Diet in Pregnancy and Preeclampsia: Is There An Association? A Hospital Based Matched Case Control Study

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ABSTRACT

Introduction: Preeclampsia has been rated amongst leading causes of feto-maternal morbidity and mortality but its etiology still remains not very clear.
Aims & Objectives: To study the association of intake of certain food items with preeclampsia.
Place and duration of study: This was a matched case-control study, carried out in tertiary care hospitals of Lahore during February 2019 to March 2020.
Material & Methods: One hunded and thirty-two subjects were recruited based on predetermined inclusion and exclusion criteria. Matching was done for age, gestational period, parity, education status, and income status. Information on consumption of various food items was recorded on food frequency questionnaire and results were analyzed to determine risk of developing preeclampsia by computing Odds Ratio. Data entry and analysis was done using SPSS version 20., p value ≤ 0.05 was taken as significant.
Results: Milk, meat and fruits consumption in study group did not show statistically significant association with preeclampsia (OR 0.51, 0.69, 1.75 and p-value=0.194, 0.211, 0.114 respectively), while consumption of green leafy vegetables shows statistically significant difference between Cases and Control. Higher risk of developing preeclampsia was seen in Cases with deficient intake of green leafy vegetables than in Controls with regular intake (Odds ratio=3.51 and p-value=0.001).
Conclusion: Deficient consumption of green leafy vegetables is associated with higher risk of preeclampsia in pregnant women.
Keywords: Preeclampsia, food frequency questionnaire, case-control study, Odds Ratio

INTRODUCTION

Preeclampsia is a multisystem pregnancy specific hypertensive condition occurring in 3–10% of pregnancies worldwide[1].Prevalence of this disorder ranges from 1.8% to 16.7% in developing countries [2].Preeclampsia occurs after twenty weeks of gestation and if not timely diagnosed and managed, the condition can lead to eclampsia which is a life threatening condition[3].Preeclampsia contributes significantly to maternal and infant morbidities and mortalities. However, the developing countries bear the impact of the disease more profoundly due to late diagnosis [4]. The problem is further complicated as the exact mechanism of developing this disease is still not clear for understanding the etiology and nature of the disease. In Pakistan its incidence ranges from 3–8 % [5].

Need for available folic acid, vitamin B12 and B6 is markedly increased during pregnancy. So, these nutrients have a very significant role in intrauterine growth of the fetus[6]. It has been suggested that increased prevalence of hypertensive disorders in women from developing countries is mainly due to dietary deficiencies[7, 8].

Proper diet and folic acid intake can be helpful to manage the inflammatory process and control preeclampsia and improve fetal growth[9].Placental hypoxia in preeclampsia triggers release of various factors and maternal nutritional status may also affect the endothelial response to these factors [10] Analysis of dietary patterns may give a more understandable description of data as compared to analysis of various foods items or single nutrient [11].

Evaluation of consumption of various food item would be an effective tool in understanding the role of diet in etiology of Preeclampsia[12]. Dietary pattern rich in fruits, vegetables and fish have shown inverse association with hypertension in Pakistani adult urban population[13].

Assessment of dietary patterns may afford a better explanation of data as compared to analysis of a single nutrient[14]. The food we take has wide variety of nutrients in different combinations thus the assessment of effect of individual nutrients on disease risks becomes difficult[15]Recent progress in nutritional epidemiology research has shown dietary

pattern rich in variety of vegetables and fruits can reduce the chance of having preeclampsia[16]. Dietary and life-style modifications have been shown to decrease risk of preeclampia[17]. A recent study evaluated the impact of consumption of Mediterranean diet (diet rich in fresh leafy vegetables, fruits and complex carbohydrates) on the risk of developing preeclampsia[18]. A large prospective cohort study found out that mothers adhering to traditional food pattern showed low risk of having this disorder[19,20]. An Iranian study revealed that pregnant women who had lower intake of vegetables and fruits showed increasing odds of preeclampsia[21]There is an alarming increase in the prevalence of nutritional disorders especially in developing countries like Pakistan[22,23].

This study is designed to investigate the possible association between certain foods and preeclampsia. The findings of this study can be helpful in giving nutritional advice for prevention and management of this disorder, in special context to dietary pattern of Pakistani population. As clinical alarm is always late in detecting preeclampsia, laboratory tests and nutritional advice can play an important role in such situation. Focused antenatal care and proper nutritional counseling can be useful in identifying and preventing preeclampsia thus reducing an undesireable pregnancy outcome.

Research Hypothesis:
Deficient Consumption of certain foods is associated with increased risk of preeclampsia in pregnant women
Aims & Objectives:
The purpose of this study is to look for most cost effective dietary solution to preeclampsia which detrimentally affects the health of the mother and her newborn.

MATERIAL AND METHODS

This study was conducted after taking approval from the Ethical Review Committee CMH LMC vide letter number 731/ERC/CMH-LMC

Study Setting: Gynecology and Obstetrics Department of Lahore General Hospital and Sir Ganga Ram Hospital for eleven months.

Sampling Technique: Non –probability purposive sampling.
Study population: Pregnant women aged 20 to 34 years at or more than 20 weeks gestation

Sample selection: Cases and controls were selected according to predetermined inclusion and exclusion criteria.
Pregnant women at or above 20 weeks of gestation having systolic blood pressure equal to or more than140mmHg and diastolic blood pressure equal to or more than 90mmHg and presence of albuminuria (1+ or more by dipstick method) were recruited as Cases, and pregnant women at or above 20 weeks of gestation with normal BP (systolic blood pressure≤120mmHg and diastolic blood pressure ≤80mmHg) as Controls. Patients with known, Diabetes mellitus, Cardiovascular disorder, Urinary tract infections, Renal failure, liver disease, Multiple gestation and Polyhydramnios were excluded from the study

Data Collection Procedure: The study was carried out as per Helsinki Declaration rights. Data was collected after obtaining fully informed, understood, and voluntary written consent of both cases and controls. Confidentiality of data was maintained. Selection of cases and controls was done from the Gynae/Obstetrics out-patient department and wards. A total of 132 subjects (66 Cases and 66 Controls) were recruited in 1:1 ratio and matching was done for age. parity, duration of gestation, education, occupation, and social status. History, physical examination and laboratory investigations were recorded in CEF (clinical evaluation form). The dietary intake was recorded on food frequency questionnaire (FFQ) by the researcher herself. This questionnaire has been used in COBRA study[13]. Based on the researchers' information about Pakistani dietary habits and their prior work experiences with the local population, some modification of the FFQ was done. In addition, available literature and information was also reviewed. The data showed common food habits of the Pakistani population belonging to low-income groups. Based on this evidence, a 31-item FFQ was formulated to evaluate the routine consumption of various food items over the last three months. Food frequency was determined irrespective of any specifications of quantity or portion size. The FFQ had questions about the frequency of consumption of different food items for locally available milk/milk products, fruits, meat and green leafy vegetables which are routinely consumed. Frequency of intake of food items was converted to number of times a food item was taken per week and then categorized into regular if taken equal or more than two times per week and deficient if taken less than two times in a week. Data entry and analysis was done using SPSS version 20. Odds Ratio was calculated to see association between

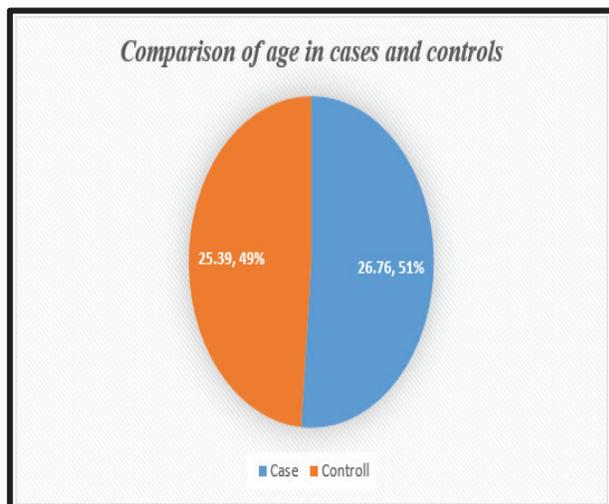food items intake and Preeclampsia in study population

RESULTS

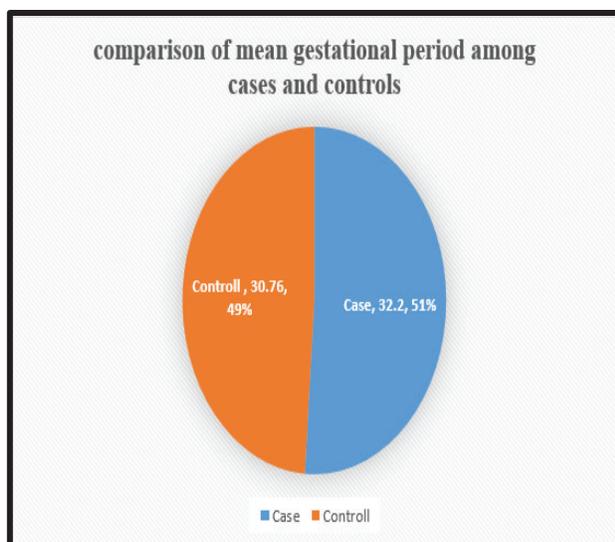**Fig-1: Comparison of Mean Age In Study Group.**

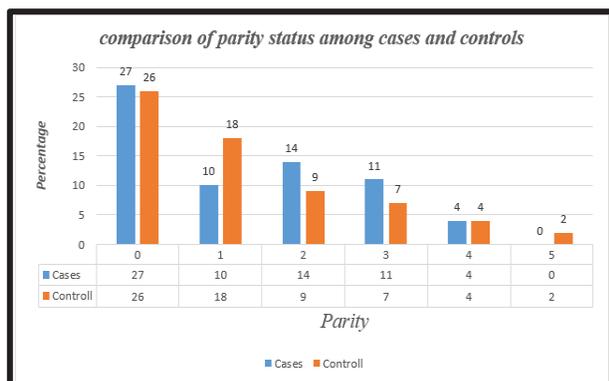**Fig-2: Comparison of Mean Gestational Period In Study Group**

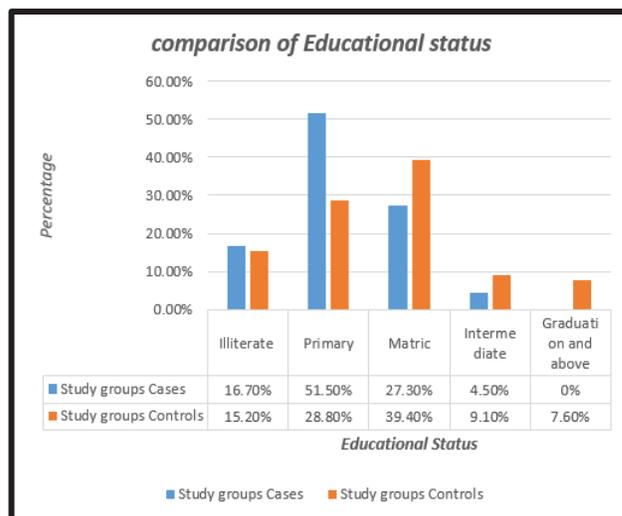**Fig-3: Comparison of Parity Status Among Cases And Controls**

Fig-4: **Comparison Of Educational Status Among Cases And Controls**

Demographic Variables	Categories	Study Groups		P-Value
		Cases	**Controls**	
Monthly Income (Rs)	<15000	51 (77.3%)	46 (69.7%)	**0.32**
	≥ 15000	15 (22.7%)	20 (30.3%)	
Occupation	Working	1(1.5%)	4(6.1%)	**0.17**
	House Wife	65 (98.5%)	62 (93.9%)	

Table-1: **Comparison Of Income And Occupation Among Study Population**

Food item	Frequncy of intake/ week	Study group (pregnant women at or more than 20 weeks of gestation)		Chi-value	p-value	OR
		Cases (Preeclamptic)	**Control (normotensive)**			
Milk/ milk products intake/ wk	*deficient	6 (36%)	11 (64%)	1.60	0.2	0.5
	*regular	60 (52%)	55 (48%)			
Meat intake/ wk	Deficient	37 (46%)	44 (54%)	1.56	0.2	0.7
	Regular	29 (57%)	22 (43%)			
Fruits intake /wk	deficient	33 (57%)	24 (43%)	2.56	0.1	1.8
	Regular	33 (44%)	42 (56%)			
*G LV intake/ wk	deficient	41 (66%)	21 (34%)	12.13	0.0	3.5
	Regular	25 (36%)	45 (64%)			

Table-2: **Association Between Various Food Items Intake and Preeclampsia.**

*deficient = < 2times/ week , *regular= ≥ 2times/week,
* GLV= green leafy vegetables

DISCUSSION

The findings of this research provide a probable association between the food intake by the pregnant women and risk of developing Preeclampsia. The mean age in cases and controls was 26.76 ± 5.82 years and 25.39 ± 4.69 years respectively. There was no statistically significant difference in mean age in both groups (p-value = 0.141) (Fig.1). The mean gestational age was 32.20 ± 4.12 weeks in cases and 30.76 ± 4.96 weeks in controls with no statistically significant difference (p-value = 0.072). (Fig 2). Parity, education, income and occupational statuses were also matched to avoid confounding (Fig.3, Fig 4, Table 1). In the present study milk, meat and fruits consumption in study groups did not show statistically significant association with preeclampsia (OR 0.51, 0.69, 1.75 and p-value=0.194, 0.211, 0.114 respectively), while difference in consumption of green leafy vegetables was statistically significant amongst study group with higher risk of developing preeclampsia with deficient intake of green leafy vegetables than with regular intake (Odds ratio=3.51 and p-value=0.001). This meant that mothers who consumed green leafy vegetables less than two times per week had 3.51 times more chance of developing preeclampsia than those who consumed GLV more than twice in a week. Another study found out that eating fruits and green leafy vegetables during pregnancy had protective effect on preeclampsia[24]Consumption of milk, which is rich in calcium, did not have any strong statistical association with the disorder while some studies found out that calcium supplements should be recommended to decrease risk of preeclampsia but no strong evidence of decreased risk of Preeclampsia was observed by intake of other micronutrients supplements[25]. A study in India, conducted on maternal nutrition, concluded that higher caloric intake and lower protein intake were linked with higher risk of developing preeclampsia while intake of fruits and green leafy vegetables showed decreased risk[26].In the present study, no statistical link was established between protein /meat intake and preeclampsia but our results, for green leafy vegetables, are in consistent with this study. A Dutch study found close association between dietary pattern and blood pressure during pregnancy[27]. An Australian study based, on systemic reviews and meta-analysis showed beneficial effect of taking fresh fruits and vegetables on preeclampsia/ eclampsia[28]. Kyozuka H. et al in their study also showed link between calcium rich foods (e.g milk and milk products) intake and risk of preeclampsia[29]. A case control

study in Addis Ababa, Ethiopia revealed consumption of fruit or vegetables at least three times a week during pregnancy to be protective against pre-eclampsia (AOR 0.42, and 0.45 respectively)[30]A study conducted in China showed that DASH-style diet which is predominantly plant based food, can reduce the development of hypertensive disorders of pregnancy.[31] A healthy dietary pattern was associated with reduced chance or prevention from preeclampsia and this can be made possible by dietary recommendations to the mothers thus avoiding adverse effects in the mother and the fetus[32].

A population based Indian study revealed that daily consumption of dairy products lead to lower risk of preeclampsia (OR= 0.88), consuming green leafy vegetables, fruits and meat at least weekly also had beneficial effect (OR=0.69, 0.92, 0.90 respectively) than those who eat them occasionally[33,24] .A case-control study conducted in Iran found no significant association between regular fruits and milk consumption and preeclampsia[34].In the present study we did not find statistically significant association between intake of milk, meat and fruits with preeclampsia while deficient consumption of GLV was found to be associated with increased risk of the disorder.

Limitations of the study

These were restricted to the study's retrospective design and chance of recall bias .

Strengths of the study

To our knowledge, very few studies have been conducted addressing the dietary risk factors of preeclampsia in Pakistan. There is a need for replicating such studies. Further research is imperative for a comprehensive assessment of dietary as well as other risk factors for having a clear understanding of etiology of this disorder.

CONCLUSION

Deficient consumption of green leafy vegetables is associated with higher risk of preeclampsia in pregnant women.

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