.954*	0.003
	Flexibility (Sit flex) -> SE	0.022	0.06	0.362	0.717

A multigroup permutation was performed to assess the differences between genders in relation to the stated model. The results demonstrate significant discrepancies in the associations between specific variables and SE.

More precisely, there are notable differences between males and females in terms of how body fat percentage (BF), body mass index (BMI), and CRF are linked to SE. The differences observed are statistically significant (BF:

Difference = -0.401, $p = 0.005$; BMI: Difference = -0.596, $p = 0.003$; VO2max: Difference = -0.336, $p = 0.010$), suggesting that these associations vary significantly between genders. In contrast, variables such as depression (DP), muscular endurance, and flexibility do not exhibit any statistically significant variations between

males and females in their connections with SE. These findings highlight the specific differences in various interactions within the model based on gender, offering useful insights into the factors that determine self-confidence differently for male and female participants.

TABLE 4
Results of Multigroup Permutation Analysis: Gender-Specific Differences in Relationships

Path	β (FEMALE)	β (MALE)	Difference	p value
BF -> SE	-0.178	0.222	-0.401*	0.005
BMI -> SE	-0.283	0.312	-0.596*	0.003
Depression -> SE	-0.359	-0.338	-0.021	0.907
Cardiorespiratory VO2max -> SE	-0.068	0.298	-0.366*	0.01
Muscular endurance (Curl-up) -> SE	0.257	0.176	0.081	0.585
Flexibility (Sit flex) -> SE	-0.13	0.022	-0.152	0.255

7. DISCUSSION

The current investigation found an association between depressive symptoms and SE for males and females. These outcomes propose indicators of positive mental health and preventive factors against future depression in both genders of adolescents. Furthermore, depressive symptoms are risk factors for lower future SE. This result is comparable to other studies showing that high depression is associated with low SE (Weber *et al.*, 2010; Nguyen *et al.*, 2019). The concept of SE from the Social Cognitive Theory has shown that SE is influenced by how we perceive acceptance or rejection in our social interactions. Depression can distort our perception, leading to lower SE even when we are valued and loved by others (Xia, 2022). Thus, if an individual has a positive self-view, they are less likely to assume that others will reject them because they believe they are worthy of being liked. The results indicated a significant negative relationship between (BF) and (BMI) in terms of SE among females. This indicates that higher BF and BMI are associated with lower SE in this particular group. Alternatively, a study investigating the relationship between BF and BMI with SE reached results similar to our finding of a significant negative correlation between BF and BMI with SE (ALAhmari *et al.*, 2019). In essence, overweight females may experience negative feelings about their body image, leading to reduced SE. In the present, significant correlations between BI and BMI with SE among males were not found. This result is consistent with prior studies. There was no strong association between BMI and SE (McCreary & Sadava, 2001). A longitudinal investigation shows that boys are less susceptible to perceiving themselves as overweight, regardless of what they are and how they perceive themselves as attractive overweight girls. A longitudinal

investigation shows that boys are less susceptible to perceiving themselves as overweight, regardless of what they are, and assess themselves as more attractive than overweight girls (Kiviruusu *et al.*, 2016). Furthermore, the socially acceptable body shape types are more versatile for males than the one rigid slim type available for females. In this study, the relationship between cardiorespiratory fitness (CRF) and SE among female students was not statistically significant. Although previous studies reported no significant correlation between CRF and SE (Maryati *et al.*, 2023), other researches indicated that CRF is positively related to SE in adolescents (Benitez-Sillero *et al.*, 2023). These findings collectively highlight the complex interplay between CRF and SE in females, influenced by various factors such as age, PF components, weight self-stigma, and social media exposure. However, more longitudinal studies are needed to show sufficient evidence of this association. Moreover, in the present study, a direct correlation was found between CRF and SE in males; this result indicated that higher CRF brings on an increase in adolescent's benefits of SE. This result is in line with the previous findings, which found a relationship between CRF and SE (Infantes-Paniagua *et al.*, 2020). The finding discovered that CRF in adolescents is important and ought to be encouraged. In addition, all of these investigations point to the existence of a positive relationship between health-related fitness and self-esteem in a range of populations and age groups. As stated by the investigation, Curl-up and SE are positively associated in both genders. This suggests that students, both female and male, who perform better on curl-up exercises normally have greater SE levels. These outcomes seem to support the current study, presenting a relationship between mental health and physical exercises, as muscular endurance is linked to a greater level of SE (Benitez-Sillero *et al.*, 2023; Greenleaf *et al.*, 2010; Baba & Balint, 2022). These outcomes emphasize the relevance of encouraging

physical fitness and muscular endurance-building activities for general well-being by illustrating the crucial role that muscular endurance plays in developing a positive SE among adolescents. This investigation showed no significant correlation between SE and flexibility in either gender. This result is aligned with the previous study outcomes (García-Martínez et al., 2012). According to previous investigations, while SE is positively associated with muscular strength in such groups as boys (Bolados et al., 2021; Ciccolo et al., 2016), the correlation may not hold true for all populations. Moreover, studies on older people point out that the interpretation of physical fitness, such as flexibility and muscular strength, may not always correspond with performance-based metrics (Schuler et al., 2004). One of the study highlights is that it suggests exploring a new model that modifies gender into account as a moderating element, which improves our understanding of adolescents' well-being. This conceptual model offers a thorough framework for investigating the complex relationships between many health-related fitness variables and depression symptoms, as well as how they affect self-esteem and gender-specific patterns. Furthermore, this study fills a vacuum in the literature by concentrating on teenagers from Iraqi middle schools who are between the ages of 12 and 15. This is especially relevant when considering Middle Eastern countries. The study's conclusions are, therefore, extremely pertinent to regional educational and healthcare environments, providing insightful information that is frequently disregarded in studies carried out in Western environments. The study limitations include the narrow age range of the adolescent participants, as the study did not encompass all stages of adolescence, which range from pre-adolescents (starting at age 11) to older adolescents (up to age 19). Additionally, the study was conducted at a single point in time, suggesting that incorporating data from different periods could enhance the applicability of the findings. Future researches should include a broader age range of adolescents and consider participants from various regions to better classify and analyze the needs and requirements of adolescents across different areas.

8. CONCLUSION:

This study points out the value of health-related physical fitness as an essential component for developing both psychological and physical wellness in youth. Improved physical fitness levels and fewer depressive symptoms correlate with stronger self-esteem, which may eventually improve the behaviour of adolescents' capacity to confront issues and reach their own goals. The research result demonstrates that involvement in planning to enhance physical fitness may successfully improve psychological durability and physical fitness,

especially when customised according to particular gender requirements. Moreover, this study contributed to health-related fitness and mental health and provided a new exploratory model. Despite all the success factors that have been adopted from the literature, the research model is novel, given that the real problems are clear in the literature and the actual work in schools for adolescents. This study investigated the issues and challenges related to male and female adolescents which were not investigated before in Iraqi society. These findings contribute new longitudinal evidence on the timeliness to develop a conceptual model that illustrates the moderating role of gender in the relationship of health-related fitness, depression, and self-esteem among adolescents. This study bridges the research gap in the literature and contributes to the field of study.

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