

Association between body mass index (BMI) and duration of pregnancy in women referred to Shariati Hospital in Bandar AbbasArefeh Shahi¹, Fatemeh Dabiri¹, Azita Kamjoo¹, Asieh Pormehr Yabandeh¹, Zahra Khademi², Nasrin Davaridolatabadi³

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Abstract

Introduction: Prolonged pregnancy is associated with increased risk of pregnancy complications. The role of body mass index (BMI) is not completely identified in the risk of occurrence of prolonged pregnancy. The aim of this study was to determine the association between BMI and duration of pregnancy in woman referred to the Shariati Maternity Hospital in Bandar Abbas (Hormozgan Province, Iran).

Methods: This cross-sectional study was carried out on 1100 pregnant women referred to the Shariati Hospital in Bandar Abbas in 2015. Gestational age determined by last menstrual period (LMP) or first-trimester ultrasonography. The women were divided into two groups of less than 40 weeks of gestation and more than 40 weeks of gestation. The women were divided based on their BMI at the first trimester of pregnancy into four groups, including less than normal, normal, overweight, and excess weight. Data were analyzed using ANOVA, Mann-Whitney test, and chi-square test by SPSS version 16.0.

Results: The average age of mothers studied was 23 ± 4.30 years. Average of gestational age was 39 ± 1.85 weeks. Among the study participants 1020 (92.7%) had term pregnancies, 53 (4.8%) had preterm pregnancies, and 27 (2.5%) had post-term pregnancies. Also among the study participants, 40% had a BMI less than 19.8 kg/m^2 , 45.9% had BMI between 19.8 and 26 kg/m^2 , and 9.8% had BMI between 26.1 and 29 kg/m^2 , and 4.3% had BMI less than 29 kg/m^2 . Mean BMI was 20.95 ± 4.02 for women with gestational age of equal to or less than 40 weeks and 23.34 ± 4.52 for women with gestational age of more than 40 weeks. Duration of pregnancy was significantly higher in women with higher BMI at the first trimester ($p < 0.00006$).

Conclusion: High BMI of a mother in the first trimester of pregnancy is associated with prolonged pregnancy and may increase the risk of post-term pregnancy. Women are recommended to reach an ideal weight before pregnancy to decrease the risk of the pregnancy complications.

Keywords: Body mass index (BMI), Duration of pregnancy, Prolonged pregnancy

1. Introduction**1.1. Background**

With recent increase in prevalence of obesity, it is considered a major health issue in developed and developing countries (1). Also the number of obese women in their childbearing age is increased (2). This high obesity rate has been shown to increase the risk of maternal, labor, and neonatal adverse outcomes, including preeclampsia, cesarean section, macrosomia, shoulder dystocia, late fetal death, congenital malformations, meconium aspiration syndrome,

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and an increased neonatal intensive care unit admissions (3). It has been shown that obesity in pregnancy is associated with prolonged gestational age, which increases the risk of post-term delivery (4, 5).

1.2. Statement of problem

Prolonged pregnancy causes higher risk of pregnancy-related complications and increases the risk of meconium evacuation, meconium aspiration syndrome, oligohydramnios, macrosomia, fetal injuries, and labor distress compared with term pregnancies (6). Also maternal complications including trauma and bleeding are higher in mothers with prolonged pregnancy (7-9). Studies show that high BMI of the mother in the first trimester of pregnancy is associated with higher risk of prolonged pregnancy and post-term delivery. Insufficient data are available for the etiologies of prolonged pregnancy, but it seems that maternal BMI and nutritional status in the first trimester may play a role in the chance of prolonged pregnancy and post-term delivery (4, 10, 11). Obesity is shown to interfere with uterine contractions in pregnant women (12). Few data are available in regards to the factors associated with risk of prolonged pregnancy.

1.3. Objectives

The general objective of the current study was to determine the association between body mass index (BMI) and duration of pregnancy in woman referred to the Shariati Hospital in Bandar Abbas. The specific objectives included:

- 1) To determine the association between duration of pregnancy and BMI
- 2) To determine the relationship between spontaneous and induced delivery and BMI
- 3) To determine the relationship between type of delivery and BMI
- 4) To determine the relationship between birth weight and BMI

2. Material and Methods

2.1. Study setting

This cross-sectional study was conducted on 1100 primigravid women at Shariati Hospital of Bandar Abbas in 2015. A purposive sample was selected for this study, where primiparous women with a singleton pregnancy whose delivery information was obtained from Shariati Hospital.

2.2. Selection criteria

The inclusion criteria included the following: 1) primigravid, singleton gravid; 2) alive fetus; 3) cephalic presentation; 4) available data about their own weight in the first trimester of pregnancy; and 5) low risk. Exclusion criteria included the following: 1) no available data about LMP; 2) absence of obstetric ultra-sonography at first half of pregnancy; 3) mother weight with the start of delivery less than 40 kg or more than 190 kg; 4) fetal anomalies; and 5) medical complications in mother.

2.3. Measuring tools

Gestational age was determined by LMP, ultra-sonography at first half of pregnancy and physical examination of neonatal just after labor. Weight in the first trimester of pregnancy recorded from antenatal booking visit and maternal weight and height was determined on admission prior to delivery. Then BMI was calculated using the weight (kg)/height² (m). Women were categorized in low weight (BMI under 19.8 kg/m²), normal (BMI: 19.8-26 kg/m²), overweight (BMI: 26-29 kg/m²), and obese (BMI higher than 29 kg/m²).

2.4. Data collection

The questionnaire used is brief, self-reported, and multidimensional with 11 items for the assessment of key dimensions of BMI and duration of pregnancy (gestational age, weight in first trimester pregnancy, height, induction, type of pregnancy, and neonatal birth weight). Content validity of the questionnaire was determined. Reliability of questionnaire was determined by Cronbach's alpha. The studied factors included 1) age of mother; 2) gravidity; 3) gestational age; 4) weight in the first stage of pregnancy; 5) weight on admitting to hospital; 6) height; and 7) normal or induced delivery. Characteristics of neonatal included Apgar score and weight.

2.5. Research ethics

The confidentiality of all the subjects were assured. Informed consent was taken before the study. The study is confirmed by the Ethics Committee of the Hormozgan University of Medical Sciences (HUMS).

2.6. Statistical analysis

Data were analyzed using SPSS version 16. Univariate analysis was done using ANOVA or Mann–Whitney test for continuous variables and chi-square test for categorical variables.

3. Results

3.1. Demographic findings

One thousand and one hundred singleton gravidas pregnant women have been studied. The mean age of mothers was 23 ± 4.30 years and the minimum 15 years and maximum was 40 years. The mean weight at the first stage of pregnancy was 52.8 ± 10.59 kg. Mean weight was 66 ± 11.34 kg at the final stage of pregnancy. The mean pregnancy weight gain was 3.13 ± 60.5 kg. Gestational age at labor was 39 ± 1.85 weeks. BMI was 21.8 kg/m^2 in the beginning of pregnancy. BMI at the final stage of pregnancy was $26.4 \pm 7.52 \text{ kg/m}^2$. One thousand and twenty (92.7%) of mothers were term. Fifty-three (4.8%) were pre-term and 27 (2.5%) post-term. Selected samples were divided into four groups based on the first of pregnancy body mass index, 440 (40%) low BMI, 505 (45.9%) normal BMI, 108 (9.8%) overweight, and 47 (4.3%) obese.

3.2. Comparison of the mean duration of pregnancy and BMI

Results showed that mean body mass index was 20.95 ± 4.02 and 23.34 ± 4.52 for gestational age equal or less than 40 weeks and gestational age more than 40 weeks, respectively. There was a significant difference between two groups ($p < 0.00006$). Details are shown in Table 1.

Table 1. Comparison of the mean duration of pregnancy and BMI

Body mass index (Kg/m ²)	<i>n</i>	Pregnancy duration (week) (Mean \pm SD)	<i>p</i> -value
<19.8	440	37.8 ± 1.85	0.0001
19.8-26	505	39.01 ± 1.86	
26.29	108	39.5 ± 1.48	
>29	47	39.64 ± 2.21	

3.3. Frequency of spontaneous and induced delivery based on BMI

In our study, 735 (66.7%) of all mothers have spontaneous delivery, and 365 (33.3%) have induced delivery. There was significant relationship between first trimester of pregnancy BMI and induced delivery ($p < 0.01$). Details about the relationship between induced and spontaneous delivery and BMI are mentioned in Table 2.

Table 2. Frequency of spontaneous and induced delivery based on BMI.

Body mass index (Kg/m ²)	Spontaneous delivery (<i>n</i>)	Induced delivery (<i>n</i>)	Total (<i>n</i>)
< 19.8	308	132	440
19.8-26	342	163	505
26.1-29.9	69	52	121
> 29.9	16	18	34
Total (<i>n</i>)	735	365	1100

3.4. Frequency of type of delivery based on BMI

Most of women ($n=802$) (72.9%) had normal delivery, 289 (26.3%) had cesarean delivery, and nine (0.08%) had instrumental delivery. Spearman rank correlation showed a linear regression between BMI in the beginning trimester of pregnancy with the type of delivery. Details are shown in Table 3.

Table 3. Frequency of type of delivery based on BMI

Body mass index (Kg/m ²)	Spontaneous delivery (<i>n</i>)	Cesarean (<i>n</i>)	Instrumental delivery (<i>n</i>)	Total (<i>n</i>)
< 19.8	343	94	3	440
19.8-26	371	130	4	505
26.1-29.9	68	51	2	121
> 29.9	20	14	0	34
Total (<i>n</i>)	802	289	9	1100

3.5. Frequency of birth weight based on BMI

Results show no significant association found between birth weight and BMI at the first trimester of pregnancy. Table 4 shows more details about the relationship between birth weight and BMI.

Table 4. Frequency of birth weight based on BMI

Body mass index (Kg/m ²)	Low weight (n)	Normal (n)	Overweight (n)	Total (n)
< 19.8	59	378	3	440
19.8-26	58	442	5	505
26.1-29.9	4	115	2	121
> 29.9	4	30	0	34
Total (n)	125	995	10	1100

4. Discussion

4.1. Association of the mean duration of pregnancy and BMI

Based on our results, higher BMI in the first trimester of pregnancy is associated with higher duration of pregnancy. Other studies have confirmed our results. There is a significant association between BMI and gestational age (3, 4, 10, 13, 14). Physiological processes that start delivery are not known exactly. One theory is “producing labor-inducing agents.” Corticotrophin-releasing hormone (CRH), which is produced in the hypothalamus and placenta, takes apart mechanisms that control the time of labor. CRH may exacerbate production of fetal cortisol that causes production of CRH raised by the mechanism of positive feedback in placenta. Decrease of plasma cortisol in obese women causes reduction of placenta CRH; as a result, it affects the time of labor start. Studies show lower increase of this hormone involves post-term more than pre-term women (4, 9). The association between obesity and reduction of contraction strength of myometrium has been shown (17). More information on this subject is necessary.

4.2. Association of spontaneous, induced delivery, and BMI

Results of this study showed that high BMI in the first trimester of pregnancy affects normal delivery in term women; statistically, significant difference in BMI in the first trimester of pregnancy between two groups of normal and induced delivery has been shown. Women with higher BMI show they are in higher need of delivery induction. Study of Usha Kiran also confirms this (14). As there are more pregnancy troubles in obese women, need of inducing delivery is higher in this group.

4.3. Association of type of delivery and BMI

There was a significant association between the first trimester of pregnancy BMI and type of delivery. Increase in BMI caused more need for cesarean section. Other investigations also showed more need for cesarean section in higher BMI (14-16).

4.4. Association of birth weight based on BMI

Result of this study showed that there was no significant difference between birth weight and BMI. In addition, the study by Chiba et al. showed no correlation between the birth weights of the infants and pre-pregnancy BMI (18). However, studies by Liu, Shin et al. and Yazdani et al. showed that women with an above-normal BMI had a higher incidence of macrosomia (19, 20).

5. Conclusions

Based on this study, the more appropriate BMI before pregnancy, the less need for induction will be; thus pre-natal side effects related to gestational age decreases. As most of the pregnancies are unplanned, obese women should be watched regularly during pregnancy to reach their appropriate weight in pregnancy.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

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

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