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Body Mass Index and Self-Esteem among Adults in Saudi Arabia: Examining Gender Differences

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Abstract

Self-esteem (SE) and obesity have been consistently linked across numerous studies. The present research explores this connection among adults living in Saudi Arabia. The main goals of this study are to examine the association between SE and body mass index (BMI) and to evaluate how sociodemographic factors interact with these variables. A cross-sectional design was adopted, with an online questionnaire collecting sociodemographic information, self-reported BMI, and responses to the Rosenberg Self-Esteem Scale.

Self-esteem levels remained largely stable across age groups, as indicated by the Chi-square test [X2 (12, n = 332) = 5.278, P-value = 0.948]. Among males, notable differences in SE levels were observed across the various BMI categories, indicating that BMI exerts a substantial effect on SE in this group. In both men and women, the findings demonstrated a negative relationship: higher BMI was associated with lower SE. This association reached statistical significance in both genders (P-value < 0.001). The effect was stronger in males (Estimate = −0.110, P-value < 0.001) compared with females (Estimate = −0.099, P-value < 0.001). For females, the negative association with education was more pronounced (−0.273) and highly significant (P-value < 0.001) relative to males (Estimate = −0.157, P-value < 0.001). Higher levels of education were linked to lower BMI (P-value = 0.018). In men, indirect effects revealed that education (Estimate = 0.0173*) and marital status (Estimate = −0.0405*) had significant influences on SE through mediating variables. Overall, BMI had a significant negative impact on SE in both genders, with a more marked effect among males. Comparisons of nested models highlighted meaningful gender differences in how these factors influence SE. A negative correlation exists between BMI and SE in both men and women, with the relationship stronger in men. These gender-specific patterns in the BMI-SE association emphasize the need to consider separate pathways for men and women in subsequent research.

Keywords: Body mass index, Self-esteem, Gender differences, Saudi Arabia

Introduction

In recent years, obesity has emerged as a complex and multifactorial condition that continues to affect populations on a global scale. Its prevalence has risen markedly over the past four decades and currently affects roughly one-third of the world's population [1, 2]. Projections indicate that by 2040, more than 50% of individuals will be classified as obese or overweight. This worldwide surge, often referred to as 'globesity', has received considerable attention [3–5]. Women show a higher likelihood of being overweight or obese than

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men, largely due to physiological changes related to pregnancy and childbirth, along with generally more sedentary lifestyles that increase their susceptibility to the adverse consequences of excess weight [4]. Obesity is associated with numerous comorbidities, including type 2 diabetes, various cancers, hypertension, heart failure, stroke, and hypercholesterolemia [6–8], all of which contribute to higher healthcare costs [9]. Consequently, individuals affected by excessive body weight often experience a diminished quality of life [10]. In addition to these adverse outcomes, individuals carrying excess weight or living with obesity often encounter bias and social stigma, which intensifies the difficulty of an already intricate problem [11]. Consequently, people with obesity generally show reduced self-esteem (SE) levels compared to those who are not obese [12–15], largely stemming from society's disapproving views toward them [16]. In addition, women experience a greater occurrence of negative body image than men, and this is connected to diminished SE along with several psychological challenges, including behavioral difficulties, depressive states, and hard-to-manage negative emotions [17–19]. The inverse association between SE and obesity is firmly established in the literature [20, 21], with studies from Jordan and Saudi Arabia further confirming this negative association [22, 23]. Some investigations propose a cause-and-effect relationship, mainly attributing it to insufficient nutrition and physical inactivity [24]. Moreover, a study conducted in Sanandaj, Iran, found that participation in a lifestyle training program resulted in greater weight loss and better SE scores, underscoring the favorable effects of weight loss on the psychological health of obese individuals [25]. Likewise, research in Esfahan, Iran, documented marked improvements in both SE and body mass index (BMI) following cognitive-behavioral therapy sessions, demonstrating that combining lifestyle changes with cognitive strategies can effectively reduce BMI and improve quality of life in obese patients [26]. A broad range of studies has confirmed that BMI, acting as an unfavorable biological element, promotes negative body image and increased worry about unfavorable judgments from others [19, 27–29]. Elevated SE is also associated with greater participation in physical exercise, which helps maintain a healthier weight [30], as well as improved eating behaviors, such as greater commitment to nutritious eating patterns, like the Mediterranean diet [31], and lower consumption of sugary soft drinks. While many studies have suggested a possible connection between SE and body weight [32–34], none have established a conclusive relationship.

Even though research on the multiple risk factors contributing to weight gain—including education, genetic makeup, biological aspects, sociodemographic elements, surroundings, and behavioral patterns—has expanded significantly [35, 36], the key processes that explain how these factors interact between men and women in Saudi Arabia are not yet fully understood. As far as we know, no prior investigation has examined the potential association between shifts in body weight and corresponding changes in SE among a large group of adults tracked longitudinally. The present study investigated SE, BMI, and various sociodemographic and lifestyle-related factors. Guided by the following research questions, we sought to evaluate the strength of the relationship between BMI and SE in the Saudi Arabian population: (1) What is the prevalence of obesity and SE in the examined sample? (2) Is there any association between the sociodemographic traits of the sample and levels of BMI and SE? What is the nature of the relationship between BMI and SE?

Materials and Methods

Design

This study adopted an observational, cross-sectional design. Data were collected from individuals living in Saudi Arabia to examine the relationships among BMI, SE, and participants' sociodemographic profiles.

The study relied on a convenience sample of literate Saudi Arabian adults aged 18 years and older. Sample size was calculated with the formula: $n = N * X / (X + N – 1)$, where X was defined as $Z\alpha/2 * p * (1 - p) / MOE^2$. Here, $Z\alpha/2$ stands for the critical value of the normal distribution at $\alpha/2$ (for example, at a 95% confidence interval, $\alpha = 0.05$ and $c = 1.96$), MOE represents the margin of error, p indicates the sample proportion, N refers to the population size, and n equals the sample size. Because the precise prevalence rate was unknown, a value of 50% was applied. This approach resulted in a calculated sample size of 384. Data collection over 4 months via an online survey yielded 332 completed responses. SE was the dependent variable, while the independent variables included age, gender, marital status, education, occupation, weight, height, smoking, and chronic illness. The cross-sectional framework also assessed the moderating influence of BMI.

Data collection method

Data were gathered via an online survey conducted over 4 months. The survey was shared across several social media channels to reach a wide, varied group of respondents. This strategy offered broad reach and ease of participation, enabling people from different regions and demographic groups to participate.

Instruments

The study employed three main tools to measure the relevant variables: sociodemographic characteristics, SE, and BMI. Sociodemographic information encompassed age, gender, marital status, education, occupation, weight, height, smoking status, and chronic illness. Self-esteem was measured with the Rosenberg Self-Esteem Scale (RSES) [37], scored according to the original guidelines, which group results into three levels: poor (0–14.9), average (15–25), and high (25.1–30). BMI was determined using the formula: (weight in kilograms / square height in meters) kg/m². BMI categories were classified as follows [38]: underweight (15–19.9), normal weight (20–24.9), overweight (25–29.9), Class I (30–34.9), Class II (35–39.9), and Class III (≥ 40).

Data analysis

Structural equation modeling (SEM) was conducted using the Analysis of Moment Structures (AMOS) software to investigate direct and indirect links between one or more independent latent variables and the outcome variables. This technique delivers a stronger, more complete assessment than standard multivariate procedures, such as multiple regression. SEM supports the simultaneous examination of multiple independent and dependent constructs. The data were initially recorded in an Excel file, examined for missing entries, and subsequently imported into the Statistical Package for the Social Sciences (SPSS). All statistical procedures were executed using SPSS version 23.0 (IBM, Armonk, NY, USA) under a 95% confidence interval. The dataset underwent thorough verification for accuracy and completeness. Although normality tests are routinely performed to confirm that continuous variables follow a normal distribution, categorical variables cannot be expected to follow a normal distribution, as they are not continuous. Nominal data consist of unordered categories without any ranking; examples include gender, marital status, and occupation. Unlike continuous or ordinal variables, nominal data lack numerical properties that would allow evaluation of skewness or kurtosis [39–42]. For example, response codes such as 1, 2, 3, and 4 might give the impression of equal spacing. Yet, certain higher categories could occur three times as frequently as the lowest one, which risks leading to inaccurate interpretations if equal intervals are incorrectly assumed [43]. For this reason, normality considerations do not apply to nominal data in the same manner as they do for interval or ratio data [44].

Ethical consideration

Ethical clearance, reference number UT-120-15-2020, was granted by the University of Tabuk Local Research Ethics Committee. An informed consent statement was included at the start of the questionnaire, and respondents who wished to join could complete the survey without supplying their name or telephone number. Participation was voluntary, and anonymity and confidentiality were maintained throughout the research. The principal investigator provided participants with complete contact details to facilitate informed consent.

Results and Discussion

Descriptive statistics of demographic variables

Table 1 presents a full summary of the distribution of several demographic characteristics in the study sample (N = 332). The variables examined include gender, marital status, education, employment status, smoking status, chronic illness status (ChronicDx), BMI categories, and RSES scores. The "Gender" variable shows how participants were divided by gender. Among the 332 respondents, 62.35% (207 individuals) were male. This shows that males formed a clear majority in the sample, highlighting a possible imbalance in gender representation.

On the other hand, 125 individuals, representing 37.65% of the total sample, were female. The gender breakdown in this research provides useful background on the representation of each gender within the Saudi cultural and religious setting, which may affect how broadly the results can be applied to wider populations. The chi-square test indicated a significant result (Chi-Square = 20.253, df = 1, P-value < 0.001), confirming a statistically meaningful difference in gender distribution. Furthermore, the chi-square test results (Chi-Square = 240.072, df = 3, P-value < 0.001) pointed to a substantial difference in the distribution of marital status among the study participants. Clear differences were also found in education levels, occupational categories, smoking status, rates of chronic illness, and BMI groupings. According to the RSES scores, most participants fell into the medium self-esteem category, while a smaller share showed low SE.

Table 1. Demographic and health variables with their chi-square tests.

Variable	Category	Percentage (%)	Frequency (n)	P-value	df	Chi-square
Age category (years)	18–25	50.6	168	< 0.001	6	431.08
	26–33	20.5	68			
	34–41	13.6	45			
	42–49	9.9	33			
	50–57	4.5	15			
	58–65	0.6	2			
	66–73	0.3	1			
	Overall total	100.0	332			
Sex	Male	62.35	207	<0.001	1	20.253
	Female	37.65	125			
	Overall total	100	332			
Marital condition	Unmarried	45.78	152	< 0.001	3	240.072
	Married	46.69	155			
	Separated/Divorced	5.12	17			
	Widowed	2.41	8			
	Overall total	100	332			
Educational level	Primary	2.11	7	< 0.001	6	403.169
	Middle school	2.41	8			
	Secondary school	23.49	78			
	Diploma	7.53	25			
	Undergraduate (Bachelor)	48.80	162			
	Postgraduate (Master)	3.31	11			
	Doctoral degree	12.35	41			
	Overall total	100	332			
Employment status	Working	46.08	153	<0.001	3	147.783
	Not employed	18.67	62			
	Retired	1.51	5			
	Students	33.73	112			
	Overall total	100	332			
Smoking status	Smoker	26.20	87	< 0.001	1	75.193
	Non-smoker	73.80	245			
	Overall total	100	332			
Presence of chronic illness	Yes	16.27	54	< 0.001	1	151.133
	No	83.73	278			
	Overall total	100	332			
Body Mass Index (BMI)	Underweight	14.46	48	< 0.001	5	244.867
	Normal	46.39	154			
	Overweight	18.98	63			
	Obesity class I	11.75	39			
	Obesity class II	5.12	17			
	Obesity class III	3.31	11			
	Overall total	100	332			
Rosenberg Self-Esteem Scale	Low	6.63	22	< 0.001	2	222.223
	Moderate	70.78	235			
	High	22.59	75			

Overall total	100	332

Abbreviations: df = degrees of freedom, and P-value = Probability value. A small P-value (≤ 0.05) suggests strong evidence against the null hypothesis.

Self-esteem scale by demographic and health variables

Table 2 reports the findings from the RSES across a range of demographic and health variables, evaluated using chi-square tests for independence. Participants' ages ranged from 18 to 73 years. Levels of SE remained largely unchanged across the various age groups (X2 [12, N = 332] = 5.278, p-value = 0.948). Distributions of SE levels were comparable for both male and female participants. No meaningful link was identified between gender and SE levels (X2 [2, N = 332] = 2.235, p-value = 0.327). Marital status exerted a significant effect on SE levels, with distinct marital categories associated with distinct SE outcomes. A clear relationship was observed between education level and SE, with higher educational attainment associated with greater differences in SE levels, demonstrating that education plays a key role in shaping SE. SE distributions also differed markedly across occupational groups, emphasizing the effect of occupation on SE. Moreover, SE levels showed significant variation between smokers and non-smokers, and the existence or lack of chronic diseases was significantly tied to SE, revealing that people with chronic conditions displayed different SE levels than those without. **Figure 1** depicts the distribution of SE levels across BMI categories specifically for males.

Table 2. SE scale by demographic and health variables.

SE Level	**Variables**	**Category**	**66–73**	**58–65**	**50–57**	**42–49**	**34–41**	**26–33**	**18–25**	**P-value**	**df**	**Chi-square**	**Total**
Self-esteem	Age categories of respondents	Poor	0	0	0	3	4	3	12	0.948	12	5.278	22
		Moderate	1	2	11	24	30	46	121				235
		High	0	0	4	6	11	19	35				75
		Total	1	2	15	33	45	68	168				332
Self-esteem	Gender	Category	-	-	-	-	-	Female	Male	0.327	2	2.235	Total
		Poor	-	-	-	-	-	5	17				22

		Moderate	-	-	-	-	-	91	144				235
		High	-	-	-	-	-	29	46				75
		Total	-	-	-	-	-	125	207				332
Self-esteem	Marital condition	Category	-	-	-	Widowed	Divorced	Married	Single	<0.001	6	242.096	Total
		Poor	-	-	-	6	13	2	1				22
		Moderate	-	-	-	2	4	95	134				235
		High	-	-	-	0	0	58	17				75
		Total	-	-	-	8	17	155	152				332
Self-esteem	Educational attainment	Category	Doctorate	Master	Bachelor	Diploma	Secondary school	Intermediate	Elementary	<0.001	12	147.594	Total
		Poor	0	0	0	0	22	0	0				22
		Moderate	14	9	116	25	56	8	7				235

		High	27	2	46	0	0	0	0				75
		Total	41	11	162	25	78	8	7				332
Self-esteem	Employment status	Category	-	-	-	Student	Retired	Unemployed	Employed	<0.001	6	67.434	Total
		Poor	-	-	-	9	0	4	9				22
		Moderate	-	-	-	93	5	58	79				235
		High	-	-	-	10	0	0	65				75
		Total	-	-	-	112	5	62	153				332
Self-esteem	Smoking habit	Category	-	-	-	-	-	No	Yes	<0.001	2	39.687	Total
		Poor	-	-	-	-	-	4	18				22
		Moderate	-	-	-	-	-	178	57				235
		High	-	-	-	-	-	63	12				75

		Total	-	-	-	-	-	245	87				332
Self-esteem	Presence of chronic illness	Category	-	-	-	-	-	No	Yes	<0.001	2	65.513	Total
		Poor	-	-	-	-	-	5	17				22
		Moderate	-	-	-	-	-	204	31				235
		High	-	-	-	-	-	69	6				75
		Total	-	-	-	-	-	278	54				332

Abbreviations: df = degrees of freedom, and P-value = Probability value. A small P-value (≤ 0.05) suggests strong evidence against the null hypothesis.

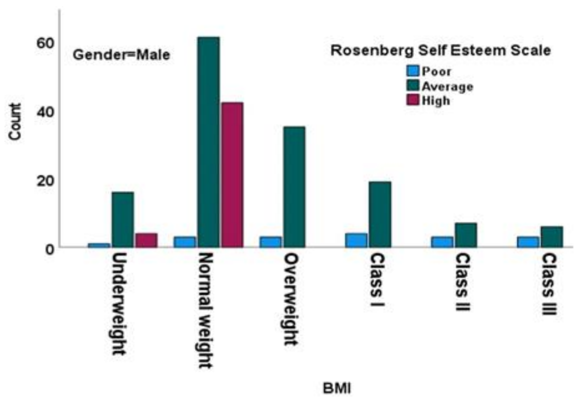

Figure 1. Chi-square test results for the Rosenberg self-esteem scale across BMI categories in males. Abbreviations: BMI = body mass index, and Df = degree of freedom.

We grouped SE scores into three distinct levels: poor, average, and high. Among underweight males, the largest proportion fell into the average SE level (16), followed by fewer in the high (4) and poor (1) levels. Within the normal-weight group, only three participants were classified as having poor SE, while substantially more were in the average (61) and high (42) levels. These findings suggest a favorable association between maintaining a normal weight and achieving elevated SE. Strikingly, no individuals from the overweight group, Class I obesity, Class II obesity, or Class III obesity categories reached the high SE level. Moreover, the chi-square test conducted among male participants revealed a statistically significant difference in SE levels across BMI categories, demonstrating that BMI groupings exert a considerable influence on SE among men. For females **(Figure 2)**, the majority of normal-weight participants were distributed between the average (29) and high (19) levels, with zero cases in the poor level. This distribution highlights a robust positive association between normal weight and higher SE (P-value < 0.001). In both genders, the highest SE level had the most participants, yet females recorded more cases at the high SE level than males. Across both sexes, members of the normal-weight category consistently showed elevated SE, although males had a modestly larger count in the high SE level. The chi-square test results confirm that BMI categories meaningfully affect SE levels in both men and women, with normal-weight individuals typically exhibiting superior SE compared with those in higher BMI categories. This pattern emphasizes the association between BMI and SE while illustrating the psychological consequences of weight status on self-image and personal confidence for males and females alike.

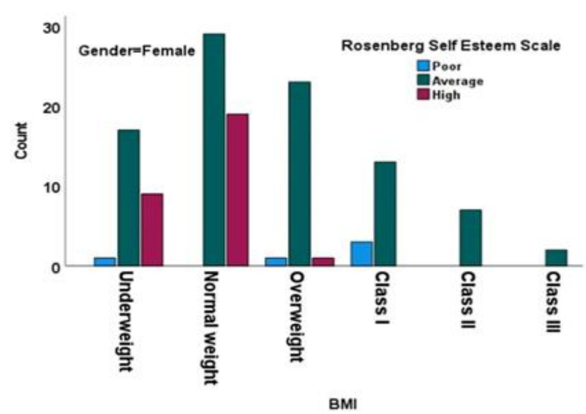

Figure 2. Chi-square test results for the Rosenberg self-esteem scale across BMI categories in females. Abbreviations: BMI = body mass index, and Df = degree of freedom.

Model fit diagnostics for unconstrained and constrained models

Table 3 compares the model fit measures for the unconstrained and constrained models (male and female groups). The evaluated indices consist of the Tucker-Lewis index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), root mean square residual (RMR), normed fit index (NFI), relative fit index (RFI), incremental fit index (IFI), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and chi-square value (CMIN). The male-versus-female model produced a CMIN/DF ratio of 2.1243, compared with 2.1388 for the unconstrained model. Additionally, the unconstrained model recorded an RMR of 0.0197, a GFI of 0.9957, and an AGFI of 0.9105. In contrast, the male-versus-female model showed values of 0.0449 for RMR, 0.9775 for GFI, and 0.9141 for AGFI. The Baseline Comparisons section reports the fit indices for both models, including NFI, RFI, IFI, TLI, and CFI, all of which indicated strong alignment. The unconstrained model yielded an RMSEA of 0.0587, while the male-versus-female model yielded 0.0584. Consequently, all indices satisfied the established acceptance thresholds [45].

Table 3. Model fit summary of unconstrained vs constrained (Male vs Female) models.

Model fit indices (CMIN)					
Model comparison	CMIN/DF	Significance (p-value)	Degrees of freedom (DF)	Chi-square (CMIN)	Number of parameters (NPAR)
Unrestricted model	2.1388	0.1178	2	4.2777	40
Comparison: Male vs Female	2.1243	0.0157	11	23.3675	31

Residuals and goodness-of-fit measures (RMR, GFI)			
Model comparison	AGFI	GFI	RMR
Unrestricted model	0.9105	0.9957	0.0197
Comparison: Male vs Female	0.9141	0.9775	0.0449

Baseline fit indices					
Model comparison	CFI	TLI (rho2)	IFI (Delta2)	RFI (rho1)	NFI (Delta1)
Unrestricted model	0.9936	0.9043	0.9941	0.8342	0.9889
Comparison: Male vs Female	0.9654	0.9055	0.9671	0.8353	0.9396

RMSEA statistics				
Model comparison	**PCLOSE**	**Upper bound (HI 90)**	**Lower bound (LO 90)**	**RMSEA**
Unrestricted model	**0.3242**	**0.1372**	**0**	**0.0587**
Comparison: Male vs Female	**0.3002**	**0.0914**	**0.0244**	**0.0584**

Abbreviations: CMIN = the chi-square value; NPAR = number of parameters; CMIN/DF = chi-square divided by degrees of freedom; RMR = root mean residual; GFI = goodness-of-fit index; AGFI = adjusted GFI; NFI = normed fit index; CFI = comparative fit index; RFI = relative fit index; TLI = tucker-lewis index; IFI = incremental fit index; RMSEA = root mean square error of approximation; LO 90/HI 90 = the 90% confidence interval for RMSEA; PCLOSE = tests whether RMSEA is close to 0.

Impact analysis

The findings reveal that, for both men and women, higher BMI is associated with lower SE, reflecting an inverse association **(Table 4)**. This inverse association was statistically significant in both genders (P-value < 0.001). However, the magnitude of BMI's influence on SE was somewhat greater among males, with an estimate of −0.110, in comparison to −0.099 for females. Although elevated BMI was associated with reduced SE across both groups, the effect appeared marginally stronger in males, suggesting that BMI may be more relevant for SE among men than among women. Overall, the negative relationship indicates that higher BMI is associated with lower SE. The impact remained more substantial for males (Estimate = −0.110, P-value < 0.001) than for females (Estimate = −0.099, P-value < 0.001).

Table 4. Gender-based differences in regression paths and nested model comparisons.

Path of regression	Gender group	Significance (P-value)	Critical ratio (C.R.)	Standard error (S.E.)	Coefficient (estimate)
SE ← BMI	Male	***	−4.628	0.024	−0.110
	Female	***	−3.315	0.029	−0.099
BMI ← Marital status	Male	***	2.821	0.130	0.367
	Female	0.080	1.750	0.177	0.310
BMI ← Educational level	Male	***	−2.356	0.067	−0.157
	Female	***	−3.994	0.068	−0.273
BMI ← Employment status	Male	0.462	0.735	0.066	0.049
	Female	***	−2.043	0.091	−0.186
BMI ← Smoking status	Male	0.420	−0.806	0.172	−0.139
	Female	0.704	−0.378	0.433	−0.164
SE ← Marital status	Male	***	−3.265	0.045	−0.148
	Female	0.959	−0.050	0.059	−0.003
SE ← Educational level	Male	***	6.539	0.023	0.151
	Female	***	4.081	0.024	0.098
SE ← Employment status	Male	***	−4.392	0.023	−0.099
	Female	***	−3.770	0.031	−0.116
SE ← Smoking status	Male	***	2.632	0.060	0.155
	Female	***	4.235	0.144	0.611
Model	**DF**	**CMIN**		***p*-value**	
Nested model comparisons					
Structural weights	9	19.089		***	
Structural residuals	20	104.853		***	
Male vs. Female	9	19.089		***	

Abbreviations: BMI = body mass index, S.E = standard error, and C.R = critical ratio. ∗P ≤ 0.05. ** P ≤ 0.01. *** P ≤ 0.001.

Among males, a positive association (Estimate = 0.367) emerged between certain marital statuses and higher BMI (P-value = 0.004). For females, a similar positive effect was observed (Estimate = 0.3095), though it did not reach statistical significance (P-value = 0.080). In males, higher education levels were negatively associated with BMI (Estimate = −0.157, P-value = 0.018). This negative association was even stronger among females (Estimate = −0.273) and reached high statistical significance (P-value < 0.001). For females, certain occupations showed a negative link to BMI (Estimate = −0.186, P-value = 0.040). In males, however, the association was not significant (Estimate = 0.049, P-value = 0.462). Regarding smoking status, no significant relationships were found for males (Estimate = −0.139, P-value = 0.420) or females (Estimate = −0.164, P-value = 0.704). For males, a negative association existed between specific marital statuses and SE (Estimate = −0.148, P-value = 0.001). Among females, this association was not significant (Estimate = −0.003, P-value = 0.959).

In both genders, higher levels of education were positively associated with SE. This positive relationship was stronger and highly significant for males (Estimate = 0.151, P-value < 0.001) than for females (Estimate = 0.098, P-value < 0.001). Across both genders, certain occupations were negatively associated with SE, with the relationship proving significant for males (Estimate = −0.099, P-value < 0.001) and females (Estimate = −0.116, P-value < 0.001). Smoking status showed a positive association with SE in both genders. The association was significant for males (Estimate = 0.155, P-value = 0.008) and highly significant for females (Estimate = 0.611, P-value < 0.001). The positive influence of smoking on SE was notably stronger for females (Estimate = 0.611, P-value < 0.001) compared with males (Estimate = 0.155, P-value = 0.008). Nested model comparisons revealed significant differences in structural weights and residuals between the male and female models. The chi-square values (CMIN) for the structural weights and the overall model were significant (P-value < 0.05), suggesting that gender alters the relationships between predictors and outcomes. In conclusion, higher education and smoking demonstrated positive ties to SE for both genders, while higher BMI consistently showed a negative tie. The effects of marital status and occupation on BMI and SE differed considerably between males and females.

Effect evaluation

Total effects

In males **(Table 5)**, smoking exerts a positive overall influence on SE (Estimate = 0.1702*), while education (Estimate = 0.1684*) and marital status (Estimate = −0.1885*) also show significant effects on SE. By comparison, BMI produces a negative influence on SE (Estimate = −0.1104*). Among females, smoking generates a considerably stronger positive overall influence on SE (Estimate = 0.6279*) than in males. Education similarly has a positive overall influence on SE (Estimate = 0.1259*), whereas occupation (Estimate = −0.0981, ns) and marital status (Estimate = −0.0337, ns) remain non-significant. BMI produces a negative influence on SE (Estimate = −0.0991*).

Table 5 Gender-based breakdown of total, direct, and indirect effects of BMI on SE.

Outcome	BMI	Marital condition	Educational level	Employment	Smoking
Male Participants					
Overall Effects					
BMI	0.000	0.3667*	−0.1569*	0.0485 ns	−0.1384*
SE	−0.1104*	−0.1885*	0.1684*	−0.1047*	0.1702*
Direct Associations					
BMI	0.000	0.3667*	−0.1569*	0.0485 ns	−0.1384*
SE	−0.1104*	−0.1480*	0.1511*	−0.0993	0.1549*
Mediated (Indirect) Effects					
BMI	0.000	0.000	0.000	0.000	0.000
SE	0.000	−0.0405*	0.0173*	−0.0054 ns	0.0153 ns
Female Participants					
Overall Effects					
BMI	0.000	0.3095*	−0.2733*	−0.1861*	−0.1640*
SE	−0.0991*	−0.0337 ns	0.1259*	−0.0981 ns	0.6279*
Direct Associations					
BMI	0.000	0.3095*	−0.2733*	−0.1861*	−0.164
SE	−0.0991*	−0.0030 ns	0.0989 ns	−0.1166*	0.6116*
Mediated (Indirect) Effects					
BMI	0.000	0.000	0.000	0.000	0.000
SE	0.000	−0.0307*	0.0271*	0.0184 ns	0.0163 ns

Abbreviations: BMI = body mass index, S.E = standard error, and C.R = critical ratio. ∗P ≤ 0.05. ** P ≤ 0.01. *** P ≤ 0.001.

Direct effects

For males, the direct influences indicate that smoking (Estimate = 0.1549*) increases SE, while education

(Estimate = 0.1511*) and marital status (Estimate = −0.1480*) are notable contributors. BMI continues to exert a negative direct influence on SE (Estimate = −0.1104*). For females, smoking creates a robust positive direct influence on SE (Estimate = 0.6116*), and occupation (Estimate = −0.1166*) shows a significant negative contribution. Education (Estimate = 0.0989 ns) and marital status (Estimate = −0.0030 ns) lack meaningful direct influences. BMI exerts a negative influence on SE (Estimate = −0.0991*).

Indirect effects

For males, the indirect influences demonstrate that education (Estimate = 0.0173*) and marital status (Estimate = −0.0405*) meaningfully affect SE through other mediating factors. Smoking and occupation show no significant indirect influences on SE. For females, education (Estimate = 0.0271*) and marital status (Estimate = −0.0307*) also exert significant indirect effects on SE, whereas smoking and occupation do not. Overall, both the total and direct influences of BMI on SE remain negative and statistically significant across genders, with the magnitude slightly stronger in men. Smoking has a clear positive effect on SE for both genders, but the effect is markedly stronger in females. Education positively shapes SE in both genders, whereas occupation and marital status display inconsistent patterns. Nested model comparisons reveal notable differences in how these variables shape SE between males and females, underscoring the value of examining distinct gender-specific pathways when investigating the link between BMI and SE. **Figure 3** presents the gender-specific demographic influences on SE.

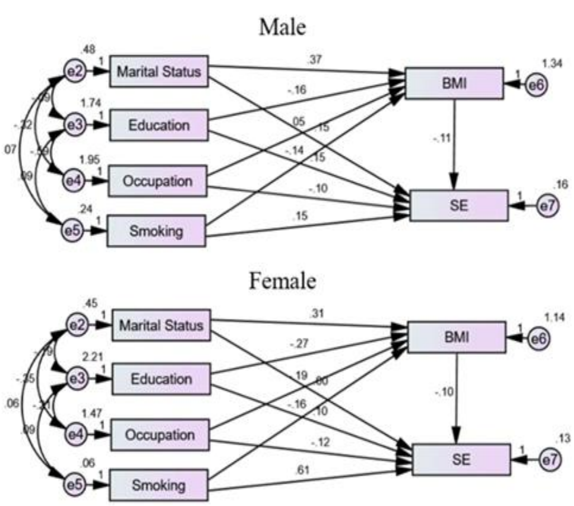

Figure 3. Gender-specific demographic impacts on SE. Abbreviations: BMI = body mass index, and SE = standard error.

This study examined SE levels in relation to a range of demographic, socioeconomic, and health-related variables. Participant ages ranged from 18 to 73 years, and SE levels showed remarkable consistency across these age groups, suggesting a stable pattern of SE throughout adult life. Existing research on SE stability in adulthood suggests that it varies according to different life phases. Trzesniewski *et al*. [46] reported that SE stability tends to be relatively low in childhood, strengthens during adolescence and early adulthood, and then begins to weaken in midlife and later years. Orth *et al*. [47] noted that SE generally rises from adolescence through middle adulthood, reaching its highest point between ages 50 and 60, before gradually decreasing in older age. The gender analysis indicated comparable SE distributions between males and females, with no statistically meaningful associations detected. This supports the notion that gender may not serve as a major determinant of SE [25]. Marital status proved to be a noteworthy factor, as different marital categories were connected to distinct SE levels. This may stem from the social and emotional benefits provided by relationships, including emotional support and social affirmation that often accompany marriage [48]. Education level demonstrated a robust positive link with SE, underscoring its importance in boosting self-worth and social position. This aligns with previous work showing that SE positively predicts academic involvement, which, in turn, closely relates to educational success [36]. In a similar vein, occupational status significantly influenced SE; employed individuals generally reported higher SE than unemployed individuals. This difference arises from the sense of identity and social recognition that work provides. Employment strengthens one's professional identity and contributes to greater self-confidence, a key element of SE [49], thereby illustrating the mental health advantages of active professional involvement.

Health-related variables also emerged as relevant, with smokers showing different SE levels than non-smokers. Prior studies, however, have frequently linked smoking to lower SE, which may in turn shape smoking habits. For example, Barros *et al*. observed that smokers tended to show reduced mindfulness and lower subjective well-being — factors closely tied to SE — relative to non-smokers [50]. Likewise, Carter and Byrne found that individuals with low SE, especially in academic domains and parent-child relationships, were more prone to smoking than their higher-SE counterparts [51]. The notable positive connection between smoking and SE observed here presents a paradoxical picture, implying that some people may perceive smoking as a socially enhancing or stress-reducing behavior that temporarily elevates self-confidence. The association between smoking and SE remains multifaceted and differs across studies. Although numerous investigations report a negative link between smoking and SE, certain findings suggest that, under specific circumstances, smoking may coincide with higher SE, particularly among females. A study conducted in Tabriz, Iran, for instance, indicated that SE had no meaningful conceptual influence on smoking behavior in males. Yet among females, smoking rates declined as SE decreased, which implies that higher SE could be connected to increased smoking in women [52]. Furthermore, the presence of chronic disease significantly affected SE levels, highlighting how physical health conditions can shape psychological well-being. Ji *et al*. reported that middle-aged and older adults living with chronic illnesses displayed lower SE, which in turn negatively influenced their overall quality of life [53].

The present study's results for both genders revealed a clear negative association between higher BMI and lower SE. This association reached strong statistical significance (P-value <0.001) in both males and females. The effect of BMI on SE was more pronounced in males (estimate of −0.110) than in females (−0.099). Consequently, although rising BMI is associated with declining SE across both genders, the magnitude of this effect appears somewhat greater in males. This suggests that BMI may be more important in shaping SE in men than in women.

Previous research has documented a stronger negative connection between BMI and body image among people with lower SE [54]. These observations align closely with the current findings, which emphasize the substantial role BMI plays in shaping an individual's sense of self-worth. Overall, the study confirms a negative correlation between elevated BMI and reduced RSES scores for both males and females.

In another investigation, researchers collected responses from 410 adolescents, of whom 51.2% were female, and 55.1% were aged 13-15 [15]. Girls recorded noticeably lower SE scores than boys in both the overweight and obese categories. Despite this, no meaningful connection appeared between SE scores and eating behaviors — especially family meals — within the overweight group, even though females had a lower average SE score overall. These outcomes align with the patterns observed in the current study, which illustrate the subtle differences in how gender and BMI categories shape SE. One previous study [23] indicated that only 6.1% of Saudi female undergraduates experienced poor SE. However, this rate climbed sharply to 9.8% among those who were overweight or obese. This result further supports the present findings, which underline the adverse influence of elevated BMI on SE in females.

Using path analysis to assess mediation, Skorek *et al*. [55] found that self-worth mediated the relationships among three personality traits and body esteem for both men and women. Greater extraversion, emotional stability, and conscientiousness were associated with higher SE, which, in turn, was associated with better body esteem. When SE was added to the model, the direct relationships between personality traits and body esteem became nonsignificant, suggesting complete mediation. This work reinforces the view that SE serves as a key mediator in the connection between BMI and overall satisfaction with body image.

In a separate piece of research, Satwik *et al*. [56] identified education level, BMI, social support, presence of mental illness, and perception of menopause as important predictors of negative body image. Negative body image occurred at a rate of 17.4% among middle-aged women and showed strong ties to both low SE and mood disorders. Lower educational attainment, higher BMI, unfavorable views of menopause, weak social support, and a history of mental health issues all raised the chances of experiencing poor body image in this group. Similarly, the current study confirms that BMI is among several major contributors to body image and SE.

Among pregnant Saudi women, Ghamri *et al*. [57] uncovered a clear positive association between SE and satisfaction with one's body. The research highlighted varying strengths of correlation involving body image satisfaction, SE, and socioeconomic elements such as education, income, smoking habits, and co-existing psychiatric or medical conditions. Participants also reported elevated SE during the early weeks of pregnancy. Taken together, these investigations demonstrate a firm link between body satisfaction and SE, with several factors — including BMI — exerting notable effects.

Shahzadi and Rasheed explored the ties between gender and SE in obese young girls and boys living in Punjab, Pakistan [58]. Their work focused on relationships among body image, BMI, dissatisfaction with body shape, and body measurements. Significant associations were found between gender, BMI, body shape dissatisfaction, and SE. Nevertheless, clear differences surfaced between girls and boys regarding SE and body image. Girls showed markedly higher average scores for body image dissatisfaction than boys, which contributed to reduced SE. The study advised using media platforms to promote positive body image and support mental and physical well-being.

In yet another study involving 55 participants (25 males and 30 females), Gómez-Díaz *et al*. [59] observed an average weight loss of 11 kg in females and 16.3 kg in males. Positive body image perception improved by 65.2% for women and 76.1% for men. SE levels also increased by 51.4% among women and 60.3% among men. These outcomes suggest that weight loss can lead to meaningful improvements in body perception and SE for both sexes, though males tended to benefit slightly more.

The present study adds support to earlier findings by confirming a robust negative association between BMI and SE in both males and females. Nevertheless, the strength of this association was modestly greater in men, highlighting the importance of designing SE-enhancing interventions tailored to the gender of the target group. One key limitation of this research is its cross-sectional design and relatively modest sample size, which may limit the broader applicability of the results. Furthermore, reliance on self-reported data collected through online surveys introduces the possibility of response bias. Additionally, the unique cultural and religious context of Saudi society may confound the relationships examined. Future research should continue to explore these gender differences while incorporating other relevant variables, such as socioeconomic status, psychiatric conditions, and broader cultural and social influences that could modify the link between BMI and SE. A deeper understanding of these complex dynamics would enable the development of more effective strategies to improve SE and overall well-being among individuals with higher BMI. The results of this study have considerable value for understanding participants' physical health and psychological state, and they may encourage subsequent statistical investigations into potential associations and effects involving BMI, SE, and other factors. The observed differences in SE across BMI categories among males suggest possible ties between physical condition and self-esteem that deserve further exploration. These outcomes underscore the complex nature of SE and the substantial role of socioeconomic, educational, occupational, and health-related factors. The complex interaction among socioeconomic conditions, cultural expectations, and individual coping mechanisms underscores the need for targeted interventions that address these core influences, thereby encouraging healthier lifestyle decisions and strengthening SE through safe, constructive approaches.

Conclusion

Although the effect was slightly stronger in men, the findings demonstrated a statistically significant negative relationship between BMI and SE for both men and women. This means that higher BMI is associated with lower SE in both sexes, with men experiencing a somewhat larger decline. In men, marriage or certain marital statuses were associated with higher BMI, whereas greater educational attainment was linked to lower BMI. In women, higher levels of education and certain occupations were associated with lower BMI. No statistically significant association between smoking and BMI appeared in either gender. Marriage was associated with lower SE in men but showed no effect in women. Higher levels of education were positively associated with SE in both genders, with a stronger effect in men. Certain occupations were associated with reduced SE in both genders, though the reduction was more pronounced in women. Smoking showed a positive association with SE in both genders, with the effect being larger in women.

Implications

To effectively address SE issues related to body weight, gender-specific interventions may be necessary, given that the negative impact of BMI on SE is more evident in men. To improve SE, focusing on BMI reduction may be more beneficial for men than for women.

The positive link between higher education and SE observed in both sexes suggests that educational programs designed to boost SE could have broad relevance. However, because the effect is more pronounced in men, such programs may be especially effective at elevating SE within this group.

The positive association between smoking and SE, particularly among women, highlights the importance of targeted anti-smoking campaigns that address the perceived SE benefits of smoking. Understanding the underlying reasons for smoking-related increases in SE is essential for creating more successful smoking-cessation programs.

Occupational health initiatives should incorporate mental health and SE components, as certain jobs can negatively affect SE. Given the stronger negative effect observed in women, customizing these programs to their specific needs could yield greater benefits.

Because marital status exerts a negative influence on SE in men, married men facing SE difficulties might benefit from marital counseling or support groups. For women, since marital status has little impact on SE, alternative forms of support should be considered.

Future research should further examine these gender differences and include additional variables such as socioeconomic status and mental health comorbidities that may affect the relationship between BMI and SE. Greater insight into these intricate connections can help design more effective strategies to enhance SE and overall well-being for individuals with higher BMI.

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