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Prevalence of Underweight, Overweight, and Obesity in Women in the First Trimester of Pregnancy in Zahedan, Iran, 2022

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ABSTRACT

Background: Underweight, overweight, and obesity in pregnant women are addressed as a importance result of the mother and child health. The purpose of this study is to ascertain the prevalence of underweight, overweight, and obesity in pregnant women in Zahedan city, southeast Iran, and also to determine any related demographic factors. **Methods:** The present cross-sectional study included 702 women in their first trimester of pregnancy in urban and rural areas of Zahedan from 20 healthcare centers in 2022. The measurements of women who had attended the first trimester visit up to the 12th week of pregnancy in Electronic Health Records, known as SIB were collected. Moreover, data were analyzed using descriptive statistics, Pearson's correlation coefficient, and chi-square test. P-value < 0.05 was considered statistically significant. **Results:** The findings indicated that 80 (11.4%) of the pregnant women were underweight, 371 (52.8%) had normal weight, 157 (22.4%) were overweight, and 94 (13.4%) were obese. Moreover, the mean body mass index was 23.98±5.04 kg/m^2. Bivariate correlations revealed that obesity and overweight status were significantly associated with age, systolic blood pressure (SBP), resident status, level of education, and the number of children. **Conclusions:** According to the findings, obesity, overweight, and underweight in the first trimester of pregnancy are significant public health concerns in society. Informing women at their reproductive age through educational interventions for weight management is recommended in this specific area.

Introduction

Underweight, overweight and obesity are major health concerns worldwide, as highlighted by the World Health Organization (WHO). These issues are particularly significant during pregnancy due to the potential complications they can cause and the importance of maternal and fetal health (Gregor *et al.*, 2016, Simko *et al.*, 2019). According to the body mass index (BMI) criteria of the WHO, participants are classified as underweight: BMI < 18.5; normal: 18.5 ≤ BMI < 25.0; overweight: 25.0 ≤ BMI < 30.0; and obese: BMI ≥ 30.0 (Mohajan and Mohajan, 2023). The prevalence of underweight, overweight and obesity were estimated at 6.76%,

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19.2%, 7.56% in Romanian population (Panaitescu *et al.*, 2019); 5.9%, 40.1%, 21.2% in Dhaka, Bangladesh (Goon, 2013); and 0.8%, 34.9%, 41.0% in Moroccan pregnant women (Taoudi *et al.*, 2021), respectively. From 1990 to 2004, the incidence of maternal overweight and obesity increased from 9.9% to 16% globally, and in Europe, it ranged from 26.8% to 54% (González-Plaza *et al.*, 2022, Heslehurst *et al.*, 2007). In 2014, there were 38.9 million pregnant women worldwide who were either overweight or obese (Chen *et al.*, 2018). Although it is less widespread in developing countries compared to developed ones (Goon, 2013), in Tehran, the capital of Iran, the prevalence of underweight, overweight and obesity in pregnant women was reported at 2.7%, 35.4%, and 10.5%, which is worth considering (Abdollahi *et al.*, 2021).

Underweight, overweight, and obesity, as malnutrition conditions, are accompanied by adverse outcomes for the mother and fetus. Gestational diabetes Mellitus (GDM), hypertensive disorders of pregnancy, preeclampsia, obstructive sleep apnea, infections, thromboembolic disorders, spontaneous abortion, and risk of cesarean section for the mothers are some of the complications that can arise (Catalano and Ehrenberg, 2006, Johns *et al.*, 2022, Van Mackelenbergh *et al.*, 2016). They can also increase the risk of childhood allergies, shoulder dystocia, hemorrhage, congenital malformations, macrosomia, increased neonatal intensive care admissions, low birth weight, intrauterine growth restriction, and prematurity during childbirth, higher neonatal mortality, and long-term developmental issues (Cochrane *et al.*, 2019, Godfrey *et al.*, 2017, Payande *et al.*, 2013, Taoudi *et al.*, 2021, Young and Ramakrishnan, 2021). Furthermore, malnutrition during pregnancy period can have irreparable consequences. According to the research on the Dutch famine, malnutrition in early pregnancy boosts the risk of coronary heart disease and an atherogenic lipid profile in later life (Kyle and Pichard, 2006). Additionally, mothers with poor nutritional status have been linked to an increase in labor time, greater bleeding, low birth weight babies, micronutrient deficiencies such as iron and folate, and an increasing risk of congenital anomalies (Zammit *et al.*, 2007).

Despite the complications associated with being underweight, overweight, and obese during the pregnancy period, to the best of the researchers' knowledge, no related study in Zahedan city was found. On the other hand, assisting women in understanding the serious risks associated with malnutrition and informing them to develop sustainable lifestyle changes could help to reduce the prevalence of underweight and obesity in pregnant women in this low-income area of the country.

Materials and Methods

Study design

The current cross-sectional study was conducted in healthcare centers in Zahedan city, southeast Iran. A retrospective data collection process was used to gather information from pregnant women who had attended the first-trimester visit in 2022. Exclusion criteria were the existence of organic defects or underlying disease.

Sample Size and Sampling Method

The minimum required sample size was based on the estimation of proportion formula (Chow *et al.*, 2017), with a prevalence for obesity of 27% (Panaitescu *et al.*, 2019), a confidence level of 0.95, a precision of 0.04, and a cluster effect of 1.4 computed as 663 eligible pregnant women. In the data collection phase, the authors collected 702 eligible samples (Urban: 500; Rural: 202).

A multi-stage cluster sampling method was employed for the subjects' selection. The living area (rural/urban) was set as the stratum. Twenty health centers (12 out of 22 urban; 8 out of 10 rural) were randomly selected from the comprehensive health services centers (clusters) of Zahedan city. Each center represented different regions based on its socio-economic status. Samples were chosen according to the probability proportional to the size (PPS) of the health center/house. Finally, information was collected from each selected health center/house using convenience sampling. In each center, the records of all the pregnant women were checked, and those

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who had attended for the first-trimester visit (up to the 12th week of pregnancy) were identified and included in the study, except for those who had organic defects or underlying diseases.

Data collection and measurements

Questionnaires were completed and provided information about the mother's age, weight, height, residence status (urban/rural), educational level (illiterate/high school diploma or lower/university degree), occupation, number of previous births, systolic blood pressure (SBP), diastolic blood pressure (DBP), and husband's occupation. All data was collected via the integrated health system, known as SIB (Daneshparsian). The information of each mother remained confidential. The SIB data was measured using standard measurement methods. Weight was recorded using a well-calibrated and standard scale with participants standing without shoes and wearing light clothing. Height was taken to make participants stand upright with their shoes off and their heels, hips, shoulders, and back of the head attached to the wall. It was measured with a tape measure. The BMI as weight/(height)^2 (kg/m^2) was calculated for each individual. According to the criteria of the WHO, participants were classified as obese if their BMI was greater than or equal to 30. Overweight was defined as a BMI range of 25.0 to 29.9. A BMI range of 18.5 to 24.9 was a normal weight range and underweight was defined as a BMI lower than 18.5 (Mohajan and Mohajan, 2023).

Ethical cosiderations

The present study proposal (code:10733) was approved by the Ethics Committees of Zahedan University of Medical Sciences (ZAUMS), Zahedan, Iran. (approval ID: IR.ZAUMS.REC.1401.252)

Data analyses

Descriptive statistics such as mean, standard deviation (SD), frequency, and percentage were used to summarize the features of the sample. The normality of the quantitative data was assessed using the Shapiro-Wilk test, and quantile-quantile plots. To examine the relationships between variables, statistical tests including independent t-test, one-way analysis of variances (ANOVA), chi-square test, Fisher's exact test, Pearson's correlation coefficient, and multiple regression model were employed. A P-value less than 0.05 was considered as significant. All the analyses were done using SPSS ver. 16 (IBM Crop., Armonk, NY, USA).

Results

Sociodemographic findings of pregnant women:

702 pregnant women with a mean age of 26.6±6.5 years old (Range:13-45) entered the survey in the 12th week of their pregnancy period. The number of children was between 0 to 9. 72 women (10.3%) were illiterate, 554 (78.9%) had a high school diploma or lower, and 76 (10.8%) had a university degree. Most of the women (95.2%) were housekeepers. The frequency of the husbands' occupations who were employed, self-employed, or unemployed was 58 (8.3%), 552 (78.6%), and 92 (13.1%), respectively. The distribution of resident status is dominated by urban population (71.2%). Additionally, the mean for height, weight, SBP, and DBP was 60.21, 158.38, 100.08, and 64.34, respectively. **Table 1** reports summary characteristics of the demographic features of the sample.

The distribution of the BMI in this study was as follows: 80 (11.4%) of all pregnant women were underweight, 371 (52.8%) had normal weight, 157 (22.4%) were overweight, and 94 (13.4%) were obese (**Figure 1**). The mean BMI also was estimated as 23.98±5.04 kg/m^2.

Table 2 reports the prevalence of malnutrition in the population subgroups. It also assesses the association between BMI and other characteristics such as age, resident status, education level, number of previous labors, and blood pressure (BP). The findings revealed that all the relationships between BMI and the other variables of interest were statistically significant (P<0.05) except for DBP. The results indicated that BMI was higher in women aged > 35 (P<0.001), and 51.4% of this age group were overweight or obese. The prevalence of being overweight/obese was about 19% higher in urban residents in comparison with their rural counterparts, which was statistically very important (P<0.001). In addition, the findings revealed that the

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prevalence of obesity in illiterate women (23.6%) was more than those with other education levels (*P*=0.031). Furthermore, the prevalence of obesity was approximately 12% higher in mothers who had three or more children in comparison with mothers with less than three children (*P*=0.002). The mean SBP was also higher in overweight/obese women than their normal/underweight counterparts (*P*<0.001).

The results of Pearson's correlation coefficients indicated that the mother's age (r=0.24; *P*<0.001), SBP (r=0.22; *P*<0.001), and DBP (r=0.09; *P*=0.01) were highly correlated with maternal BMI. The findings of the multiple regression model also demonstrated that age, resident status, and SBP were three effective predictors of mothers' BMI (adjusted-R^2 = 12%) (**Table 3**). In this way, increasing women's age led to an increase in BMI, and rural residents had lower BMI. Moreover, increased SBP was positively associated with BMI.

Discussion

Investigating the prevalence of obesity is an important step in society's health and disease prevention, and its investigation into pregnant women can be far more determined due to its impact on the health of future generations of society. This study was conducted on 702 pregnant mothers in the first trimester of pregnancy. The findings showed the prevalence of underweight, overweight, and obesity in women was 11.4%, 22.4%, and 13.4%, respectively. The reason for recording information up to the 12th week was that the weight of the fetus does not affect the weight of the mother. To the best of the authors' knowledge, no studies reported the prevalence of obesity or overweight in pregnant women of Zahedan city.

Pre-pregnancy BMI and weight gain during pregnancy are so important in delivery complications and have long-term effects on infants' lives. A study in Iran determined that mothers' BMI significantly differs in the two groups of low and normal birth weight infants (Nazari *et al.*, 2013). A positive correlation between maternal obesity and child BMI has been elaborated in several studies (Flores *et al.*, 2024, Önnestam *et al.*, 2022, Rerkasem *et al.*, 2024). Besides, the quality of maternal lifestyle before pregnancy has a role in child weight management (Dhana *et al.*, 2018). Lack of normal weight in mothers can cause irreparable consequences for both mother and child like preeclampsia, postpartum hemorrhage, neonatal hypoglycemia, and a higher rate of preterm birth (Steffen *et al.*, 2024, Syböck *et al.*, 2023).

Table 1. Descriptive statistics of the demographic characteristics of women in the first trimester of pregnancy in Zahedan, Iran, 2022.

Characteristics	n (%)
Age (y)	
≤20	144 (20.5)
20-35	484 (68.9)
>35	74 (10.5)
Body mass index (kg/m^2)	
<18.5	80 (11.4)
18.5-24.9	371 (52.8)
25-29.9	157 (22.4)
≥30	94 (13.4)
Resident status	
Urban	500 (71.2)
Rural	202 (28.8)
Level of education	
Illiterate	72 (10.3)
High school iploma or lower	554 (78.9)
University degree	76 (10.8)
Mother's occupation	
Housekeeper	668 (95.2)
Self-employed	12 (1.7)
Employee	22 (3.1)
Husband's occupation	
Unemployed	58 (8.3)
Self-employed	552 (78.6)
Employee	92 (13.1)
Number of children	
0	166 (23.6)
1	194 (27.6)
2	147 (20.9)
≥3	195 (27.8)
Cuantitative variables	**Mean ± SD**
Weight (kg)	60.21±13.26
Height (cm)	158.38±5.63
Systolic blood pressure (mmHg)	100.08±10.25
Diastolic blood pressure (mmHg)	64.63±7.54

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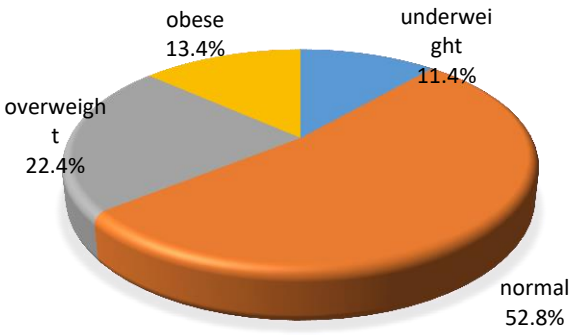

Figure 1. Distribution of body mass index of women in the first trimester of pregnancy in Zahedan, Iran, 2022.

The findings in the prevalence of categories of BMI were largely consistent with the research conducted in developing Asian nations. For instance, in a study on 1252 women in Turkey, 7.9% of pregnancies were thin, 60.3% were normal, 23.7% were overweight, and 8.1% were obese at the initial stage of pregnancy (Çalik *et al.*, 2018). Another study in Jordan showed that 33.6% and 38.8% were overweight and obese respectively (Al Nsour *et al.*, 2013). According to Goon et al.'s study, 5.9% of Bangladeshi women were underweight, and 61.3% were overweight or obese during their first trimester of pregnancy (Goon, 2013). Investigations in other cities of Iran indicated aligned outcomes in obesity prevalence with this study. According to a study in Tehran, 10.5% of pregnant women were obese (Abdollahi *et al.*, 2021)

According to this research, about 50% of women over the age of 35 were overweight or obese, which indicated a relationship between higher BMI and older age. The results about the relation between age and BMI were consistent with the findings of different studies. In China in 2008, Leung et al. illustrated that increasing women's age leads to an increase in BMI (Leung *et al.*, 2008). Aging is accompanied by mechanisms that are among the factors causing obesity; such as changes in the hormonal system, reduction in lean body mass, and growth hormone reduction (Jura and Kozak, 2016). However, some studies such as Selltrom et al. did not find a connection between mothers' age and obesity (Sellström *et al.*, 2009).

This study also revealed a greater rate of obesity among urban mothers, while the underweight rate was higher in rural settings. As previous studies showed in urban sites and economically developed areas, overweight and obesity are more prevalent. However, according to a study in China (Dong *et al.*, 2022), the intergenerational transmission of obesity in rural areas may be higher than urban areas. According to a survey by Thapa et al., the prevalence of obesity and overweight was greater in urban areas and grew as socioeconomic level scores climbed (Thapa *et al.*, 2021). One probable hypothesis is differences in lifestyle; for instance, lack of exercise in urban populations. Work stress also has a substantial role in the development of obesity or deterioration underweight in bigger societies (Kivimäki *et al.*, 2006). The higher prevalence of underweight among rural women compared to their urban counterpars may be attributed to socioeconomic disparities, limited access to nutritional and healthcare services, and lower awerness of pregnancy-related nutritional needs in rural areas (Rahman *et al.*, 2016).

The findings indicated that university-educated women had a lower incidence of obesity, which corroborated with many studies. For instance, in the studies by Chung and Lim (Chung and Lim, 2020), and Murakami et al. (Murakami *et al.*, 2017) the prevalence of obesity was largely higher in less-educated women. It seems that the women with higher education have a greater sense of control than the others. Thus, these women avoid harmful behaviors and mostly are more informed about health-related issues (Mirowsky and Ross, 2007, Weyers *et al.*, 2010). Some women with university education who have unhealthy lifestyles are more vulnerable to obesity development under work stress, so it can explain the inconsistency in research findings about the association between education and obesity (Fujishiro *et al.*, 2015).

The rate of obesity was the highest in mothers with more than three children in this study. McKeating et al. showed the percentage of obesity is the highest in mothers with more than four children, and that the rate of obesity increases with

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aging (McKeating *et al.*, 2015). In addition,, one of the characteristics that Biggers et al. concluded is associated with an increased risk of obesity in children (Martin-Biggers *et al.*, 2017). It can be the result of physiological weight gain after childbirth which can be attributed to hormonal shifts and lifestyle modifications of mothers. Nutritional or psychological interventions can be employed to prevent the detrimental consequences (Nartea *et al.*, 2019).

Table 2. Prevalence of weight status according to the demographic subgroups and their associations in women in the first trimester of pregnancy in Zahedan, Iran, 2022.

Characteristics	Underweight (n=80)	Normal (n=371)	Overweight (n=157)	Obese (n=94)	P-value
Age (y)					
≤20	28(19.4)[a]	87(60.4)	23(16)	6(4.2)	<0.001
20-35	47(9.7)	253(52.3)	111(22.9)	73(15.1)	
>35	5(6.8)	31(41.9)	23(31.1)	15(20.3)	
Resident status					
Urban	42(8.4)	252(50.4)	129(25.8)	77(15.4)	<0.001
Rural	38(18.8)	119(58.9)	28(13.9)	17(8.4)	
Level of education					
Illiterate	4(5.6)	41(56.9)	10(13.9)	17(23.6)	0.031
Diploma or under	69(12.5)	290(52.3)	125(22.6)	70(12.6)	
University	7(9.2)	40(52.6)	22(28.9)	7(9.2)	
Number of children					
0	24(14.5)	98(59.0)	33(19.9)	11(6.6)	
1	26(13.4)	98(50.5)	45(23.2)	25(12.9)	0.002
2	15(10.2)	82(55.8)	35(23.8)	15(10.2)	
≥3	15(7.7)	93(47.7)	44(22.6)	43(22.1)	
Systolic blood pressure (mmHg)	96.76±10.07[b]	90.28±9.72	102.32±9.91	102.34±11.80	<0.001
Diastolic blood pressure (mmHg)	63.41±6.40	64.49±7.43	65.18±7.79	65.27±8.36	0.293

[a]: n (%); [b]: Mean±SD; Chi-esqure test.

Table 3. Determination of effective covariates on maternal body mass index using multiple linear regression analysis.

Covariates	Unstandard coefficient		P-value
	B	S.E.	
Age (y)	0.19	0.03	< 0.001
Resident status (rural)	- 1.96	0.41	< 0.001
Systolic blood pressure (mmHg)	0.09	0.02	< 0.001

SBP was directly associated with maternal BMI in this research. Pre-pregnancy BMI has been shown to affect BP and even the risk of hypertensive disorders. A positive correlation between BP and increased BMI has been noticed in previous studies (Miller *et al.*, 2007, Thompson *et al.*, 2009). Nevertheless, in Lynch et al.'s study, there was no significant correlation between overweight/obese pregnant women's diet and BP ,but high BMI was still a risk factor for hypertensive disorders (Lynch *et al.*, 2024). One of the body's most vital organs for regulating BP is kidney. Weight gain, the accumulation of fat tissue around the kidney, the increase in abdominal pressure, and the cytokines released by adipose tissue can all have an impact on the kidney, which is important in the direct correlation between weight and BP (Seravalle and Grassi, 2017).

One limitation of the current study was not having access to accurate mothers' BMI at the onset of the pregnancy, although weight gain up to the 12th week of pregnancy can be ignored. Despite limitations, the authors have provided a precise checking of the information and accurate analyses of maternal BMI and its correlation with other

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probable environmental issues in the region.

Conclusion

In conclusion, the research showed that obesity, overweight, and underweight in the first trimester of pregnancy are significant public health concerns in society. In addition, the authors noticed a significant relationship between mothers` BMI and covariates such as age, SBP, resident status, level of education, and the number of children. Informing women as they enter the reproductive age period through educational interventions for weight management and adopting health promotion policies can be influential steps in mothers' and child health promotion. Hence, more investigations are needed on the effects of being overweight/obese in the first trimester of pregnancy in this special area with distinct cultures.

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Authors' contributions

Study design and execution: Bozorgmehr N, Payandeh A, Juybar M; Data collection: Salajeghe S, Sataee F, Dashtkar A; Statistical analysis and data interpretation: Payandeh A, Bozorgmehr N, Juybar M; Manuscript drafting: Bozorgmehr N, Salajeghe S, Juybar M, Sataee F, Dashtkar A, Payandeh P; Final approval: Bozorgmehr N, Salajeghe S, Juybar M, Sataee F, Dashtkar A, Payandeh P.

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Conflict of interest

The authors declared no conflict of interests.

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