Evaluation of the Relationship Between Types of Occupational Risk Factors and Pregnancy Induced Hypertension Among Iranian Employed Pregnant Women

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Abstract- Gestational hypertension or pregnancy-induced hypertension is the emergence of hypertension in a pregnant women after 20 weeks of gestation. This study aimed to evaluate the job-related factors associated with pregnancy-induced hypertension. This cross-sectional study was conducted on 560 pregnant women who referred to the Nursing Clinic of Imam Khomeini Hospital in 2017; of all studied cases, 210 pregnant women with pregnancy-induced hypertension were selected as cases and 350 women without pregnancy-induced hypertension were selected as controls. The data on demographic characteristics, occupational characteristics, and ergonomic dangers were collected by the researchers. Finally, the relationship between job variables and the probability of developing hypertension in pregnant women was measured. The results of the logistic regression analysis showed that the variables of body mass index, fertility, shift work, and service works had a significant relationship with pregnancy-induced hypertension. Women with service work were 2.32 times more likely to develop hypertension than women with other types of jobs (P=0.013). The people who had a shift work were 2.28 times more likely to develop pregnancy-induced hypertension than those who did not have shift work. Based on the results of this study, there was no relationship between ergonomic risks and pregnancy-induced hypertension. It seems that due to the higher frequency of pregnancy-induced hypertension in highly demanding jobs, it is necessary to pay more attention to the assessment of related risk factors, such as psychological variables.

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Introduction

Pregnancy can increase blood pressure in women who have previously had normal blood pressure. This increase is one of the common causes of hospitalization of pregnant women that occurs in 10-15% of pregnancies. If this condition is not controlled, it will exacerbate and result in the development of symptoms of preeclampsia and eclampsia and finally may become a life-threatening complication for the mother and the fetus (1-3).

Hypertension is one of the three deadly factors, which along with bleeding and infection, contribute to maternal morbidity and mortality. Pregnancy-related hypertension refers to a systolic blood pressure higher than 140 mm Hg and diastolic blood pressure higher than 90 mm Hg after 20 weeks of gestation. This disorder is associated with problems such as cerebral, cardiac, pulmonary, liver, and kidney damages to the mother and early birth, respiratory failure, and decreased intrauterine growth of the fetus (4,5).

There are four types of blood pressure in pregnancy including gestational hypertension, preeclampsia, eclampsia, and chronic hypertension (6).

In most cases, gestational hypertension is a temporary and transient condition that can be controlled by taking rest, but there is a risk of exacerbation and the development of preeclampsia until the end of pregnancy. On the other hand, this disease imposes a lot of stress and cost on the patient and the health care system. The exact cause of this disorder is unknown, but there are many theories in this regard, including theories of physical stress (7).

Studies have listed various types of severe physical

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stress as hazardous factors including long-term stand-ups, carrying heavy objects, heavy cleaning tasks, noise, shift work, high-speed work, occupational stress, and long hours of work (6-9).

Many people who work in night shifts and prolonged shifts suffer from different diseases such as digestive problems, cardiovascular diseases, immunosuppression, and metabolic disorders, cancer, mental disorders, reproductive system diseases (through changes in circadian rhythms, psychosocial stresses and sleep disturbances that cause irregular and prolonged menstrual cycles, dysmenorrhea, hypertension, preterm delivery, abortion, and low birth weight), as well as epilepsy, asthma, and diabetes (8,10-13).

Previous studies have shown that changes in circadian rhythms (such as shift work) are associated with an increased risk of preterm labor, limited intrauterine growth, hypertension, and preeclampsia (14,15). Therefore, given the effects of pregnancy-induced hypertension on maternal and fetal health, as well as the lack of studies in this area in Iran, this study aimed at investigating the effects of physical stress and shift work on the incidence of pregnancy-induced hypertension in pregnant women in Iran.

Materials and Methods

This case-control study was conducted on pregnant women who were employed and referred to hospitals affiliated to Tehran University of medical sciences for prenatal care or delivery; it only included women who did not meet the exclusion criteria. Overall, 560 pregnant women with a mean age of 31.5 (standard deviation=4.7 years) were studied. Of all, 210 pregnant women with pregnancy-induced hypertension and 350 pregnant women without pregnancy-induced hypertension were enrolled in the study as cases and controls, respectively.

All the required data, in keeping with the variables under the study (shift work, stand up time, the weight of transferred objects, frequency of bending and standing up, etc.) were collected using a checklist through interviews, an examination by a physician and assessing the results of clinical and paraclinical tests.

Exclusion criteria were the following: a history of hypertension prior to gestation, a history of cardiovascular disease in the mother during and before pregnancy, and a history of kidney diseases in the mother during and before pregnancy. Based on the inclusion criteria, this study only included women who were employed and were within an age range of and years. Informed consent was obtained from all patients prior to the above-mentioned activities.

In our study, the jobs were classified into four categories: the first group was entitled "Manager/Office/Business" with 152 cases, the second group was entitled "Health care worker" with 147 cases, the third group was entitled "Teacher/layer/reporter" with 108 cases, and the fourth group was entitled "service workers" with 148 cases. The details on the categorization of jobs are presented in table 1.

Finally, the data collected through using the checklist were entered into the SPSS16 statistical software and were analyzed. Then, the indices of mean, mode, and standard deviation were calculated. *t*-test and Chi^2 test were used to analyze the data.

Logistic regression was used to investigate the relationship between job variables and pregnancy-induced hypertension. When evaluating the mentioned relationship, the confounding variables related to this relationship were also included in the regression model. In order to investigate the relationship between occupational risk factors and hypertension in the logistic regression model, as described above, occupational categories were first specified. The jobs were classified into the four mentioned job categories, and then a two-dimensional variable was defined for each job and entered into the logistic model.

Table 1. Classification of occupations in the present study

Categories	Components
Health care workers	Medical doctor, nurse, obstetrician, practical nurse, nurse assistant, pharmacologist, dentist, Radiology technologist, surgical technologist,
Manager /business	Manager, financial and traditional jobs
Service workers	Service worker, janitor, carpet weaver, chef, tailor, hostler, photographer
Teacher/ layer/reporter	Employee, secretary, teacher, professor, typist

Results

As indicated in table 2, the mean age of pregnant women with pregnancy-induced hypertension (cases) was 32.59 years and, while in those without pregnancy-induced hypertension (controls), it was 30.93 years

(*P*<0.0001).

The mean BMI was 31.39 in the case group and 26.95 in the control group, and the difference was statistically significant (*P*<0.0001).

The mean working hours was 7.71 hours per day in the case group and 7.77 hours per day in the control group, and this difference was statistically significant.

Of all the studied people, 51.6% in the case group and 66.7% in the control group were shift workers (*P*=0.001). The comparison of the other characteristics of the studied people is presented in table 2.

Table 2. Characteristics of patients in women with and without gestational hypertension

Variables		With gestational HTN (n=210)	Without gestational HTN (n=350)	*P*
		Mean (SD)	Mean (SD)	
Age		32.59 (5.04)	30.93 (4.38)	<0.0001
Duration of job history (year)		8.29 (4.25)	7.07 (3.62)	<0.0001
Work duration in day (hour)		7.71 (1.63)	7.77(1.89)	<0.0001
BMI		31.39(4.88)	26.95(3.61)	<0.0001
Time spend for standing (hour)		4.90 (2.83)	4.11(2.51)	0.001
Weight of transferred burden (kg)		3.09 (3.19)	2.43 (2.46)	0.007
Time work with PC (hour)		2.11(2.29)	2.74 (2.46)	0.003
		Percent	Percent	
Parity	**≤1**	70.9%	29.1%	0.013
	>1	48.8%	51.2%	
Education	**≤Diploma**	64.5%	35.5%	0.81
	>Diploma	62.4%	37.6%	
Chemical exposures	**Yes**	56.7%	43.3%	0.07
	No	64.8%	35.2%	
Shift work	**Yes**	51.6%	48.4%	0.001
	No	66.7%	33.3%	

HTN: Hypertension, BMI: Body mass index, PC: Personal computer

The results of logistic regression analysis are presented in table 3. As shown in the table, the variables of body mass index, fertility, and shift work, and shift work job had a significant relationship with the risk of hypertension.

Women with a service work job were 2.28 times more likely to develop hypertension than women who had other jobs (*P*=0.013).

The study of the relationship between shift work and hypertension showed that people who were working in a shift work job were 2.28 times more likely to develop pregnancy-induced hypertension than those who did not have shift work.

Table 3. Logistic regression model for investigating the association between job variables and pregnancy-induced hypertension

Variables	Odds ratio	95% CI	*P*
Age	1.027	.97-1.08	.364
BMI	1.27	1.21-1.34	<0.001
Parity	1.98	1.28-3.09	.002
Education	1.82	.68-4.82	.227
Job	1.02	.95-1.09	.535
Teacher/ layer/reporter	1.12	0.86-1.37	0.508
Health care workers	1.26	.62-2.55	0.324
Manager /busines	1.08	.56-2.1	.801
Service workers	2.32	1.19-4.52	.013
Shift work	2.28	1.27-4.07	.011
Duration of standing in a day (hour)	1.05	.96-1.15	.217
Weight of transferred burden (kg)	1.03	.95-1.14	.421
Duration of working with computer in a day (hour)	.98	.88-1.09	.810
Chemical exposures	1	.59-1.7	.991

BMI: Body mass index

Discussion

In this study, it was tried to determine the relationship between occupational risk factors and pregnancy-induced hypertension in a case-control study. The results of this study showed that the variables of body mass index, fertility, shift work, and shift work job had a significant relationship with the risk of hypertension.

In a study by Chang and colleagues in 2010 in Taiwan, the researchers investigated the relationship between night work or long hours of work and pregnancy-induced hypertension or preeclampsia; based on the results of the mentioned study, pregnancy-induced hypertension or preeclampsia had no relationship with long hours of work or shift work (16). However, our study showed a significant relationship between pregnancy-induced hypertension and shift work; according to our findings, pregnancy-induced hypertension was more prevalent in women who worked in night shifts than in those not working in night shifts. Apparently, the changes in levels of the hormone in shift workers result in an increase in pregnancy-induced hypertension in this group.

In 2011, Jasovic *et al*., conducted a case-control study on pregnant women to examine the relationship between parity and mothers' age at the time of pregnancy and the incidence of pregnancy-induced hypertension. In the mentioned study, 67 pregnant women with severe hypertension were compared with 129 pregnant women with normal blood pressure and it was concluded that pregnancy-induced hypertension was more common in young primipara and multipara women (17). In our study, there was a significant relationship between multiparity and pregnancy-induced hypertension and after the regression analysis, the results still indicated a significant relationship ($P<0.05$).

In 2012 Hogan *et al*., conducted a study on 2230 pregnant women and compared obese women and those with normal BMI in terms of the incidence of pregnancy-induced hypertension. In this prospective observational study, BMI was measured at the beginning of pregnancy, and to reduce the effect of confounding factors, only white European women with single pregnancies were included in the study. Of the 2230 women, 16.8% were obese and preeclampsia was observed in 3.5% (74 patients) while pregnancy-induced hypertension was observed in 3% (67 cases). It was concluded that the prevalence of hypertension was higher in women with multigravid and primigravid obesity (18). In our study, there was a significant relationship between BMI and the incidence of pregnancy-induced hypertension in employed pregnant women with a higher body mass index (BMI).

In a study by Bilhartz *et al*., in Texas, 2005, the files of 385,537 births were investigated, and mothers' jobs were coded using the Standard Occupational Classification (SOC), and the relationship between pregnancy-induced hypertension and occupational classification was studied. The researchers concluded that the risk of pregnancy-induced hypertension varies in different job classifications (SOC). After controlling the confounding factors, it was found that women working in management, legal, and social services, education, counseling, and health care services were are more at risk of HDP, as compared with women working in industries such as food, cosmetics, personal care services, or women who were not employed (19).

In a study conducted on 560 employed pregnant women, the results of the regression analysis showed that the risk of pregnancy-induced hypertension was higher in service jobs such as hairdressers, tailors, retailers, and cleaners than in women who worked in office and management positions. In our study, there was no meaningful relationship between pregnancy and ergonomic hazards such as the weight of the transferred objects, time of daily stand-ups, computer use, and chemical exposure. Our finding is consistent with the results of other studies in this area; for example, in a cohort study by Nugteren *et al*., that was conducted on 4465 pregnant employed women in the Netherlands (2002-2006), the relationship between pregnancy-induced hypertension and preeclampsia in patients and physical and psychological stresses was investigated. The questionnaire was filled in the middle of the time of pregnancy and it was concluded that pregnancy-induced hypertension had no significant relationship with work-related hazardous factors such as prolonged standing ups, walking, heavy lifting, working hours, and exposure to chemicals (20).

Inconsistent with our study, Sorel *et al*., conducted a study to investigate the relationship between working conditions and hypertension during pregnancy; the study was conducted on 621 female hospital staff in Paris from 1979 to 1981. The required data were collected through interviewing during normal medical examination at the end of the postpartum period. Women who had to stand for a long time, carry heavy loads, or perform heavy washing were more prone to develop hypertension during pregnancy, as compared with women who were not exposed to these conditions (9).

Based on the results of this study, there is no

relationship between ergonomic risks and pregnancy-induced hypertension. However, shift work and service jobs can increase the risk of pregnancy induced hypertension among Iranian women. It seems that due to the higher frequency of pregnancy-induced hypertension in highly demanding jobs, it is necessary to pay more attention to the assessment of related risk factors, such as psychological variables. In addition, physicians must pay more attention to prenatal care and pregnancy-induced hypertension in employed women who have shift work.

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