«Original Articles»

The relationship between egg consumption during pregnancy and risk of gestational diabetes mellitus

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Abstract

Background: Substantial evidence indicates that diet can influence glucose homeostasis. Therefore modification of diet may have beneficial effects on diabetes risk. Limited studies have been published about the association between egg consumption and diabetes mellitus but studies about such association during pregnancy are very limited. The aim of this study was to investigate the association between egg consumption during pregnancy and risk of gestational diabetes mellitus (GDM) in Ahvaz.

Material and methods: In this case - control study, 123 pregnant women with GDM and 130 healthy pregnant women were compared. Usual egg consumption during pregnancy was determined by a food frequency questionnaire. Participants were classified into three groups according to usual egg consumption, as follows: low (<1 per week), moderate (1 to less than 4 per week) and high (≥ 4 per week). Data were analyzed by logistic regression test.

Results: After adjustment for the possible confounding factors (age, prepregnancy body mass index, monthly weight gain, parity, abortion in previous pregnancies, macrosomia in previous pregnancies, history of GDM, diabetes or GDM in the first-degree relatives, hypertension, education and spouse's education, gestational age) odds ratios for moderate and high egg consumption compared to low consumption were 1.602 and 1.345; (p=0.297 & p=0.573), respectively.

Conclusion: According to findings of this case-control study there was no association between egg consumption during pregnancy and risk of GDM.

Key words: diabetes, gestational diabetes mellitus, egg consumption.

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Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia (1). The worldwide prevalence of diabetes is rising rapidly. It is projected that 366 million individuals will be diabetic by the year 2030. According to the World Health Organization report, in year 2000 there were over 2 million diabetic patients in Iran and it has been projected that the number will be over 6.4 million by the year 2030 (2). Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (3). Normal pregnancy has been characterized as a "diabetogenic state" (4) and diabetes is a common medical complication of pregnancy (5). GDM represents nearly 90% of all pregnancies complicated by diabetes (6). The trend toward older maternal age, the epidemic of obesity and diabetes, and the decrease in physical activity and the adoption of modern lifestyles in developing countries may all contribute to an increase in the prevalence of GDM (7). It is estimated that GDM affects 1–14% of all pregnancies (8). The reported prevalence of GDM in Iran is 1.3 - 10% (9). Older age, overweight, a family history of diabetes, multiparity, macrosomia in earlier pregnancies and previous GDM or Impaired Glucose Tolerance (IGT) are the most important risk factors for GDM (10). GDM is associated with adverse effects on both mother and fetus (11). In addition to the adverse consequences of diabetes during pregnancy, women diagnosed with GDM are at risk for future type 2 diabetes mellitus and cardiovascular disease (12).

GDM is treated largely through dietary changes and moderate exercise to maintain appropriate weight gain (13).

Eggs are an important source of dietary cholesterol (a medium-sized egg contains about 200 milligrams of cholesterol) and other important nutrients such as minerals, vitamins, proteins, carotenoids, and saturated (~1.5 g/egg), polyunsaturated (~0.7 g/egg), and monounsaturated (~1.9 g/egg) fatty acids. Whereas several of these nutrients have been associated with an increased risk of type 2 diabetes (i.e., saturated fat and cholesterol), other nutrients may confer a lower risk of type 2 diabetes (i.e., polyunsaturated fat) (14). Findings from some studies suggest that dietary cholesterol from eggs leads to a modest increase in blood concentrations of total and low-density lipoprotein (LDL) cholesterol. Both traits have been found to be positively related to diabetes risk (15). Moreover, consumption of eggs instead of carbohydrate-rich foods may raise high density lipoprotein (HDL) cholesterol levels and decrease blood glycemic and insulinemic responses (16). In addition, a diet enriched with egg yolk was associated with elevated plasma glucose compared with a control diet in rats (17). High levels of egg consumption (≥1 eggs/day) have been related to an abnormal lipid profile in men and women with type 2 diabetes mellitus (18, 19). High egg consumption has also been associated with increased risk of type 2 diabetes in men and women (14). Additionally, positive associations of cholesterol intake with fasting glucose (20), incidence of type 2 diabetes (21), and gestational diabetes (22) have been reported.

Limited studies have been published about the association between egg consumption and diabetes mellitus and to the best of our knowledge only one study has published about such association during pregnancy (23). According to the authors' search, no report has been published about the relationship between egg consumption and diabetes mellitus in Iran. The aim of this study was to investigate the relationship between egg consumption during pregnancy and risk of GDM.

Material and methods

This was a case - control study. Participants were 123 pregnant women

with GDM and 130 healthy pregnant women as control (this sample size was enough for detection of statistical significant association between egg consumption and GDM with a power of 80%). Participants were recruited from a specialized clinic in Ahvaz. In this study, GDM was defined according to the latest American Diabetes Association diagnostic criteria (24). Controls were women who their diagnostic test was negative. Eligible women were those who were ≥18 years old, did not have overt diabetes before pregnancy and were not smokers. Informed consent was taken from all participants. Information about age, height, gestational age, pre-pregnancy weight, current weight, weight at diagnosis of GDM, parity, history of GDM, abortion or macrosomia in previous pregnancies, diabetes or gestational diabetes in first-degree relatives, hypertension, exercise, education and spouse's education was assessed by questionnaire. Usual egg consumption during pregnancy was estimated by a food frequency questionnaire (FFQ) that included questions about the frequency and amount of egg consumption (alone and in foods that contain egg). Participants were classified into three groups according to usual egg consumption, as follows: low (<1 per week), moderate (1 to less than 4 per week) and high (≥ 4 per week). Nutrients intakes were estimated by three 24-hour recalls by telephone interview. Data were analyzed with SPSS statistical software version 17, by t-Student, Chi-square and logistic regression tests.

Results

The characteristics of the case (GDM patients) and control groups are displayed in Table 1. The two study groups were significantly different with regard to a few variables, including age, parity, and prepregnancy Body Mass Index (BMI) (Table 1). Thirty three women in the case group and 25 women in the control group reported previous abortion (*P=0.141*). Four women in the case group and 1 woman in the control group reported a history of macrosomia in previous pregnancies (*P=0.148*). In addition, gestational diabetes in previous pregnancies was not significantly different between cases and controls. Nearly all participants reported no exercise during pregnancy. It was expectable and usual during pregnancy. Participants' energy intakes were calculated by 24-hour dietary recalls in three days and the data were analyzed by the N4 software. Since individuals were aware of their gestational diabetes while completing the 24-hour dietary recalls, there was a probability of error in reporting. In order to distinguish such misreporting, the "reported energy intake (EI) to Basal Metabolic Rate (BMR) ratio (EI: BMR) " was calculated. BMR was calculated according to FAO/WHO/UNU formula (25). Participants with (EI: BMR) < 1.35 were considered as under-reporters (26). High percentages of participants (86.7 % of cases and 44.6% of controls) were identified as under-reporters. The estimated energy intakes data were not reliable and therefore they were not reported. The average egg consumption was 2.61 eggs per week in case group and 3.08 eggs per week in control group (*P=0.23*). The numbers and proportions of low, moderate and high egg consumption are shown in table 2. After adjustment for the possible confounding factors (age, prepregnancy BMI, monthly weight gain, parity, abortion in previous pregnancies, macrosomia in previous pregnancies, history of GDM, diabetes or GDM in the first-degree relatives, hypertension, education and spouse's education, gestational age), the odds ratios (OR) of GDM for 1 to less than 4 eggs per week, and at least 4 eggs per week, compared with less than one egg per week, were 1.602 (95%CI: 0.661 - 3.883; P=0.297) and 1.345 (95% CI: 0.481-3.763; P=0.573), respectively, which were not statistically significant (Table 2).

Table 1. Characteristics of Gestational Diabetes Mellitus Cases and Controls, Ahvaz

Characteristic	Cases (n=123)			Controls (n=130)			P-value
	No.[a]	%	Mean (SD[b])	No.[a]	%	Mean (SD[b])	
Maternal age, years			30.1(4.9)			27.6(4.7)	0.00
gestational age, weeks			22(9.3)			28(3.3)	0.00
Parity			2.6(1.4)			2(1.3)	0.003
Prepregnancy BMI[c] (kg/m^2)			29.3(5.3)			26.2(5)	0.00
< 18.5	1	0.9		4	3.3		0.001
18.5-24.9	20	18.9		49	40.5		
≥ 25	85	80.2		68	56.2		
Monthly weight gain(kg)			1.1(1)			1.3(0.85)	0.112
Diabetes or GDM in the first-degree relatives	76	61.8		56	43.1		0.003
Education:							
Illiterate & elementary	36	29.3		15	11.6		0.00
Middle & high school	71	57.7		77	59.2		
University	16	13		38	29.2		
Spouse's education:							
Illiterate & elementary	24	19.5		8	6.2		0.004
Middle & high school	75	61		99	76.1		
University	24	19.5		23	17.7		
Hypertension	13	10.7		2	1.6		0.002

[a] Because data for all variables were not available for all subjects, the sum of some variables are not equal to the total numbers.
[b] SD: Standard Deviation
[c] BMI: Body Mass Index

Table 2. Odds Ratios(OR) for Gestational Diabetes Mellitus According to Maternal Egg Consumption, Ahvaz

Egg consumption (eggs/week)	Cases(n=123)		Controls(n=130)		OR[a]	95% CI[b]	P- value
	No.	%	No.	%			
< 1	32	26	28	21.5	1		
1 to less than 4	65	52.8	64	49.2	1.602	0.661 – 3.883	0.297
≥ 4	26	21.2	38	29.3	1.345	0.481 – 3.763	0.573

[a] Adjusted for age, prepregnancy BMI, monthly weight gain, parity, abortion in previous pregnancies, macrosomia in previous pregnancies, history of GDM, diabetes or GDM in the first-degree relatives, hypertension, education and spouse's education, gestational age.
[b] CI: Confidence Interval

Discussion

In this case-control study, there was no association between egg consumption during pregnancy and gestational diabetes mellitus. To the best of our knowledge, only in one study (23) the association between egg consumption and gestational diabetes risk has been investigated. Qiu et al. in their study analyzed data from a case - control study (Alpha study) and a cohort study (Omega study). In the Alpha study, consumption of ≥ 7 eggs per week compared with no consumption and in the Omega study consumption of ≥10 eggs per week compared with no consumption was associated with an increased risk of gestational diabetes. Because individuals with such high egg consumption were not in our study, participants' classification (according to usual egg consumption) was different from the mentioned studies. Limited studies have been published about the association between egg consumption and diabetes mellitus. Djoussé et al. (14) reported that high levels of egg consumption (≥7 eggs/week), compared with no consumption, were associated with increased risks of incident type 2 diabetes in both men (relative risk = 1.58; 95% CI: 1.25-2.01) and women (relative risk = 1.77; 95% CI: 1.28-2.43). In a case - control study (27) Radzevičienė et al. reported more than twofold increased risk of type 2 diabetes mellitus for individuals consuming 3–4.9 eggs/week (OR=2.60; 95% CI: 1.34-5.08) and threefold increased risk of the type 2 diabetes mellitus for individuals consuming ≥5 eggs/week (OR=3.02; 95% CI: 1.14-7.98) compared with those eating <1 egg/week. Shi et al. (15) observed significant and positive associations between egg consumption and the diabetes risk, particularly in women. In that cross-sectional study which was based on data from a subsample of the national nutrition and health survey in China, the odds ratios of diabetes for consumption of ≥1 eggs per day compared with < 2 eggs per week was 2.9 (95% CI: 1.08-7.84) in women and 2.22 (95% CI: 1.11-4.46) in the total sample. There was a similar, however, not statistically significant association in men. Although in that study the egg consumption was positively associated with the risk of diabetes, two potentially important confounding factors that are known risk factors for type 2 diabetes did not controlled for. Central obesity (waist circumference) was almost double in the diabetic group (55.7% in the diabetic group and 28.9% in non-diabetic group); in addition hypertension was significantly higher in diabetic group. Therefore the observed significant association may be due to uncontrolled confounding factors. Findings from these studies are in contrast to our study. Only the results of one study (28) is in line with our study. In that cohort study there was no association between egg consumption and increased risk of incident type 2 diabetes in older adults.

Our investigation has several strengths. In the present study, FFQ was completed before awareness of participants from their gestational diabetes. We estimated egg consumption alone and in foods that contain egg. In addition we collected information on whether participants consumed egg yolks or egg whites alone (nobody report consuming egg whites or egg yolks only). Previous studies estimated egg consumption alone. In addition, in other studies information about such behavior was not collected.

The limitation of our study is that we could not calculate actual nutrient and energy intakes from dietary habits (because of under-reporting). In Conclusion In the present study the odds ratios of GDM for 1 to less than 4 eggs per week, and at least 4 eggs per week, compared with less than one egg per week, were 1.602 and 1.345, respectively, which were not statistically significant. According to the results of this study, there is no association between egg consumption during pregnancy and risk of gestational diabetes.

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