

The Association of Prenatal Depression and Body Mass Index (BMI) in Pregnant Women Referred to Health Centers in Qom

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Abstract

Introduction: Pregnancy is a period during which women experience physical and psychological changes. The considerable changes can be found in their bodies and weights and they are quickly exposed to being overweight and obesity. On the other hand, few studies have assessed the association of depression with body mass index (BMI). This study explored whether depression and BMI affect each other in pregnancy. It aimed to investigate the correlation between prenatal depression and BMI in pregnant women in Qom.

Methods: This was a descriptive-correlational study conducted on pregnant women referred to health centers in 2016. Participants were selected using multi-stage cluster sampling. Samples of 236 pregnant women were divided into two groups: the second (14-28 weeks) and third (28-40 weeks) trimesters of pregnancy. Height and weight were measured to determine the initial BMI as well as BMI during pregnancy. Demographic information was collected from demographic and obstetric forms. Depression was measured using the Beck Depression Inventory (BDI-II). Data were analyzed using SPSS software and descriptive statistics, t-test, ANOVA, regression analysis and Pearson's correlation coefficient, significant at $P < 0.05$.

Results: The results showed BMI in the second trimester to be 48.3% in the normal range, 16.1% overweight, and 30.5% obese. In the third trimester, BMI was 16.9% in the normal range, 34.4% overweight, and 46.6% obese. The rate of depression was 19.5% in the second trimester and 17.8% in the third trimester. Pearson's correlation test showed that the association between prenatal depression and BMI did not exist in the second trimester ($P = 0.499$). In the third trimester, there was a significant negative correlation ($P = 0.024$). Based on regression analysis, among the factors related to BMI (depression, number of family members, gravidity, number of living children, parity, mother's age, unwanted pregnancy by father, unwanted pregnancy by mother), depression and were are the only predictive factors strongly associated with BMI ($P = 0.002$ and $P = 0.028$, respectively).

Conclusions: In our study, there was an inverse correlation between depression and BMI of pregnant women, so that with increase in depression, BMI decreased. According to the different results of the research, further studies should be carried out regarding the effect of depression on BMI in order to be able to provide further assistance to pregnant women.

INTRODUCTION

Despite the expansion of roles that contemporary women undertake, pregnancy and motherhood remain central to a woman's identity [1]. Women experience mental and physical changes during pregnancy [2]. The considerable changes are seen in their bodies and weights [3]. They are quickly exposed to weight gain and obesity [2]. It is important for a normal pregnancy to be accompanied by sufficient and appropriate weight gain for the mother and infant's health. Lack of weight gain or excessive weight gain has negative effects on both [4].

Body mass index (BMI) is used to define and classify being overweight, being a simple index of weight to height. Weight in kilograms divided by height squared in meter (kg/m^2) defines the index [5]. According to the definition of the Institute of Medicine (IOM), the index is classified for pregnant women into four groups: low weight ($< 19.8 \text{ kg}/\text{m}^2$), normal weight ($19.8 - 26 \text{ kg}/\text{m}^2$), overweight ($26.1-29 \text{ kg}/\text{m}^2$), and obese ($> 29 \text{ kg}/\text{m}^2$) [6].

The World Health Organization (WHO) has reported that high BMI is a risk factor causing non-communicable disease such as cardio-vascular disease, diabetes, musculoskeletal problems and some cancers. Pregnancy influences preeclampsia, macrosomia and congenital abnormalities [7]. Mother's low BMI is one of the risks for premature labor and low birth weight, intrauterine growth retardation, anemia, and increased mortality during labor [8]. Obesity is epidemic among pregnant women [9]. According to the statistics from WHO, overweight people's rate has doubled since 1980 [10]. Kelishadi et al. (2005) studied 89532 subjects aged 15 years old from 28 provinces in Iran and reported that the incidence of being overweight, obesity, and morbid obesity were 28.6%, 10.8% and 3.4%, respectively. They added that the BMIs of women and men were 48% and 37%, respectively [11]. Hosseini and Jamei (2003) noted that excessive weight and obesity rates in pregnant women from Tehran were 19.8% and 18.6%, respectively [12]. In the last 25 years, we have seen a 16% increase in the obesity prevalence among women of childbearing age [3]. In Australia, almost 50% of pregnant women are overweight during pregnancy. The United States indicates that 67% are overweight during pregnancy [2].

A lot of factors such as behavior, family, society, culture and environment have an effect on obesity and being overweight during pregnancy, but scientists have paid more attention to mental factors [6, 13]. Depression is one of them, including fluctuation in mood and lack of short-time emotional response to daily challenges [14]. It is accompanied by anxiety, frustration, qualm, worthlessness, lack of interest in activities once enjoyed, exhaustion, sleeplessness, changes in appetite, thoughts of suicide, difficulty in concentration, changes of cognitive abilities, speaking and vegetative actions (sleep, appetite, sexual relations and other biological rhythms), and disorders of occupational, social and interpersonal relations. Symptoms of depression mostly last at least two weeks [15]. Depression is the fourth factor causing some diseases in the world [16]. According to studies of diseases and injuries in Iran conducted by the Ministry of Health (2004), depression in women was the second ranking factor among the first twenty pathogenic

factors [17].

Pregnancy is stressful and it can accelerate or exacerbate depression [18]. The IOM study (2009) estimated that one in seven pregnant women suffered from depression during pregnancy or post-pregnancy [6]. According to studies of pregnancy depression in Iran, figures have been reported from 14.29% to 45.7% [19].

When overweight pregnant women suffer from depression, there are some complications such as preeclampsia, labor problems, low lactation, late fetal death, decrease of growth in initial childhood and behavioral and mental disorders in middle and final childhood [2].

Although the relation between depression and BMI has been investigated in different researches [2, 20, 21], few researches have studied depression in pregnancy [2]. Due to the fact that depression and obesity contribute to disability and poor quality of life, this study seems necessary. BMI is used as a simple and sensitive index to determine excessive weight; but on the other hand, there was no published Iranian study examining the relationship between BMI and depression, especially during pregnancy in Iran. Researches in other parts of the world contradict each other; so, this study aimed to assess the correlation between pregnancy depression and BMI in pregnant women from Qom.

METHODS

The present study used a descriptive-correlational design. The study population included 236 pregnant women who were in their 14-40 weeks of gestational age. They had been referred to health centers for prenatal care and they were divided into two 118-member groups. The first group was in the second trimester (14-28 weeks) and the second group was in the third trimester (28-40 weeks). The women were 15-35 years old. All of them were Iranian and lived in Qom. They could write and read. The samples of women were taken care of by the health center and did not experience any traumatic events, had singleton pregnancies with no abnormalities, chronic or mental health history, special medicine history or severe pregnancy complications.

The formula relevant to correlation tests was used to determine the sample size. The confidence coefficient test was 95% ($\alpha = 0.05$), the power of the test was 90% ($\beta = 0.10$) and the correlation coefficient (r) was 0.30. Considering the 10% reduction of the amount, the samples were obtained as 120 members in each group.

Sampling was multi-stage cluster. First, a list of health centers affiliated to Qom University of Medical Sciences was listed. Some centers were randomly chosen on the basis of decuple regions. Non-random samples from these centers were available, which were selected based on objectives and consistent.

Firstly, participants filled in the questionnaires; next, their weights and heights were measured by the researcher at the health center. Sampling took place from the middle of May to July. Two people from each group were omitted for not filling their questionnaires completely. Finally, each group had 118 samples.

Multi-part questionnaire and anthropometry were used to collect data. In the first part, the demographic and obstetric questionnaire was related to data of demography,

anthropometry, menstrual time, pregnancy age, etc. The second part of the questionnaire measured depression. It was provided by Beck et al. (1961), including 21 multiple-choice questions [22]. Each question had 0-3 scores. The maximum and minimum scores were 0-63. The conditions of participants were measured for severity and level of depression. Scores of 0-9 referred to normal condition, 9-16 to minor depression, 16-24 to mild depression, and over 24 to major depression. Reliability and validity of the questionnaire have been proven in several studies. The questionnaire has been used in more than 1500 studies [23].

Rajabi and Kasmaei (2012), Golparvar et al. (2007) and Holcomb et al. (1996) have estimated the reliability of the questionnaire and confirmed its validity [24-26].

Since some depression symptoms such as sleep disorder, being overweight and low energy can be seen in pregnancy, depression is hardly diagnosed. Some studies have considered the threshold of depression higher for preventing false positive items. Holcomb et al. defined a score of 16 as depression [26]. Therefore, researchers described score of 16 and more as pregnancy depression.

This paper is a result of Shahid Beheshti University of Medical Sciences master's thesis. This study was carried out by retaining the right to free choice of individuals to participate in the study, ensuring the confidentiality of information, filling out consent forms and referring patients to specialists for evaluation and treatment of depression. A measuring tape and a scale were used to determine height and weight. The scale was RASA standing pointer made in Iran and its accuracy was 500 g. The set had been calibrated by 10 samples standing on it with witness barbell (5 kg) before starting the test. The measuring tape used in the study was SECA wall meter made in Germany with an accuracy of 1 mm. The reliability of the measurement was determined by the researcher and her partner observing the measurement.

After measuring height and weight, the formula was used to determine the BMIs. Data was classified on the basis of values defined by IOM. Samples were allocated to thin, normal, overweight and obese groups.

SPSS-21 software was used to analyze the data. Firstly, descriptive statistics (dispersion and measures of central tendency) were used to analyze the data. To determine the correlation between depression and BMI, Pearson's correlation test was used. Independent t-test, variance, and Spearman were utilized to investigate the relations between demographic variables and BMI. Regression analysis was used to investigate the effects of variables on BMI. Confidence coefficient was determined 95% ($\alpha = 0.05$) in the study.

RESULTS

Four people were rejected from the study, because they did not completely fill in the questionnaires. Eventually, 236 samples were divided into two 118-member groups. The mean and standard deviation of the first group (second trimester samples) was 26.60 ± 4.93 and 33.1% of the group were 21-25 years old. The second group (third trimester samples) had a mean and SD of 27.78 ± 4.44 and 41.5% of

the group were 26-30 years old. The rates of housewives in the first and second groups were 94.1% and 97.5%, respectively. The rates of husbands being employees were 48.3% for the first and 39% for the second groups. The rates of high school diploma holders were 44.1% and 49.2% in the first and second groups, respectively; 37.3% of husbands of the first group studied high school; 39% of husbands of the second group had gone to university; 49.2% of the first group and 47.5% of the second group had an income of 6000000-10000000 Riyals; 53.4% of the first group and 50% of the second group were tenants. None of them had cigarette or drug abuse history. View of the midwifery subjects are presented in Table 1.

The first and second groups had a BMI mean of pregnancy equal to 26.65 ± 4.88 and 29.12 ± 3.45 , respectively. Regarding weight, the majority of the first group had a normal range index (48.3%); the second group was in the range of obesity index (46.6%). In the second group, none of the samples were at the thin level (Table 2).

In the study, in the first group 19.5% samples and in the second group 17.8% samples suffered from depression. The results of the Pearson's test indicated that there was a negative and significant correlation between pregnancy depression and BMI in 28-40 week pregnant women ($P = 0.024$). The more the number of children, gravidity, and parity, the higher BMI was observed in the study. According to her husband's idea, when pregnancy was unwanted, BMI decreased ($P = 0.012$). Also, t-test results showed that there was a significant relationship between unfavorable sex from parent's view and the BMI in the first group ($P = 0.001$) and in the second group, with increase in number of family members, BMI also increased ($P = 0.030$). In both groups, there was a relationship between age and BMI (the first group $P < 0.001$ and the second group $P = 0.005$); with the increase of age, BMI also increased. Tables 1 and 2 present a relationship between BMI and the variables.

Other independent variables with linear regression were used to predict BMI and they significantly explained 24% of BMI changes in third trimester of pregnancy ($R = 0.48$, $R^2 = 0.24$, $F = 3.32$, $P = 0.001$). Table 3 shows that among the factors listed, only depression and age are able to significantly predict changes of BMI in the third trimester ($P = 0.002$ and $P = 0.028$, respectively).

DISCUSSION

So far, with extensive studies conducted in the field of depression and BMI, different results have been obtained which can have several different reasons.

In this study, there was no significant relationship between pregnancy depression and BMI in the second trimester, but a negative and significant correlation was seen in the third trimester, that is, with increase in depression BMI decreased in the pregnant women, supported by results of Ho et al. (2008). They found that there was a negative relationship between depression and classification of BMI, such that increase of depression made BMI decrease [27]. Kim et al. (2005-2010) examined 2318 adults from Korean villages and concluded that there was a significant and negative relationship between depression and BMI, that is, women who suffered from depression had lower BMIs [28].

Table 1: The Obstetrics Data of the Research Unite and Their Relation With Body Mass Index

Variable	Second Trimester, No. (%)	Result	Third Trimester, No. (%)	Result
Gravidity		P = 0.01, R = 0.23		P = 0.094 ^a , R = 0.155
One	44 (37.3)		40 (33.9)	
Two	44 (37.3)		38 (32.2)	
≥ Three	30 (25.4)		40 (33.9)	
Number of Living Children		P = 0.037, R = 0.192		P = 0.098 ^a , R = 0.153
Without Child	52 (44.1)		48 (40.7)	
One	46 (39)		45 (38.1)	
Two	11 (9.3)		20 (16.9)	
Three	9 (7.6)		5 (4.2)	
Parity		P = 0.011, R = 0.235		P = 0.086 ^a , R = 0.159
Without Labor	44 (37.3)		40 (33.9)	
One	45 (38.1)		38 (32.2)	
Two	20 (16.9)		31 (26.3)	
≥ Three	9 (7.6)		9 (7.6)	
Number of Family Members		P = 0.634, R = 0.044		P = 0.030 ^a , R = 0.200
Two	44 (39.4)		47 (39.8)	
Three	47 (37.3)		39 (33.1)	
Four	12 (10.2)		24 (20.3)	
≥ Five	15 (12.7)		8 (6.7)	
Abortion History		P = 0.058, R = 0.175		P = 0.726 ^a , R = 0.033
Once	17 (14.4)		15 (12.7)	
Twice	-		4 (3.4)	
More Than Twice	-		2 (1.7)	
Sex				
Girl	24 (20.3)		51 (43.2)	
Son	36 (30.5)		66 (55.9)	
Uncertain	58 (49.2)		1 (0.8)	
Worried About Labor Cost		P = 0.500		P = 0.689 ^b
Yes	27.11 ± 5.17		28.97 ± 3.85 ^c	
No	26.28 ± 4.64		29.18 ± 4.01	
Unwanted Pregnancy by Mother		P = 0.117		P = 0.429 ^b
Yes	26.93 ± 5.06		29.35 ± 3.97	
No	25.76 ± 4.22		28.42 ± 3.89	
Unwanted Pregnancy by Father		P = 0.012		P = 0.308 ^b
Yes	27.03 ± 5.09		29.49 ± 3.91	
No	24.98 ± 3.47		27.76 ± 3.89	
Favourable Sex From Mother		P = 0.001		P = 0.952 ^b
Yes	27.35 ± 4.83		29.13 ± 3.99	
No	26.77 ± 0.39		29.03 ± 3.97	
Favourable Sex From Father		P = 0.001		P = 0.834 ^b
Yes	27.35 ± 4.83		29.06 ± 3.98	
No	26.77 ± 0.396		29.59 ± 3.95	

^a Spearman test.

^b t-test.

^c Mean ± SD.

* P-value < 0.05 statistically is significant.

Table 2: Frequency Distribution of Body Mass Index and Its Correlation With Depression in the Research Unites

The Body Mass Index	Second Trimester, No. (%)	P*	R**	Third Trimester, No. (%)	P	R
Low Weight (< 19.8)	6 (5.1)	0.499	-0.063	-	0.024	-0.028
Normal (19.9-26)	57 (48.3)	0.499	-0.063	20 (16.9)	0.024	-0.028
Over Weight (26.1-29)	19 (16.1)	0.499	-0.063	43 (34.4)	0.024	-0.028
Obesity (< 29)	36 (30.5)	0.499	-0.063	55 (46.6)	0.024	-0.028
Mean ± SD				26.65 ± 4.88		

* P-value < 0.05.

** Pearson test.

Table 3: The Results of Regression Model to Predict Body Mass Index in Third Trimester of Pregnancy by Related Factors

Variable	Estimated Coefficient (B)	Std. Error	Standardized Coefficients (Beta)	t	P-Value
Depression	-0.155	0.048	-0.335	-3.20	0.002
Number of Family Members	1.34	0.775	0.338	1.73	0.087
Gravidity	-4.03	3.95	-1.12	-1.02	0.310
Number of Living Children	-1.35	1.09	-0.290	-1.24	0.217
Parity	3.99	4.02	1.09	0.992	0.323
Mother's Age	0.249	0.112	0.277	2.22	0.028
Unwanted Pregnancy by Father	1.77	0.945	0.182	1.88	0.062
Unwanted Pregnancy by Mother	2.36	2.11	0.194	1.11	0.265

Although a lot of studies about depression and BMI have been performed up to now, few studies have been related to pregnancy [2]. Studies about depression and BMI during pregnancy have shown different conclusions, indicating a significant and positive relationship. McPhie et al. (2014) investigated 183 pregnant women and demonstrated that there was a positive and significant relationship. They revealed that depression made BMI increase in the normal overweight group [2]. Bogaerts et al. (2013) researched two groups of Belgian women (normal and obese) and perceived that depression had decreased in the normal women and the control group between the second trimester and the first trimester, but no change could be seen in obese women and they showed more depression [29]. Carter et al. (2000) studied 64 pregnant women up to 14 months after labor (14 post-labor months) and discovered that there was no significant correlation between depression and BMI in pregnancy, but there was a significant relationship after labor [30]. Mannan et al. (2016) did a review study and concluded that depressed adults were suspect to overweight [31].

Rafati et al. (2012) and Feizi et al. (2013) understood that among students, there was a positive and significant correlation between depression and BMI [32, 33].

Results of these studies are in contrast with the present study. As most of the participants in these studies were well-educated, the level of education may have been one of the reasons; but in our study, most of the participants had secondary school level education.

Furthermore, in some of these studies, antidepressant usage was not controlled, while these drugs lead to weight gain [31]. In addition, many of these studies have been conducted in the US and Europe, while these countries are different in social and cultural fields with developing countries. Probably that is why these findings contradict with our results.

In another study, Pine et al. (1997) examined the effect of

pubertal depression and anticipation on increasing BMI in adulthood and concluded that depression had a significant and positive relationship with BMI of men, but there was no significant relationship regarding women [20]. Vafaei et al. (2011) surveyed 300 students from Tehran and did not recognize any significant and statistic relationship [21]. Perhaps, being in violation of this study with the results of our research was due to different sampling methods; in that study, BMI was measured according to self-report weights and heights. In our study, the majority of people in the first group had normal BMIs. Perhaps for this reason, this relationship was not significant; but in the second group, there was an inverse relationship between depression and BMI. A number of reasons can be cited; we can say that the relationship between depression and obesity was related to social class in some studies, so that direct relationship between depression and obesity has only been found in high social classes, while in the present study, participants belonged to middle and lower classes [34]. Kim et al. related the negative relation to "the Jolly fat" theory [28], in which Crisp and McGuinness (1975) investigated 790 elderly females and males. The researchers found that there was a positive relationship between obesity and mild depression and stated that genetics and culture may have roles. The researchers quoted by Glucksman and Hirsch suggested that another reason was the characteristics of personality and personal relationship patterns [35].

In the current study, to determine BMI predictor factors, different variables were examined. These factors included depression, number of family members, gravidity, number of living children, parity, mother's age, unwanted pregnancy by father and unwanted pregnancy by mother. Among these factors, it was found that depression and age were the predictor factors of BMI. These results are consistent with the researches of McPhie et al. (2014) and Pine et al. (1997).

The strengths of this study were that contrary to some stud-

ies (McPhie et al. (2014)) which had been performed only among well-educated people, it was conducted on people with all levels of education. Another strong point was that most months of pregnancy (second and third trimester) were studied. Also in this research, to determine the amount of BMI, height and weight were measured by the researcher, which led to more accurate results.

In the present study, the samples were evaluated in a short period of time. It is suggested that future longitudinal studies need to be pursued to investigate more accurately the effects of depression on BMI.

This study was conducted in Qom, a city with its own specific cultural context. It is recommended that similar studies be carried out in other cities and the results of this study be compared with the future ones.

Although the study indicated a negative correlation between depression and BMI, the results showed that depression decreased BMI. More studies are needed to determine the inverse effect mechanism of depression and BMI to find a solution.

In this study, we investigated factors that provided BMI; but, it seems that more factors are effective. Therefore, it is necessary that more research be carried out on the impact of various factors on depression and BMI.

Since pregnancy is dangerous and decrease of BMI has an unfavorable effect on mother and fetus, more efforts to improve screening of depressed pregnant women and assisting them in their appropriate weight gain in health centers are required.

ETHICAL CONSIDERATION

This paper is a result of Shahid Beheshti University of Medical Sciences master's thesis. IR.SBMU.PHNM.1394, 266 is the code of ethics. We also obtained permission from the Qom University of Medical Sciences to conduct research.

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CONFLICT OF INTERESTS

There is no conflict of interest to be declared.

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AUTHORS' CONTRIBUTIONS

All authors contributed to this project equally and approved the final manuscript.

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