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Original Article

Dietary determinants of pregnancy induced hypertension in Isfahan

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Abstract

BACKGROUND: Pregnancy-induced hypertension (PIH) is a pregnancy-specific condition that occurs after the 20th week of gestation. These physiologic changes can be aggravated by undernutrition. There are some evidence based on the importance of nutrient deficiency in developing this syndrome. Therefore, the aim of present study was to determine the nutritional risk factors for pregnancy induced hypertension in a group of pregnant women in Isfahan.

METHODS: In this case-control study, we recruited 46 Isfahanian pregnant women in two groups (with and without PIH). They were 19 to 45 year-old and they did not consume any antihypertensive or diuretic medications. Demographic questionnaire and food frequency questionnaire were filled in both groups.

RESULTS: There were no significant differences in energy and vitamin E and C intakes between the two groups. Zinc and calcium intakes were lower in women with PIH compared to those without PIH (P = 0.04 and P = 0.007, respectively). Riboflavin and protein intakes were lower in women with PIH compared to subjects without PIH (P = 0.03 and P = 0.01, respectively).

CONCLUSIONS: Lower intake of calcium, zinc, riboflavin and protein should be considered as possible risk factors for PIH. Adequate intake of dairy products which are good sources of mentioned nutrients are recommended to prevent PIH.

KEYWORDS: Pregnancy induced hypertension, diet, nutrient.

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Pregnancy induced hypertension is characterized by abnormal blood pressure, proteinuria and edema that usually develops after the 20th week of pregnancy [1]. This condition occurs in approximately 10% of pregnancies worldwide [2]. PIH can progress to eclampsia and also can result in preterm labor and delivery and low birth weight infants [3,4]. In developed countries, perinatal mortality of infants of preeclamptic mothers is five fold greater than for non-preeclamptic women and preterm deliveries due to preeclampsia account for 15% of preterm births [5]. The etiology of preeclampsia is not clear exactly [6], but PIH have been proposed to occur secondary to malnutrition [7]. However, Clausen et al [8] reported that energy intake was higher in women with preeclampsia. Despite the belief that low protein intake is associated with an increased risk of preeclampsia, a number of studies showed that reduced protein intake is not related to preeclampsia and protein supplementation did not reduce the incidence of preeclampsia [5]. Intake of calcium [9-11], zinc [11], folate [5,12] and vitamin C and E [5,13,14] have been suggested to be associated with preeclampsia.

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Knowledge regarding preeclampsia has increased dramatically in the past 10 years, but the role of diet has not been adequately studied and most of the nutritional studies have been poorly designed [5]. As it is difficult to reach conclusions from different studies of diverse populations, determining the nutritional risk factors of PIH deserves closer attention. Therefore, we compared the dietary intake of pregnant women with and without PIH.

Methods

Subjects: This case-control study has been conducted on consecutive pregnant women attending to Al-Zahra and Shaheed Beheshti hospitals in Isfahan, Iran during 1381-1382. Cases were selected from those pregnant women with PIH that were 19-45 year-old, had no renal or gastrointestinal diseases and had not used medications such as diuretics, antihypertension, antacids or calcium supplements. Control group included pregnant women without PIH that were matched with cases in age and parity. Therefore, the present study was conducted on 46 pregnant women with PIH and 46 pregnant women without PIH in Isfahan. Demographic information about age, parity and abortion was obtained by using a pre-tested questionnaire. The proposal of this study was approved by the Isfahan University of Medical Sciences and informed written consent was obtained from all women.

Anthropometry: All anthropometric measurements were made according to the World Health Organization protocol [15]. Weight was measured, with subjects minimally clothed, without shoes using digital scales and recorded to the nearest 100 grams. Height was measured in a standing position, without shoes using a tape meter while the shoulders were in a normal position.

Dietary intake assessment: Dietary intake was assessed by means of a semi-quantitative food frequency questionnaire (FFQ) and 24-hour dietary recall, which were completed by trained dietitians. FFQ consisted of a list of foods with a standard serving size. Participants were asked to report their frequency of consumption of each food item during the previous year on a daily, weekly or monthly basis. Nutrients intake were calculated according to the Nutritionist III software (Version 7.0., N Squared Computing, Salem, OR), which was modified for Iranian foods.

Statistical analysis: First, the normal distribution of each variable was tested by Kolmogorov-Smirnov test. We compared continuous variables in the two groups by student t test in the SPSS software. P values less than 0.05 were considered significant. Analysis of covariance adjusted for BMI and age was used in the univariate models for presenting the adjusted means of nutrients intake. Subjects who had lower intake than Recommended Dietary Allowances were considered as nutrient-deficient women.

Results

Mean age of the women with and without PIH were 26.5 ± 0.89 and 24.6 ± 0.72 years, respectively (P = 0.1). Mean BMI in women with and without PIH were 25.6 ± 0.89 and 23.6 ± 0.58 kg/m^2, respectively (P = 0.05). Twenty four percent of women with PIH and none of the non-PIH group were in the first pregnancy. Table 1 shows the demographic and the fertility characteristics of women in the two groups. There was no significant difference between case and control groups in age, height, parity, delivery interval, number of pregnancies and number of abortions. Prevalence of uneducated women in PIH group was higher than that in non-PIH group (15 % vs. 3 %, P<0.05). Table 2 shows the macronutrients and micronutrients intake in the two groups by adjusting the effects of age and BMI. There was significant difference in protein intake between pregnant women with PIH and those without PIH. Pregnant women with PIH had lower intake of calcium, zinc and riboflavin compared to pregnant women without PIH.

Table 1. Demographic and Fertility characteristics of pregnant women with PIH and pregnant women without PIH.

Fertility characteristics	Pregnant women with PIH (n = 46)	Pregnant women without PIH (n = 46)	P value[1]
Height(cm)	157.72 ± 3.6	158.45 ± 0.74	0.8
BMI(kg/m^2)	25.65 ± 0.89	23.6 ± 0.58	0.05
Age	26.5 ± 0.89	24.6 ± 0.72	0.1
Parity	2.5 ± 0.2	2.6 ± 0.2	0.35
Pregnancy intervals	1.13 ± 0.05	1.19 ± 0.07	0.40
Number of pregnancy	1.76 ± 0.13	1.93 ± 0.12	0.50
Number of abortion	1.76 ± 0.9	1.93 ± 0.8	0.30
Education:			
□ **Uneducated**	1 (3%)	7 (15%)	0.03 [2]
□ **Primary School**	12 (27%)	11 (24%)	
□ **Junior High School and High School**	22 (50%)	14 (3%)	
□ **Diploma and Higher**	9 (20%)	13 (28%)	

1. P values resulted from t test.

2. P values resulted from chi-square.

Table 2. Mean and standard error of macronutrients and micronutrients intake in pregnant women with PIH, and pregnant women without PIH (adjusted by BMI and age).

Nutrients	Pregnant women without PIH (n = 44)	Pregnant women with PIH (n = 44)	Mean Difference (95% CI)
Energy (kcal/d)	2943 ± 87.9	2783 ± 81.3	159.6 (-78.50,397.69)
Protein (g/d)	97 ± 2.5	88 ± 2.6	9 (1.75,16.49)
Calcium (mg/d)	1301.2 ± 59.8	1132.1 ± 56.13	169.1 (6.10,332.21)
Zinc (mg/d)	7.68 ± 0.4	6.09 ± 0.3	1.5 (0.45,2.72)
Vitamin E (mg/d)	0.6 ± 0.1	0.49 ± 0.06	0.1 (-0.14,0.35)
Riboflavin (mg/d)	1.89 ± 0.09	1.62 ± 0.07	0.27 (0.02,0.50)

Discussion

The results of present study, which was conducted in two groups of pregnant women, showed that women with PIH consumed lower amounts of protein and some micronutrients. However, there was no significant difference between women with PIH and pregnant women without PIH regarding the energy intake. Previous studies showed lower intake of macronutrient in preeclamptic women compared to those without PIH [8]. Calcium intake in women with PIH was lower than that in those without PIH in the present study. Previous studies also showed lower intake of calcium in preeclamptic women [16]. Even some clinical trials showed that calcium supplements can reduce the prevalence of preeclampsia. Its mechanism might be related to changes in prostaglandin E2 (PGE2) concentration. During pregnancy calcium metabolism is changed; several associated alterations in calcium metabolism have been identified. Possible metabolic abnormalities include a decrease in serum 1,25-dihydroxyvitamin D concentration [17], a decrease in serum ionized calcium concentration [18] and a decrease in urinary calcium excretion [16]. It is not clear if these abnormalities are consequences of PIH or results of inadequate dietary calcium intakes [16]. Increased intracellular calcium and decreased extracellular calcium have been observed during pregnancy, in which parathyroid hormone may play a role. Knight and Keith [19] showed that calcium supplements could reduce the angiotensin II sensitivity in women with PIH. However, Levin et al [20], reported no significant

effect of calcium supplements on preeclampsia. In the present study, zinc intake was lower in PIH group. The serum zinc level was 43 % lower in the preeclamptic women in previous studies [21,22]. However, in another study, median leukocyte zinc concentrations were 31% higher in preeclamptics as compared with controls [23]. Few data exist on biochemical zinc deficiency in pregnant women, which is partly due to lack of an appropriate indicator. Low plasma zinc concentrations during pregnancy resulting from low dietary bioavailability have been associated with congenital abnormalities and preeclampsia. Results of zinc supplementation trials in US women with low plasma zinc concentrations and whose intake of zinc was inadequate, showed improvement in pregnancy outcomes [24]. In the present study, women with pregnancy induced hypertension had lower intake of riboflavin compared to control group. Walker et al [25] showed high prevalence of preeclampsia in a group of pregnant women with riboflavin deficiency. Riboflavin deficiency was positively correlated with the development of preeclampsia even when controlled for parity, maternal age, weight and gestational age. Riboflavin deficiency was more common towards the end of pregnancy. Riboflavin status often decreases at the end of pregnancy because placenta formation depends on a reproduction-specific riboflavin carrier protein [25]. Endothelial dysfunction is a major pathophysiologic alteration observed in preeclampsia, which may result from oxidative stress and lipid peroxidation. Essential antioxidant enzymes such as glutathione reductase basically are dependent on flavin adenine dinucleotide as a prosthetic group [26]. Furthermore, the endothelium derived nitric oxide, which plays an important role in placental blood flow, is reduced in preeclampsia. Nitric oxide synthase requires flavin adenine dinucleotide and mononucleotide as cofactors [25]. Another possible cause for endothelial dysfunction, is low intake of antioxidant vitamins such as vitamin C and E [24]. However, in present study there was no significant difference in vitamin C or E intake between the two groups, which might be due to the low power of the study. We used FFQ and dietary recall for dietary assessment, which had underreporting and overreporting biases as its information was dependent on the memory [27]. Another limitation of the present study was its case-control design, which might have difficulties in matching and choosing the best control group [28]. We did not determine the validity and reproducibility of the FFQ, which was one of our limitations. Furthermore, because of cost limitations, we did not measure the calcium, zinc, vitamin B, C, E levels in the blood in the present study. In summary, intakes of zinc, Riboflavin, protein and calcium were lower in women with PIH compared to those without PIH. It seems that health centers in Iran should provide a comprehensive program of food supplementation for at risk pregnant women. Nutrition education sessions for introducing the food source of mentioned nutrients should be conducted for pregnant women in health centers in Iran.

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