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Latent profiles and associated factors of body image in pregnant women

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This study aimed to investigate the status of body image among pregnant women and identify associated factors using latent profile analysis (LPA). This cross-sectional study was conducted using a convenience sample of 460 pregnant women in the gynecology outpatient clinic of a tertiary hospital in Zunyi between December 2023 and April 2024. Data on body image, demographic characteristics, quality of life, and E-health literacy were collected. Then, multiple stepwise linear regression was conducted to identify risk factors associated with level of maternal body image in the study participants. Lastly, latent profile analysis was used to classify participants based on their body image status. The results of the latent profile analysis revealed that 48% of participants exhibited high level body image dissatisfaction , 44.60% suffered from moderate level body image dissatisfaction , and the remaining 7.30% of patients had low levelbody image dissatisfaction . Additionally, significant differences were observed in scale scores and dimensions among the three categories (both $p < 0.001$). Finally, multiple regression analysis identified QOL (B = 0.65, $p < 0.001$), E-health literacy (B = 0.05, $p < 0.05$), and gestational age (B = -0.01, $p < 0.05$) as significant factors associated with body image among pregnant women. Body image dissatisfaction is highly prevalent among pregnant women in China. Thus, healthcare providers are recommended to prioritize addressing body image dissatisfaction and develop effective intervention strategies to improve the quality of life and e-health literacy of pregnant women.

Body image is a significant concept in psychological research that refers to an individual's perception, emotions, and behavioral responses regarding their physical appearance. It is a complex, multidimensional psychological construct encompassing perceptual dimensions (perceptions of body shape), emotional dimensions (attitudes towards and satisfaction with one's body), and behavioral dimensions (body-related behaviors)[1]. Notably, the development of body image is markedly influenced by biological, psychological, and sociocultural factors[2]. From a psychological perspective, body image not only impacts self-esteem and mental health but is also closely associated with eating disorders, depression, and anxiety[3]. Pregnancy, a unique experience for women, involves rapid and significant changes in body size and shape, frequently deviating from societal ideals of body image[4]. These changes primarily include an increase in the size of breasts, abdomen, hip, legs and thigh, accompanied by undesirable changes in skin and hair such as acne, stretch marks, cellulite, varicose veins, and thicker or oily hair[5]. Previous study found that pregnant women often experience dissatisfaction with their body image during pregnancy[6,7]. At the same time, the dissatisfaction with the body image of pregnant women leads to adverse effects on maternal health and well-being.

According to earlier studies, body image dissatisfaction during pregnancy not only increased the risk of body image dissatisfaction in the postpartum[8], but also may increase the risk of anxiety and depression during pregnancy[9,10]. Body image dissatisfaction and interoceptive sensibility significantly predict postpartum depressive symptoms.Factors such as partner support, self-regulation and acceptance of bodily changes may mediate or moderate this relationship.However, the relationship between body image dissatisfaction and anxiety and depression is bidirectional, given that dissatisfaction can both cause and exacerbate these conditions[11]. Meanwhile,dissatisfaction with body image during pregnancy is also associated with a weaker prenatal attachment with the fetus, including a decreased intention to breastfeed and shorter breastfeeding durations[12]. Interestingly, previous studies[13,14] have reported that dissatisfaction with body image may also result in physical diseases and adverse pregnancy outcomes. Indeed, pregnant women experiencing body image dissatisfaction may engage in harmful practices such as unhealthy dieting, fasting, and excessive defecation, which may adversely affect

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the fetus, resulting in outcomes such as low birth weight and preterm birth. In contrast, a positive recognition of body image changes during pregnancy is linked to improved mental and physical health, including fewer depressive symptoms, increased self-esteem, and a higher likelihood of adopting health-promoting behaviors[15].

Nonetheless, this psychological condition is typically overlooked by prenatal healthcare workers. A study[16] described that fewer than 1/3 of healthcare workers evaluate body image concerns during routine antenatal check-ups. This lack of attention highlights the pressing need for developing more effective strategies for assessing and addressing the diverse experiences of body image dissatisfaction among pregnant women. Potential profile analysis (Latent Profile Analysis, LPA) is a statistical analysis method based on a Person-Centered Approach[17]. It assumes the existence of a classification method that can categorize individuals[18], thereby enabling the identification of unique characteristics across different sub-groups. To the best of our knowledge, no recent studies have updated our understanding of the heterogeneity of body image subgroups in pregnant women. Hence, there is an urgent need to further investigate body image profiles among pregnant women.

Thus, this study aimed to identify potential categories of body image among pregnant women and investigate related factors using latent profile analysis in order to formulate targeted intervention and management strategies.

Methods
Study design and setting
This cross-sectional observational study utilized convenience sampling to recruit pregnant women from the Obstetrics Ward and Perinatal Health Department of the Affiliated Hospital of Zunyi Medical University, located in Zunyi City, Guizhou Province, China. The study was conducted from December 2023 to April 2024. The inclusion criteria comprised primigravid women aged between 18 and 45 years and a gestational age ranging between 30–37 weeks. Women with or undergoing treatment for any preexisting medical, surgical, or psychiatric illness were excluded from the study to minimize confounding factors.

Data collection
Three researchers independently conducted face-to-face data collection. Participants fulfilling the inclusion criteria were provided with detailed information regarding the nature of the study, purpose, and investigation procedures. All participants signed the informed consent form prior to participating in the study. A research questionnaire was developed using the Questionnaire Star platform by incorporating the relevant survey items, variables, and questions into the template. All questions were pre-tested to ensure accuracy and clarity. Participants accessed the questionnaire via a code or link generated by the platform. While the participants were completing the questionnaire, one researcher monitored the questionnaire filling status. To minimize invalid responses, incorrect or incomplete responses were reviewed and addressed in real time.

Sample calculation
The sample size for this cross-sectional study was calculated using PASS 15.0 software. According to previous studies, the prevalence of body image dissatisfaction in pregnant women was estimated at 34.1%[6]. With a 90% confidence level and a confidence interval width of 10%, the sample size was determined to be 262 patients. Considering a non-response rate of 20%, the sample size was adjusted to 328 individuals.

Measures
The self-administered questionnaire included items evaluating demographic characteristics (self-designed) and instruments to assess body image, quality of life, and health literacy.

Sociodemographic characteristics
Next, a standardized questionnaire was developed based on a review of relevant literature and in line with the study's objectives and administered to collect information such as age, occupation, residence, gestational age, educational attainment, and body mass index (BMI).

Body image pregnancy scale
The body image pregnancy scale (BIPS), originally developed by Sun Weijia[19], was translated and adapted into Chinese for use among pregnant women. Using exploratory factor analysis (EFA), the adapted scale identified nine dimensions, namely physical strength, appearance attention, facial features, attractiveness to the opposite sex, weight control due to appearance, appearance being prioritized over body function, appearance-related avoidance behavior, and physiological changes during pregnancy), and encompassing 35 items. Confirmatory factor analysis (CFA) demonstrated a strong model fit, with key indices such as RMSEA < 0.08, CFI > 0.90, and TLI > 0.90, indicative of a robust and reliable factorial structure for the Chinese context. The scale employed a 5-point Likert scoring method. The initial section assesses pregnant women's views on the physical aspects of pregnancy, ranging from 1 (strongly disagree) to 5 (strongly agree), whilst the subsequent section evaluates their satisfaction levels with physical changes, ranging from 1 (very satisfied) to 5 (very dissatisfied). Lastly, the third section examines behavioral evaluations, ranging from 1 (never) to 5 (always). The total score is calculated by summing the score of each item, with higher scores reflecting lower maternal body image levels. The Cronbach's alpha coefficient of the scale in this study was 0.94.Concurrent validity was established through significant correlations with measures of body image and eating pathology, including the Body Shape Questionnaire (BSQ; r = 0.65–0.80, p < 0.001), Body Image Concern Inventory (BIC; r = 0.60–0.75, p < 0.001), and Eating Disorder Inventory (EDI; r = 0.55–0.70, p < 0.001). In contrast, discriminant validity was supported by weak or non-significant associations with theoretically distinct constructs: psychological distress (Depression, Anxiety, and Stress Scales, DASS; r < 0.30, p < 0.001) and self-esteem (Rosenberg Self-Esteem Scale, RSES; r = 0.20–0.35, p < 0.001).

Quality of life[20]

The mainland Chinese version of the WHOQOL-BREF consists of 28 items, including 26 standard items from the original WHOQOL-BREF and two additional items unique to the Chinese version. Of the 26 standard items, two focus on overall quality of life and general health, whereas the remaining 24 items are distributed across four domains, namely physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items). The two items specific to the Chinese version are:"Does family friction affect your life?" and "How is your appetite?" These items were included at the end of the questionnaire, reflecting the cultural significance of family dynamics and appetite in Chinese culture as potential indicators of quality of life. Following the recommendations of the developers of the Chinese WHOQOL-BREF, these two culturally specific items were independently analyzed and not included in the domain scores to maintain comparability with the standard WHOQOL-BREF. The answers for each item were recorded on a 5-point Likert scale, with scores ranging between 1–5, and 1 and 5 denoting the minimum and maximum effects, respectively. A higher total of points scored corresponds to a higher QoL in the relevant domain[21].

Electronic health literacy[22]

The electronic health literacy (eHEALS)scale was developed by Norman and Skinner in 2006 and aims to assess electronic health literacy skills, especially the ability to evaluate online information and applications. The eHEALS scale is composed of 8 items, where respondents are asked to rate each item on a five-point Likert scale (strongly disagree, disagree, neither, agree, or strongly agree). Total scores range from 8 to 40, with higher scores indicating higher self-perceived eHL. The score of each item was calculated to obtain the mean score for all Items. The internal consistency of the collected eHEALS data was high, with a Cronbach alpha score of 0.932.

Statistical analysis

This study examined the optimal number of latent profiles representative of patients' perceptions of each dimension of body image. A range of models with one to four profiles was tested using Mplus 8.3 and robust maximum likelihood estimation for all analyses[23]. According to literature guidelines, information criteria (AIC, BIC, and SABIC), wherein lower values indicated a superior model fit, as well as likelihood-based tests (VLMRLRT and BLRT) were used to compare k profile solutions with k-1 profile solutions. A non-significant value ($p \geq 0.05$) for the k-profile solution supported the k-1 profile solution.

According to the relative entropy, values ranging from 0.0 to 1.0 indicate greater classification accuracy. Posterior probability analysis was conducted to determine the likelihood of profile inclusion, with values above 0.80 indicating a reliable solution for the profile. Then, a body image classification was established for pregnant women based on their most likely latent class. Several factors associated with body image were identified via multinomial latent variable regressions.

Ethical considerations

All procedures involving human participants in this study adhered to the ethical standards set by the institutional and/or national research committee, in line with the 1964 Helsinki Declaration and its subsequent amendments or comparable ethical standards.The study was approved by the Ethics Committee of the Affiliated Hospital Ethics Committee of Zunyi Medical University. All the participants have filled out an informed consent before participating in the study.

Results

Finally, 460 valid questionnaires were included after excluding invalid questionnaires. As listed in Table 1, the patients exhibited the following characteristics. The mean age of participants was 30.27 ± 4.71 years, with a BMI of 30.25 ± 7.98 and a mean Body Image in Pregnancy Scale (BIPS) score of 2.87 ± 0.57. A total of 164 patients (35.65%) experienced sleep disorders, while 85 patients (18.48%) had a history of adverse pregnancy outcomes. In addition, 223 patients (48.48%) originated from metropolitan regions, while the remaining 237 (51.52%) resided in urban or rural areas.

Based on the evaluation of the BIPS scale, several profiles were developed. The results of the LMR tests were not statistically significant, and Class 4 did not have the lowest BIC value (Table 2). According to the model fit indices, Class 3, which included three potential profiles, demonstrated the best fit. The results of the study are presented in Table 2. Class 1, 2, and 3 were subsequently categorized based on the average score of each item in the BIPS scale, and these distributions were further divided into three categories. Figure 1 illustrates the average score for each category. As displayed in Fig. 1, Class 3 had the highest overall score and was thus categorized as "low level of body image" (7.30%). Meanwhile, Class 2 was labeled as "Moderate level of body image" (44.60%), and Class 1 was labeled as "High level of body image" (48%).

The result of the post hoc analysis using the Turkey HSD method revealed that patients with higher levels of maternal body image scored higher on both the total scale score and each dimension compared to patients with moderate and low levels of maternal body image. Moreover, the group with moderate self-management behaviors scored higher than the group with a low level of maternal body image. The results are detailed in Table 3.

As summarized in Table 4, significant differences were noted in the BIPS scores among patients with different gestational ages ($p < 0.01$). Likewise, significant differences were observed in BIPS scores among patients with different levels of education ($p < 0.001$), areas of residence, and sleep disorders ($p < 0.001$).

Table 5 shows the results of the stepwise multiple linear analysis, which revealed that QOL (B = 0.65, $p < 0.001$), E-health literacy (B = 0.05, $p < 0.05$) and gestational age (B = −0.01, $p < 0.05$) were associated with body image dissatisfaction. The model unveiled that 49% of the variance in maternal body image was explained by the dependent and independent variables ($R2 = 64.9$, $p < 0.001$).

Variables	Categories	Mean (SD)	Frequency (N)	Percentage (%)
Age		30.27 ± 4.71		
BMI		30.25 ± 7.98		
Gestational age		36.36 ± 4.50		
Residence	City		237	51.52
	Countryside		223	48.48
Education	Elementary		22	4.78
	Middle school		136	29.57
	High school		65	14.13
	College		237	51.52
Occupation	Employed		130	28.26
	Unemployed		40	8.70
	Farmers		51	11.09
	Other		239	51.96
A history of bad pregnancy and childbirth	Yes		85	18.48
	No		375	81.52
Sleep-disorder	Yes		164	35.65
	No		296	64.35
Primary parturient	Yes		197	42.83
	No		263	57.17
Body image		2.87 ± 0.57		
QLF		3.24 ± 0.69		
E-health literacy		2.53 ± 1.08		

Table 1. Demographic characteristics of participants(N = 460).

Model	LL	AIC	BIC	aBIC	Entropy	LMR P-value	BLRT P-value	Category probability (%)
Class1	−5162.039	10,360.079	10,434.441	10,377.314				
Class2	−4718.988	9493.976	9609.65	9520.786	0.956	0.0011	0	0.87/0.12
Class3	−4423.739	8923.479	9080.465	8959.864	0.941	0.0001	0	0.47/0.45/0.07
Class4	−4343.415	8782.83	8981.128	8828.79	0.885	0.35	0	0.13/0.43/0.34/0.08

Table 2. Potential profile analysis indicators (N = 460).

Discussion

This study is the first large-scale national study to investigate body image levels among pregnant women in China using LPA. Herein, 48% of patients had a high level body image dissatisfaction, whereas 7.3% of patients displayed a low level body image dissatisfaction, consistent with the results of some previous research and inconsistent with the findings of other studies. For example, Chen Miao et al.[24] (2024) concluded that a significant proportion of pregnant women experience body dissatisfaction, in line with our results concerning the prevalence of high level body image dissatisfaction. However, other studies carried out in different cultural contexts, such as those conducted in Western countries, have reported lower levels of body image dissatisfaction among pregnant women, attributable to differences in cultural ideals surrounding pregnancy and body acceptance[25,26]. The high prevalence of body image dissatisfaction observed in this study may be attributed to several factors. Physiological changes during pregnancy, such as weight gain, changes in body shape, and fluid retention, can significantly affect a woman's perception of her body. These changes often deviate from societal beauty ideals that prioritize slimness and can result in increased body dissatisfaction. In China, where there is a strong cultural emphasis on physical appearance and "slimness" as an ideal of beauty, pregnant women may be more vulnerable to experiencing body image dissatisfaction[27,28].

In addition to physical changes, hormonal fluctuations during pregnancy, particularly increased levels of estrogen and progesterone, can affect mood and increase emotional sensitivity. Pregnant women may become more self-conscious and sensitive to their appearance, leading to a heightened focus on potential body imperfections. These biological changes could further exacerbate body dissatisfaction and the development of body image disorder[29]. It is also worthwhile acknowledging that social and psychological factors may play a critical role. In Chinese society, where traditional ideals of beauty and body size prevail, pregnant women may face societal pressures to maintain a certain appearance even during pregnancy. The social stigma associated with weight gain or changes in body shape may contribute to the high levels of maternal body image noted in this study. Additionally, a lack of comprehensive psychological support in prenatal care settings may leave pregnant women without adequate resources to cope with these body image issues[30]. In conclusion, the findings of this
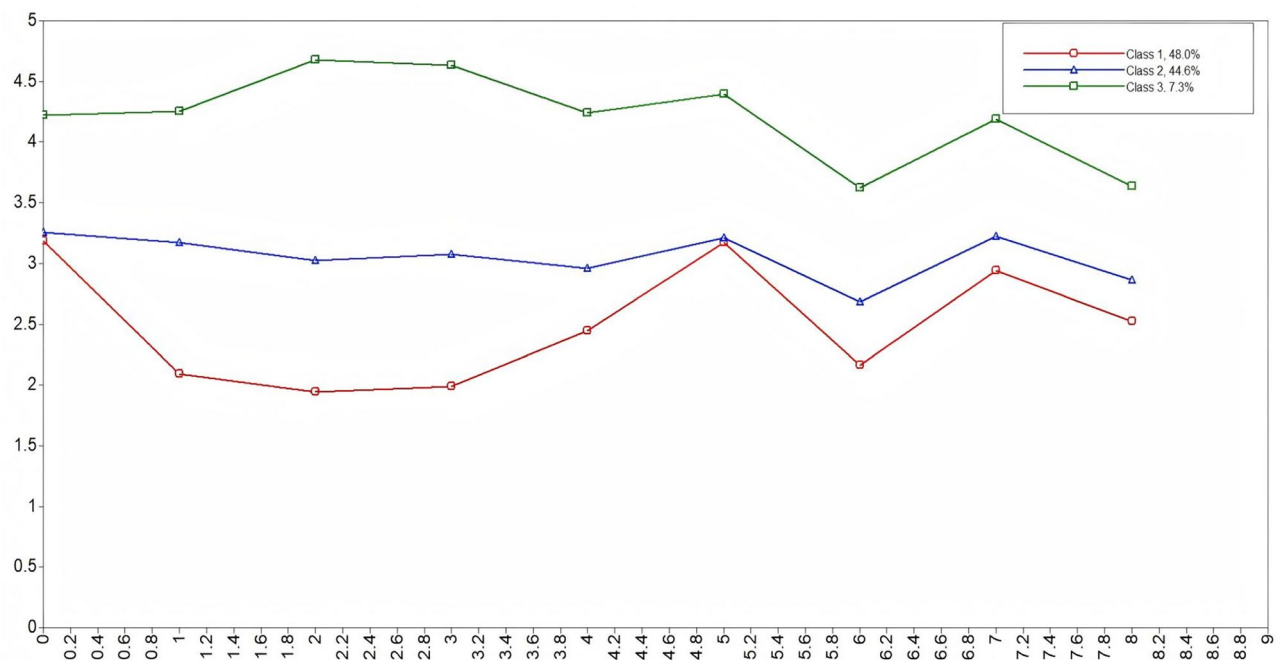
Fig. 1. Status of body image dissatisfaction. Note: Class1 = High levelof body image; Class2 = Moderate level of body image; Class3 = Low level of body image.

Variables	Class1 Mean ± SD	Class2 Mean ± SD	Class3 Mean ± SD)	F	P
Appearance attention	3.18 ± 0.34	3.05 ± 0.28	4.20 ± 0.50	25.25	< 0.001
Dissatisfaction with body parts	2.08 ± 0.44	3.16 ± 0.58	4.24 ± 1.07	317.04	< 0.001
Physical dissatisfaction	1.93 ± 0.38	3.02 ± 0.51	4.68 ± 0.46	695.06	< 0.001
Facial features are dissatisfied	1.97 ± 0.37	3.07 ± 0.50	4.63 ± 0.47	693.63	< 0.001
Dissatisfaction with physiological changes during pregnancy	2.44 ± 0.65	2.95 ± 0.57	4.23 ± 0.85	129.85	< 0.001
Appearance is superior to the body	3.17 ± 0.85	3.20 ± 0.71	4.39 ± 0.55	38.44	< 0.001
Appearance controls weight	2.14 ± 0.74	2.70 ± 1.03	3.59 ± 1.42	43.80	< 0.001
Attraction to the opposite sex	2.94 ± 0.54	3.22 ± 0.52	4.19 ± 0.80	76.60	< 0.001
Appearance-related avoidance behavior	2.52 ± 0.75	2.86 ± 0.78	3.64 ± 1.19	31.67	< 0.001
Body image	2.48 ± 0.34	3.05 ± 0.28	4.20 ± 0.50	454.76	< 0.001

Table 3. Body image scores and dimensions in different categories (n = 460).

study emphasize the need for a comprehensive approach to maternal care that addresses body image issues in addition to physical and mental health. Given the high prevalence of body image dissatisfaction in pregnant women in China, healthcare professionals are recommended to prioritize these concerns and incorporate strategies to promote positive body image as part of prenatal care.

To the best of our knowledge, this is the first study to explore the relationship between quality of life and level of maternal body image among pregnant women. The results uncovered that higher scores in quality of life among pregnant women were correlated with lower level of maternal body image. Similar previous studies have shown a correlation between body image and quality of life[31]. In addition,studies have pointed out that[32,33] individuals with more positive emotions, attitudes, and cognition towards their bodies are more likely to form a healthy self-concept, which is conducive to psychological well-being, personality development, and a better quality of life. To some extent, the physical appearance of an individual influences their self-worth. While changes in body image during pregnancy are natural physiological processes, many women struggle to accept these changes and become increasingly focused on alterations in their physical appearance. This heightened attention may negatively impact their body image perception, evoke distressing emotions, and ultimately diminish their quality of life. In contrast, those who have a relatively high level of acceptance toward body image changes during pregnancy typically maintain a positive perception of body image, which assists them in alleviating personal distress, minimizing the lifestyle and emotional impact of physical changes, and thus contributing to a higher quality of life.

Variables		Class1	Class2	Class3	F/c²	P
Age		30.46(4.68)	29.92(4.50)	31.18(4.94)	1.375	**0.25**
BMI		29.79(7.28)	30.63(8.55)	30.93(7.98)	0.72	**0.48**
Gestational age		36.75(3.94)	36.27(4.29)	34.35(7.67)	4.31	0.014
Residence	City	118	109	10	7.25	0.027
	Countryside	101	98	24		
Education	Elementary	7	9	6	16.53	0.011
	Middle school	68	59	9		
	High school	28	30	7		
	College	116	109	12		
Occupation	Employed	63	58	9	10.65	0.1
	Unemployed	18	16	6		
	Farmers	32	15	4		
	Other	106	118	15		
A history of bad pregnancy and childbirth	Yes	39	37	9	1.56	0.46
	No	180	170	25		
Sleep-disorder	Yes	64	83	17	8.78	**0.012**
	No	155	124	17		
Primary parturient	Yes	93	92	12	1.02	0.6
	No	126	115	22		
QOL		2.51(0.32)	2.97(0.35)	3.25(1.19)	75.39	P < 0.001
E-health literacy		2.24(0.89)	2.71(1.10)	3.25(1.49)	19.78	P < 0.001

Table 4. Demographic and characteristics by latent profile(N = 460).

Model	Variable	Unstandardized coefficients		Standardized coefficients			95.0% Confidence interval for B		R²	P
		B	Std. error	Beta	t	Sig	Lower bound	Upper bound		
1.00	(Constant)	0.96	0.11		8.71	0.00	0.74	1.17		
	Quality of life	0.69	0.04	0.64	17.68	0.00	0.61	0.77		
2.00	(Constant)	1.41	0.20		7.00	0.00	1.01	1.81		
	Quality of life	0.69	0.04	0.63	17.66	0.00	0.61	0.76		
	Gestational age	−0.01	0.01	−0.10	−2.67	0.01	−0.02	0.00	64.9	P < 0.01
3.00	(Constant)	1.39	0.20		6.93	0.00	1.00	1.79		
	Quality of life	0.65	0.04	0.60	15.36	0.00	0.56	0.73		
	Gestational age	−0.01	0.01	−0.09	−2.63	0.01	−0.02	0.00		
	E-healthy	0.05	0.02	0.09	2.24	0.03	0.01	0.09		

Table 5. Multivariate analysis (stepwise) of predictors for body image (body image score). a. Dependent variable: Toal scores of body image.

Furthermore, this study explored the relationship between electronic health literacy and level of maternal body image among pregnant women. The results exposed that higher scores in electronic health literacy among pregnant women were associated with lower levels of level of maternal body image. This finding may be ascribed to the following factors. To begin, women with high e- literacy may have high socioeconomic status and this also may explain higher efficiency in searching and accessing health information[34], and can more accurately identify and screen relevant information that is conducive to reducing body image concerns. Besides, they can improve their ability to communicate with healthcare professionals by leveraging network health information and make informed decisions on body image management[35]. On the other hand, pregnant women with low levels of e-health literacy face challenges in accessing health information through online platforms. High levels of e-health literacy not only promote constructive communication between pregnant women and healthcare workers but also assist in alleviating anxiety related to body image during pregnancy[36,37]. Therefore, e-health literacy should be promoted in pregnant women by integrating e-health literacy training into comprehensive body image management programs to encourage pregnant women to better accept changes in body image, effectively use electronic health resources, adopt a healthy lifestyle, and improve their satisfaction with body image during pregnancy.

The present study identified a significantly negative association between gestational age and the mean body image score, suggesting that body image disturbance decreases as pregnancy progresses, in line with the observations of previous studies. Aksoy et al[38]. observed that pregnant women in the later stages of pregnancy

reported a more positive perception of their body changes compared to those in the early stages. This finding may be ascribed to reduced societal pressure for thinness as maternal identity becomes salient, a shift supported by social role theory, Postpartum studies further indicate that motherhood prioritizes functional body appreciation over aesthetic ideals[39–41]. Therefore, healthcare professionals are recommended to prioritize the early identification and management of level of maternal body image during pregnancy and devise strategies to improve body image management protocols, dietary plans, and exercise guidance, and promote reasonable weight control. These interventions may reduce the degree of body image changes, especially in pregnant women in the third trimester.

This study boasts several strengths. This was the first study to use latent profile analysis to investigate level of maternal body image in pregnant women and provide targeted intervention strategies for the management of this condition. Furthermore, it is the first study to explore the relationship between level of maternal body image and QOL while also validating the effects of demographic factors, QoL, and e-health literacy on level of maternal body image among pregnant women. Nevertheless, some limitations of this study cannot be overlooked. Firstly, this study was performed in a single hospital, which may limit the generalizability of the findings. To validate the conclusions of this study, further studies should include pregnant women from multiple provinces in China and from other countries. The possibility of reporting bias cannot be excluded, given that all participants self-reported their body image level.

Conclusion

In summary, this study demonstrated that pregnant women experience severe body image dissatisfaction. Moreover, the results indicate that three factors—quality of life, gestational age, and e-health literacy—are associated with a higher risk of developing body image dissatisfaction among pregnant women. Therefore, future studies are warranted to evaluate and improve the management of level of maternal body image. The present study addresses a critical knowledge gap and provides valuable insights for designing level of maternal body image protocols and highlights the need for developing a standardized framework for body image management during pregnancy.

Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Competing interests

The authors declare no competing interests.

Additional information

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