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# Investigating the relationship between anthropometric indicators of the mother during pregnancy with the weight, height, and head circumference of the infant at birth: A mother-infant cohort study

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## Abstract:

**BACKGROUND:** The growth and development of the fetus inside the womb depends on several factors, including the weight gain of the mother during pregnancy. The aim of the current research is to determine the relationship between anthropometric indicators of the mother during pregnancy and the weight, height, and head circumference of the infant at birth.

**MATERIALS AND METHODS:** The present study is a Historical cohort study that was conducted on 1623 pregnant mothers from the beginning of pregnancy to delivery by census method in 4 reference and specialized gynecology and obstetrics hospitals affiliated to Shahid Sadoughi University of Medical Sciences in Yazd from 2016 to 2021. The tools used were the questionnaires approved by the Ministry of Health and the Research Council of the University to conduct the mother-infant cohort. Data analysis was performed with SPSS Software Version 22 with analytical statistical tests.

**RESULTS:** The baby's weight had a significant negative relationship with the mother's weight and the mother's body mass index at the beginning of pregnancy. The baby's height had a significant positive difference with the body mass index at the beginning of pregnancy. The baby's head circumference had a positive and significant relationship with the mother's weight in the third trimester of pregnancy.

**CONCLUSION:** According to the results of the study and the importance of the health of the mother during pregnancy due to the effect on the health of the fetus, it is recommended to monitor the weight of mothers more sensitively from before pregnancy to the end of pregnancy.

## Keywords:

Anthropometric index, cohort study, infant, mother, pregnancy

## Introduction

Birth weight is one of the most powerful predictors of individual child survival. Because underweight babies are not able to adapt to the extra uterine environment due to their special conditions and are more at risk of death, therefore, lower weight

indicates the risk of more death in babies. Also, the abnormal size of the baby's weight at birth has potential effects on the baby's health and growth, as well as his cognitive functions during childhood.<sup>[1,2]</sup> It has been observed in studies that asthma and high blood pressure have a higher incidence in people with low birth weight.<sup>[3,4]</sup> According

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to available statistics, the death rate of low birth weight babies is 40 times higher, and very low birth weight babies are 200 times higher than normal birth weight babies. In Iran, two-thirds of newborn deaths occur in low birth weight babies in the first 24 hours after birth.<sup>[5]</sup> Therefore, factors affecting fetal growth and intrauterine weight may also affect health outcomes in later years of life.<sup>[6]</sup> Compared to other normal-weight babies, low birth-weight babies are exposed to many disabilities and problems and medical failure that threaten their health and survival.<sup>[7]</sup> Therefore, estimating the weight of the fetus during pregnancy by controlling the mother's weight gain and continuously checking the height of the uterus can be considered an important issue.<sup>[8]</sup> Fetal growth and birth weight are related to many factors during pregnancy, such as socioeconomic status, diet, number of pregnancies and deliveries, mother's age and body mass index, baby's gender, racial factors, occupation, night shift work, mother's education, history of smoking, oral and dental infections and maternal depression during pregnancy. Even the season of the baby's birth is seen in the literature as an influencing factor in birth weight.<sup>[8-10]</sup> The results of Najafi *et al.*'s study in Gonabad showed that there was a statistically significant relationship between the weight and head circumference of the baby and the mother's initial BMI.<sup>[8]</sup> The results of the study by Kamiab *et al.* in Rafsanjanshowed that abnormal body mass index can have adverse effects on the mother and fetus, as well as the anthropometric indices at birth.<sup>[9]</sup> Therefore, the birth of a baby with a balanced weight requires parents' awareness and knowledge of the factors affecting the weight of the fetus during pregnancy and performing prenatal care. Various studies have investigated the effect of various factors on fetal weight. In this regard, the review of studies shows that there is a need for research with a large number of research communities and a comprehensive review of various factors. In this context, cohort studies are a very suitable option for obtaining high-value and generalizable information. Therefore, the purpose of this research is to determine the relationship between anthropometric indicators of the mother during pregnancy with the weight, height, and head circumference of the infant at birth: A mother-infant cohort study.

## Materials and Methods

### Study design and setting

The present study is a Historical cohort study that was conducted based on the data collected from 4 reference and specialized obstetrics and gynecology hospitals (Shahid Sadouqi Hospital, Afshar, Shohada e Kargar, and Mojibian) affiliated with Shahid Sadoqi University of Medical Sciences, Yazd from 2016 to 2021.

### Study participants and sampling

The population of this research was pregnant women who were referred to the mentioned medical centers for pregnancy care. The inclusion criteria were consent to participate in the study, referral before the 12<sup>th</sup> week of pregnancy, resident of Yazd, no intention to emigrate, and Iranian citizenship. Exclusion criteria were: history of miscarriage and stillbirth, multiple pregnancies, history of having any underlying diseases such as diabetes, high blood pressure, and epilepsy, suffering from mental illnesses under treatment, disturbance in fetal health examinations based on fetal health tests, cases of pregnancy that resulted in miscarriage, stillbirth, malformed baby, or fetal growth restriction.

### Data collection tool and technique

The tools used were: The tool in this study was a questionnaire. This questionnaire included the following items: demographic characteristics – pregnancy, anthropometric characteristics of mother and baby. The validity of this questionnaire was confirmed by content validity. The reliability of the questionnaire was confirmed with alpha of 0.79. Weight, waist circumference, hip circumference (beginning of pregnancy, second trimester, and end of third trimester), and mother's height (beginning of pregnancy) were recorded. The weight, height, and head circumference of the baby were measured and recorded immediately after birth. The reliability of the mother's scale with a standard weight of 2 kilos, the reliability of the baby scale with a standard weight of 500 grams, and the reliability of the meter with a standard wooden graduated ruler were checked and confirmed. SPSS version 22 software was used for data analysis. Then, they were analyzed with descriptive and analytical statistical tests (Pearson and regression) and at a significance level of less than 5%.

### Ethical consideration

This study was carried out after being approved by the Research Vice-Chancellor of Shahid Sadoughi University of Medical Sciences, Yazd (code: IR.SSU.SPH.REC.1400.016). Written consent was obtained from all mothers to participate in the study. All mothers were assured that their information would remain confidential and would be used without identifying individuals.

## Results

1623 pregnant women participated in this study. The baby's weight had a significant negative relationship with the mother's weight and the mother's body mass index at the beginning of pregnancy. The baby's height had a significant positive difference with the body mass index at the beginning of pregnancy. The baby's head circumference had a positive and significant relationship with the mother's weight in the third trimester of pregnancy [Table 1].

**Table 1: The relationship between anthropometric indicators of the mother during pregnancy with the weight, height, and head circumference of the baby immediately after birth**

Variable	Baby's weight immediately after birth		Baby's height immediately after birth		Infant's around the head immediately after birth	
	R	P	R	P	R	P
Mother's weight at the beginning of pregnancy	-0.05	0.03	-0.04	0.06	-0.008	0.76
Mother's hip circumference at the beginning of pregnancy	-0.04	0.08	-0.03	0.16	0.01	0.70
Mother's waist circumference at the beginning of pregnancy	-0.04	0.08	-0.03	0.21	-0.01	0.69
Mother's height at the beginning of pregnancy	0.01	0.50	0.006	0.82	0.001	0.97
Mother's weight in the second trimester of pregnancy	0.02	0.34	0.03	0.16	0.01	0.63
Mother's hip circumference in the second trimester of pregnancy	0.01	0.57	0.02	0.35	-0.004	0.88
Mother's waist circumference in the second trimester of pregnancy	0.01	0.61	0.005	0.83	0.003	0.91
Mother's weight in the third trimester of pregnancy	0.02	0.33	0.03	0.13	0.05	0.04
Mother's hip circumference in the third trimester of pregnancy	0.008	0.76	0.03	0.14	0.02	0.32
Mother's waist circumference in the third trimester of pregnancy	0.007	0.79	0.04	0.13	0.02	0.43
Mother's body mass index at the beginning of pregnancy	-0.06	0.007	-0.05	0.03	-0.01	0.59
Body mass index of the mother in the second trimester of pregnancy	0.02	0.40	0.03	0.20	0.008	0.77
Body mass index of the mother in the third trimester of pregnancy	0.01	0.66	0.02	0.27	0.02	0.26

The results of the data analysis with the regression test showed that the baby's weight immediately after birth has no significant relationship with any of the studied maternal variables [Table 1].

## Discussion

The results of the data analysis showed that the weight of the baby immediately after birth with the weight of the mother at the beginning of pregnancy and the body mass index of the mother at the beginning of pregnancy has a significant negative relationship with the mother's weight at the beginning of pregnancy, and there is a significant positive relationship with the difference between the average mother's weight in the second trimester and the first trimester of pregnancy. Based on the findings of Delaram *et al.*'s study (2017) in Shahrekord, the weight at the beginning of pregnancy and the weight gain during pregnancy had a significant relationship with the weight at the time of the birth, and the weight of the baby also increased with the increase in the weight of the mother, both at the beginning of pregnancy and throughout it.<sup>[10]</sup> Also, the results of Gunderson's study (2001) showed that the weight at the beginning of pregnancy has a significant relationship with the birth weight. In this study, only primiparous women were examined.<sup>[11]</sup> In addition, the results of Shapiro's study (2000) showed that the weight at the beginning of pregnancy has a significant relationship with the weight at birth.<sup>[12]</sup>

The results of Goshtasebi *et al.*'s study (2011) in Tehran showed that the body mass index of the mother at the beginning of pregnancy was related to the amount of weight gain during pregnancy and the birth weight of the baby. Also, mother's weight gain during pregnancy was related to baby's birth weight.<sup>[13]</sup>

The results of the study by Pakniat and colleagues (2012) showed that low birth weight was related to mothers in the overweight group, although the difference was not statistically significant.<sup>[14]</sup> The results of the study by Sharifirad *et al.* in Isfahan, Sharifzadeh *et al.* in Birjand, and Tabandeh also found a significant direct relationship between the pre-pregnancy body mass index and the weight of the baby at birth, so that the weight of the babies in the group of overweight women was higher than that of normal weight and underweight women.<sup>[15-17]</sup> The results of Daliri *et al.*'s meta-analysis in Iran (2017) showed that the weight of the mother has a significant relationship with the birth of a low birth weight baby, so that with an increase in the weight of the mother of more than 50 kilograms, the birth of low birth weight babies decreases.<sup>[5]</sup>

Also, the results showed that the baby's height immediately after birth has a significant negative difference with the body mass index at the beginning of pregnancy and a significant positive difference with the average weight difference from the second trimester to the first trimester of pregnancy and the difference between the average weight of the third trimester and the first trimester of pregnancy, the difference of the mother's body mass index in the third trimester and the first trimester of pregnancy, and the difference between the average waist circumference of the mother in the third trimester and the first trimester of pregnancy. In addition, the results showed that the baby's head circumference immediately after birth has a significant positive relationship with the mother's weight in the third trimester of pregnancy. Of course, it should be noted that researchers believe that among the indicators of newborns' body weight at birth, the weight and head circumference of the newborn are mostly influenced by the mother's nutrition.<sup>[16-20]</sup>

Most of the existing studies in the field of evaluating the mother's dietary pattern during pregnancy and its relationship with the pregnancy outcome and the baby's anthropometric characteristics have focused on the weight at birth, and less has been discussed about the relationship between the mother's dietary pattern and the height and head circumference of the baby at birth. However, Yung and Huffman's study indicates the positive effects of consuming high-fat nutritional supplements during pregnancy on the height of the baby at birth.<sup>[19]</sup>

### Limitations and recommendation

According to the results, it is recommended to monitor the weight of mothers more sensitively from before pregnancy to the end of pregnancy. Since the current study was a retrospective cohort and examined a large number of mothers, it increases the generalizability of the results. It is recommended that more studies in this field be conducted by examining more variables.

### Conclusion

The baby's weight had a significant negative relationship with the mother's weight and the mother's body mass index at the beginning of pregnancy. The baby's height had a significant positive difference with the body mass index at the beginning of pregnancy. The baby's head circumference had a positive and significant relationship with the mother's weight in the third trimester of pregnancy. According to the results of the study and the importance of the health of the mother during pregnancy due to the effect on the health of the fetus, it is recommended to monitor the weight of mothers more sensitively from before pregnancy to the end of pregnancy.

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### Conflicts of interest

There are no conflicts of interest.

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