

# Investigation of the Effect of Gestational Hypertension on Neonatal Hemoglobin in Selected Hospitals in Qom, Iran

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Article Info	ABSTRACT
<p><b>Article type:</b> Original article</p>	<p><b>Background and Aim:</b> Gestational hypertension is one of the most important disorders during pregnancy. The present study aimed to investigate the effect of gestational hypertension on neonatal hemoglobin in the selected hospitals in Qom in 2017.</p>
<p><b>Article History:</b> Received: 19 February 2020 Revised: 09 May 2020 Accepted: 18 May 2020</p>	<p><b>Materials and Methods:</b> The cohort retrospective study was conducted on 100 women who had referred to selected hospitals in Qom. They were divided into two groups so that women with gestational hypertension were allocated to the case group (n=50) while normotensive women were allocated to the control group (n=50) group. Finally, the hemoglobin levels of neonates in the two groups were compared.</p>
<p><b>Keywords:</b> Hypertension Neonatal hemoglobin Pregnancy</p>	<p><b>Results:</b> The mean level of hemoglobin in neonates born to mothers with gestational hypertension (17.3 gr/dl) was significantly higher than the control group (14.65 gr/dl), which remained significant after regrouping the mothers based on their demographic and gestational characteristics.</p> <p><b>Conclusion:</b> Due to the high prevalence of gestational hypertension and its dangerous side effects in infants, it is necessary to pay attention to screening programs and laboratory tests of pregnant mothers to prevent an unusual increase in hemoglobin levels of infants and reduce pregnancy complications.</p>

## ➤ How to cite this paper

Eshraghi A, Matini E, Shafagh H, Eshraghi A, Eshraghi M, Noori E, Rezvan S. Investigation of the Effect of Gestational Hypertension on Neonatal Hemoglobin in Selected Hospitals in Qom, Iran. J Vessel Circ. Spring 2020; 1(2): 6-10-. DOI: [10.21859/JVesselCirc.1.2.6](https://doi.org/10.21859/JVesselCirc.1.2.6)

## Introduction

Blood pressure complications during pregnancy are among the most important complications of pregnancy which along with bleeding and infection are the three leading causes of maternal death and counts for 75,000 deaths annually around the world (1, 2). Hypertension is one of the most common pregnancy complications which generally occurs in 12-22% cases (3). It causes various fetal and maternal complications, including increased fetal and neonatal mortality, preterm delivery, low birth weight, intrauterine growth restriction, premature placental abruption, cesarean delivery, heart failure, renal failure, and HELLP syndrome (4, 5). Moreover, people with hypertension during pregnancy are at high risk for cardiovascular diseases, diabetes, and obesity in the future.

In the United States, 17.6% of maternal deaths are due to hypertension during pregnancy. Normally, in the second trimester of the pregnancy, the plasma volume increases which results in the decrease of hemoglobin and hematocrit. Lack of this decrease or increase in these factors in hypertensive mothers can be accompanied by an increased risk of complications in both mothers and fetuses. Previous studies have shown that the level of maternal hemoglobin has a significant relationship with the level of hemoglobin in the baby's umbilical cord. Therefore, high levels of maternal hemoglobin can directly affect the fetus. The result of this change in fetal hematopoiesis is the development of abnormal hemoglobin levels at birth, which can

lead to serious disorders in the future (9). Therefore, knowing the hemoglobin level of these infants and comparing them with those of the infants born to healthy mothers, helps the healthcare staff to prevent, decide, and provide more and more useful services.

The increase in intrauterine erythropoiesis is usually due to placental insufficiency and intrauterine chronic hypoxia, which is more common in infants with low birth weight who have been born to mothers with preeclampsia or other hypertensive or vascular disorders. Polycythemia can also be observed in pregnancies that have been accompanied by cardiovascular diseases (10). The relationship between neonatal hemoglobin levels and gestational hypertension has not been established yet. Only a few studies have examined the hemoglobin concentration in infants born to hypertensive mothers as an appropriate and inexpensive indicator since the examination of the hemoglobin level in newborns is a routine test that is performed on all newborns and does not impose any more cost on mothers.

On the other hand, lifestyle, race, and economic, social, and climatic conditions can all affect the hemoglobin level at birth. Therefore, each region should have a clear picture of the hematological status of its infants due to its specific conditions. In addition, no studies have been performed in Iran to investigate the level of neonatal hemoglobin and its association with pregnancy hypertension. Moreover, few studies have been conducted in the world about this issue and none of them have accurately compared the hemoglobin levels of neonates born to mothers with hypertension during pregnancy to healthy neonates. Moreover, due to the high prevalence of gestational hypertension and its wide range of complications and high costs of treatment and its effects on the individual and society, this study was conducted to investigate the level of hemoglobin in infants born to hypertensive mothers.

## Materials and Methods

This cohort retrospective study was conducted on mothers who referred to one of the hospitals affiliated to Islamic Azad University, Qom Branch, Iran. The sample size was calculated, based on the sample size formula, at 100 subjects (50 hypertensive and 50 normotensive pregnant women). For pregnant women to be included in this study, they must have referred to one of the hospitals affiliated with Islamic Azad University, Qom Branch during 2017 with single pregnancy (opposed to twin) and had their blood pressure measured twice with a 6-hour interval. On the other hand, the exclusion criteria were 1) chronic

hypertension, 2) diabetes, 3) renal disease, 4) smoking, 5) use of drugs that affect blood parameters, 6) performance of prenatal tests in hospitals that were not affiliated with Islamic Azad University, Qom Branch.

After the research proposal was confirmed by the Research Deputy of Islamic Azad University, Tehran Medical Sciences Branch, the researcher started to collect information through the convenience sampling method. The data collection tool consisted of a record sheet including five main sections. The first section included individual and demographic characteristics, such as age, education level, occupation, pre-pregnancy weight, weight gain during pregnancy, body mass index (BMI), and history of hypertension in close relatives. The second section included questions about the status of previous pregnancies, such as stillbirths, preterm births, miscarriages, previous birth defects, and gestational hypertension.

The third section was about the status of the last pregnancy and delivery. The items in the fourth section were about the severity of maternal hypertension and the time of its diagnosis. Finally, the last part was about the hemoglobin level of the infants and the adverse consequences of pregnancy for the mother or the infant. The data was collected by the researcher through the record sheets. Eventually, the obtained data were analyzed in SPSS software (version 22). The results for quantitative variables were expressed as mean and standard deviation (mean $\pm$ SD) and for categorized qualitative variables as percentages. The quantitative variables were compared using the t-test. A p-value of 0.05 was considered statistically significant in the present study.

## Results

In total, 100 pregnant eligible women entered the study and were divided into two groups of case and control. The case group (n=50) consisted of hypertensive women while the control group included normotensive women (n=50). The mean age of the subjects was 26.25 $\pm$ 4.2 years (18-35 years old). The results of the present study are summarized in Table 1.

As can be observed in Table 3, the mean value of hemoglobin in neonates born to mothers with gestational hypertension in all the four birthweight groups was significantly higher than the control group ( $P<0.05$ ).

## Discussion

The present study aimed to evaluate the effect of gestational hypertension on neonatal hemoglobin in the selected hospitals in Qom during 2017. The results of this study revealed that the mean value

**Table 1.** Mean and standard deviation of hemoglobin in neonates born to hypertensive and normotensive mothers based on demographic characteristics

Characteristic	Group	Number	Mean	Standard deviation	p-value
Neonatal hemoglobin	Case	50	17.3	2.01	<0.001
	Control	50	14.56	1.19	
25≤ years old	Case	21	17.35	1.73	<0.001
	Control	27	14.69	1.06	
25> years old	Case	29	17.25	2.22	<0.001
	Control	23	14.41	1.35	
60≤ years old	Case	20	17.30	1.75	<0.001
	Control	24	14.70	1.07	
60> years old	Case	30	17.29	2.19	<0.001
	Control	26	14.43	1.31	
Body mass index of the mother	Case	24	17.38	1.69	<0.001
25<	Control	30	14.58	1.08	
	Case	26	17.21	2.30	<0.001
25>	Control	20	14.53	1.38	
Occupation of the mother	Case	40	17.26	2.03	<0.001
Housewife	Control	46	14.61	1.13	
	Case	10	17.42	2.01	0.013
Employed	Control	4	13.99	1.89	
Weight gain of the mother	Case	22	17.31	1.69	<0.001
12≤ kg	Control	24	14.70	1.06	
	Case	28	17.28	2.25	<0.001
12>	Control	26	14.43	1.31	

**Table 2.** Mean and standard deviation of hemoglobin in neonates born to hypertensive and normotensive mothers based on demographics variables

Characteristic	Group	Number	Mean	Standard deviation	p-value
Mother's age at the time of pregnancy	Case	17	14.61	2.11	<0.001
Less than 37 weeks and 6 days	Control	13	17.39	2.12	
	Case	33	14.54	1.25	<0.001
38-41 weeks and 6 days	Control	37	17.16	1.65	
History of hypertension in the mother	Case	13	14.73	1.12	<0.001
Yes	Control	21	17.52	1.84	
	Case	9	14.52	0.88	0.003
No	Control	6	17.20	2.07	
History of hypertension in the mother	Case	40	14.57	1.24	<0.001
Yes	Control	44	17.68	1.68	
	Case	10	14.52	0.88	0.001
No	Control	6	17.19	2.10	
Gravidity	Case	28	14.43	1.23	<0.001
1	Control	25	17.42	1.292	
	Case	22	14.69	1.17	<0.001
2≥	Control	25	17.29	2.05	
Miscarriage	Case	44	14.55	1.22	<0.001
Yes	Control	46	17.33	1.84	
	Case	6	14.7	1.02	0.033
No	Control	4	17.39	2.13	
Delivery	Case	25	14.62	1.14	<0.001
Vaginal	Control	31	17.23	1.92	
	Case	25	14.47	1.31	<0.001
C-section	Control	19	17.19	2.10	
Parity	Case	28	14.43	1.23	<0.001
0	Control	25	17.42	1.92	
	Case	22	14.69	1.17	<0.001
1≥	Control	25	17	1.62	
Interval	Case	12	14.41	1.18	<0.001
3≤ years	Control	15	17.39	2.50	
	Case	10	14.61	2.11	0.006
3> years					

**Table 3.** Mean and standard deviation of hemoglobin in neonates born to hypertensive and normotensive mothers based on the birth weight of the infant

Birthweight of the neonates (gr)	Group	Number	Mean (gr/dl)	Standard deviation	p-value
1500<	Case	3	18.24	1.17	0.023
	Control	2	14.34	0.46	
1500-2500	Case	18	17.55	1.93	<0.001
	Control	23	14.41	1.08	
2500-4600	Case	28	17.06	2.17	<0.001
	Control	23	14.65	1.34	
4600>	Case	1	16.55	-	-
	Control	2	15.62	1.39	

of hemoglobin in neonates born to mothers with gestational hypertension (17.3 gr/dl) was significantly higher, compared to the control group (14.65 gr/dl). This difference remained significant regarding the demographic and medical characteristics of pregnant women. According to the results of previous studies, gestational hypertension affects the blood parameters of infants (11-14).

Samreen Farooqui et al. conducted a study to investigate the effects of hypertension on the neonatal red blood cell parameters (2017) in India and found that gestational hypertension increases red blood cells, reticulocytes, and reticulocyte production index. However, contrary to the present study, they declared that gestational hypertension reduces hemoglobin and neonatal hematocrit. This inconsistency could be due to differences in the type of study or demographic characteristics (15).

## Conclusion

Based on the results of the present study, the level of hemoglobin in infants born to mothers with gestational hypertension was significantly higher, compared to the control group, which remained significant with the grouping of mothers based on demographic characteristics and medical history. Therefore, due to the high prevalence of gestational hypertension and its dangerous side effects in infants, appropriate screening and laboratory tests should be performed on pregnant mothers to prevent the increase of hemoglobin levels in infants and thus reduce pregnancy complications.

Given the results of the present and previous studies regarding the high levels of hemoglobin in infants born to mothers with hypertension, promptly and correctly regular examination of positive signs and symptoms and clinical examination and Paraclinical tests are recommended. Therefore, hypertensive mothers will be diagnosed as soon as possible and screened for gestational hypertension so that they can control it properly and reduce neonatal complications.

## Acknowledgments

This study was derived from a thesis submitted

for the partial fulfillment of the requirement for the degree of Doctor of Medicine (No. 6523). The authors would like to thank the Islamic Azad University of Tehran Medical Sciences and all the people who contributed to this research.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

## Funding

The present study was funded by the Islami Azad University of Qom Branch, Iran.

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