



High Body Mass Index a Risk Factor of Preeclampsia: A Hospital Based Case-Control Study

¹Zoofishan Qureshi, ¹Muhammad Ashraf Chaudhry, ²Nayyer Uzair,

³Tariq Mukhtar Farani, ⁴Uzair Mumtaz, ⁵Muhammad Umer Farooq

¹Department of Community Medicine, CMH Lahore Medical College, Lahore

²Department of Community Medicine, Services Institute of Medical Sciences, Lahore

³Department of Surgery, CMH Lahore Medical College, Lahore

⁴Department of Physiology, Fatima Jinnah Medical University, Lahore

⁵Institute of Public Health, Lahore

ABSTRACT

Introduction: Preeclampsia is a disease which is associated with pregnancy and enhances perinatal and maternal morbidity and mortality. The relationship of obesity and preeclampsia is still under research among different populations. **Aims & Objectives:** The objective of this study is to determine the strength of association of body mass index with preeclampsia in pregnant women. **Place and duration of study:** Gynecology/Obstetric Departments of Services Hospital, Lahore General Hospital and Sir Ganga Ram Hospital Lahore from 1st January 2019 to 30th June 2019. **Material & Methods:** It was a matched case-control study. Sixty six diagnosed pre-eclamptic antenatal women were selected as cases and they were matched with equal number of normotensive antenatal women. The definition, source and eligibility criteria of cases and controls were pre-determined. Odds ratio was calculated to measure strength of association between preeclampsia and body mass index (BMI). **Results:** Among 66 preeclamptic women, the mean age was 26.76±5.82 years and among 66 normotensives mean age was 25.36±4.69 years. Among cases, 49.7% had BMI ≥25 and 30.3% had BMI <25. Likewise among controls, 40.9% had BMI ≥25 and 59.1% had BMI <25. Odds Ratio was 3.32. The result was found statistically significant (P=0.001). **Conclusion:** Study concluded that high body mass index is a risk factor of preeclampsia among pregnant women.

Key words: Preeclampsia, antenatal, body mass index, BMI

INTRODUCTION

Preeclampsia is described as proteinuria and hypertension developing after twenty weeks of the gestation.^{1,2} However, the exact reason is unrecognized, pathophysiologic processes responsible for this disorder are explained in 2 stages. Stage-1 is due to decreased placental perfusion while stage-2 refers to maternal systemic manifestations due to inflammatory, thrombotic and metabolic reactions that meet to modify vascular function leading to multi-organ impairment.³ Globally, 2-8 percent pregnancies are affected by preeclampsia⁴ and it is linked with an elevated maternal morbidity and death in addition to risk of perinatal mortality, intrauterine growth restriction and preterm delivery.⁵

Among world populated countries, Pakistan is at sixth number and has 3rd highest burden regarding

fetal, child and maternal death as per global mortality latest systematic analysis.⁶ In Pakistan, 34% maternal mortalities occur due to eclampsia among females admitted in teaching health facilities.⁷ Investigators believed that preeclampsia is one of the multifactorial diseases and propose numerous risk determinants for it.⁸ For preeclampsia many risk factors are researched and still evidence is being generated on advanced age of mother, nulliparity, diabetes, persistent hypertension, family and previous history of preeclampsia, long gap between last and current pregnancy, multiple pregnancies and high BMI (body mass index).^{9,10} The obesity incidence is rising at a disturbing rate all over the globe.¹¹ Among reproductive age females obesity is growing fast. In America 61.9 percent young females are obese or overweight while in Pakistan about 34.8% reproductive age females are found overweight, which is approximately double when compared with

India.¹² Preeclampsia risk increases with obesity through hyperlipidemia, insulin resistance as well as persistent inflammation.¹³

The association between obesity and preeclampsia has greatly been studied.¹⁴ A study carried out in UK demonstrated that extremely obese females had fourfold enhanced risk of preeclampsia when compared with female who had normal weight.¹⁵ It was found that obese females have 8.7% prevalence of preeclampsia.¹⁶ A study carried out in India indicated that prevalence of preeclampsia among females was 18.0% while it was considerably higher among obese females than normal weight females.¹⁷ A comparative study carried out at Rawalpindi Military Hospital showed that the frequency of preeclampsia was 35.0% among obese women.¹⁸ A study performed in Multan at Nishtar Hospital demonstrated that among obese women, the frequency of preeclampsia was 23.8%.¹³ Another case-control study conducted at Lady Reading Hospital, Peshawar found 33 obese women out of 40 cases (preeclamptic) which is almost 82.5 percent while 25 obese women among 40 control (normotensives), which is about 62.5%. Study found that preeclampsia is very common in obese female.¹¹

Preeclampsia is an important health issue among females that enhances the risk of perinatal death, preterm delivery and maternal mortality. Therefore, current study is designed to investigate the strength of association of BMI with preeclampsia in pregnant women.

MATERIAL AND METHODS

It was a matched case-control study conducted from January 2019 to August 2019.¹³² pregnant women (66 cases and 66 controls, keeping the cases to control ratio 1:1). Females attending Gynecology/Obstetric Departments of Services Hospital, Lahore General Hospital and Sir Ganga Ram Hospital were included through non-probability convenience sampling technique. Cases and controls were matched for age, gestational period and income status.

Sample size: It was calculated with WHO sample size calculator for case-control study, with 90% power of study, 5% margin of error, anticipated probability in cases 43% and in controls 13%.⁷

Definition, source and selection of Cases: Pregnant women aged between 20 to 35 years, at ≥ 20 weeks of gestation having confirmed preeclampsia by a gynecologist with systolic blood pressure ≥ 140 mmHg and diastolic blood

pressure ≥ 90 mmHg, along with presence of albuminuria (1+ or more by dipstick method).

Definition, source and selection of Controls:

Pregnant women aged between 20 to 35 years at ≥ 20 weeks of gestation with systolic blood pressure ≤ 120 mmHg and diastolic blood pressure ≤ 80 mmHg.

Patients with following conditions were excluded from the study; known cardiovascular disorder, diabetes mellitus, renal failure, liver disease, multiple gestation, polyhydramnios and urinary tract infections.

Selection of cases and controls was done from the Gynecology/Obstetrics Out-patient Departments and wards after taking written informed consent.

The study was carried out as per Helsinki declaration on protection of rights of human subjects. Scientific and ethical review of this research was done by Department of Community Medicine, CMH Lahore Medical College.

Statistical analysis:

Data was collected through questionnaire, which was entered into computer using SPSS 20.0. For quantitative variables mean and standard deviation were calculated and for qualitative variables frequency and percentages were calculated. Chi-square test was applied to find out association between categorical variables and Odds Ratio was calculated to measure strength of association. Confidentiality of the data was ensured and proper consent was obtained before data collection.

RESULTS

Table-1 exhibits that among cases (preeclamptic), mean age was 26.76 ± 5.82 years and among controls (normotensive), the mean age was 25.36 ± 4.69 years. Among 66 cases, 11 (16.7%) pregnant women were illiterate and 55 (83.3%) were literate. Likewise among 66 controls, 10 (15.2%) pregnant women were illiterate and 56 (84.8%) were literate. The result was found statistically significant as the p-value was 0.019.

Out of 66 cases, 51 (77.3%) pregnant women had family monthly income $< 15,000$ rupees and 15 (22.7%) had $\geq 15,000$ rupees. Among 66 controls, 46 (69.7%) pregnant women had family monthly income $< 15,000$ rupees and 20 (30.3%) had $\geq 15,000$ rupees. Result shows that among 66 cases, only 1 (1.5%) pregnant woman was working and 65 (98.5%) were housewives. Similarly among 66 controls, 4 (6.1%) pregnant women were working and 62 (93.9%) were housewives. The result was found statistically insignificant as the p-value was 0.171.

Table-2, Fig-1 assert that among cases, mean BMI was 27.95±4.98 while among controls, mean BMI was 23.60±4.09. The difference was found statistically significant as the p-value was 0.001.

Table-3 demonstrates that among 66 cases (preeclamptic), 46 (49.7%) had BMI ≥25 and 20 (30.3%) had BMI <25. Likewise among 66 controls (normotensive), 27 (40.9%) had BMI ≥25 and 39 (59.1%) had BMI <25. The result was found statistically significant as the p-value was 0.001. Odds Ratio being 3.32.

	Study groups		P-value
	Case	Control	
Age (mean±SD)	26.76±5.82	25.36±4.69	0.141
Educational status			
Illiterate	11 (16.7%)	10 (15.2%)	0.019
Literate	55 (83.3%)	56 (84.8%)	
Total	66 (100.0%)	66 (100.0%)	
Monthly income			
Rs.<15,000	51 (77.3%)	46 (69.7%)	0.324
Rs.≥15,000	15 (22.7%)	20 (30.3%)	
Total	66 (100.0%)	66 (100.0%)	
Occupation			
Working	1 (1.5%)	4 (6.1%)	0.171
Housewife	65 (98.5%)	62 (93.9%)	
Total	66 (100.0%)	66 (100.0%)	

Table-1: Socio-demographic characteristics

	Study groups		P-value
	Case	Control	
Height	1.60±0.09	1.60±0.06	0.942
Weight	71.20±11.87	60.38±10.05	0.001
BMI	27.95±4.98	23.60±4.09	0.001

Table-2: Clinical characteristics

BMI	Study groups		p-value	OR	β	P-value	AOR	C-I
	Case	Control						
≥25	46 (69.7%)	27 (40.9%)	0.001	3.32	0.92	0.021	2.66	1.16-6.10
<25	20 (30.3%)	39 (59.1%)						

Table-3: Association between preeclampsia and high body mass index

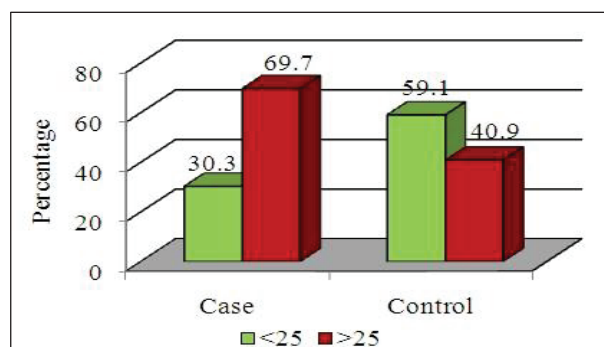


Fig-1: Association between preeclampsia and high body mass index

DISCUSSION

The current study was conducted to evaluate the body mass index as a risk factor for pre-eclampsia and to determine the strength of association. Age is a known confounder so in our study we matched females in both group. Mean age in both groups was not significantly different statistically. In cases the mean age of the pregnant women was 26.76±5.82 years while among controls the mean age of the pregnant women was 25.36±4.69. The findings of our study are comparable with a recent study performed by Wajahat et.al (2019) who demonstrated that mean age of pregnant women presenting with pre-eclampsia was 27.08±3.59 years.⁴

Educational status was significantly different in both groups and majority of pregnant women in both groups were literate. When the occupation was assessed among pregnant women, study disclosed that one (1.5%) in cases and four (6.1%) in controls were working women and remaining massive portion of pregnant women was of housewives. Findings of our study are in contrast to study carried out by Shao and coworkers (2017) indicated that among cases 59.7% pregnant women and among controls 68.3% pregnant women were working and remaining proportion was of housewives.² This might be due to the role of our cultural norms in relation to working women. Usually women are not working after marriage.

Role of family monthly income can never be ignored because better family income encourages pregnant women in acquiring timely and better treatment. It was very disturbing to know that 77.3% cases and 69.7% controls had family monthly income <15,000 rupees. A similar study carried out by Shamsi and fellows (2010) also highlighted that among pregnant women, more than half (65.6%) in cases and (54.8%) in controls had family monthly income <15,000 rupees.⁵

When the BMI among both cases and controls was assessed, study disclosed that controls had normal weight (mean BMI 23.60±4.09) while cases had over weight (mean BMI 27.95±4.98) indicating BMI to be a risk factor for preeclampsia. The study done by Parveen and associates (2017) reported that preeclamptic pregnant women were obese (mean BMI 31.74±1.01).¹³

Association between preeclampsia and high body mass index was determined. Among cases, 69.7% pregnant women had overweight and 30.3% were normal while among controls 40.9% pregnant women had overweight and 59.1% were normal. Mbah et al. (2010) reported in their study that

prevalence of preeclampsia among obese females was 8.7%.¹⁶ Another study undertaken in India by Dasgupta and partners (2014) elucidated that among respondents preeclampsia incidence was 18% and it was considerably higher among obese women.¹⁷ A study conducted in Rawalpindi by Choudhry and collaborators (2009) asserted that incidence of preeclampsia was 35% among obese females.¹⁸ The results of a study performed by Parveen and associates (2017) in Nishtar Hospital Multan highlighted that prevalence of preeclampsia was high (23.8%) among obese women.¹³ A recent study carried out in Peshawar by Salman et al. (2019) confirmed that among obese women, 82.0% had preeclampsia.¹¹ Another study conducted by Wajahat and teammates (2019) confirmed that among cases the incidence of preeclampsia was 55.3% while the incidence was 13.4% among controls.⁴

Adjusted odds ratio (AOR) in current study is 2.66 (CI=1.16-6.10) which means the odds of presence of high BMI is 2.66 times more in preeclamptic females as compared to normotensive pregnant females. This is very close to another case control study reporting AORs as 3.33 (95 % CI: 1.87, 5.79).¹⁹ In another recent study of 2020 the AOR was found to be 2.00, 95% CI (1.10, 3.63),²⁰ which is very close to our findings. All this evidence suggests a strong association between BMI and preeclampsia.

Current study has highlighted the association as well as strength of this association which means adding evidence to the existing literature. Case control study always has a limitation of biases but selection bias was reduced as much as possible in this study. It is recommended to conduct more analytical studies to measure the risk posed by BMI in development of preeclampsia.

CONCLUSION

Study concluded that high body mass index is a risk factor for preeclampsia among pregnant women and both are strongly associated. By reducing BMI in and before pregnancy can help removing an important risk factor for developing preeclampsia.

REFERENCES

1. Hutcheon JA, Lisonkova S, Joseph K. Epidemiology of pre-eclampsia and the other hypertensive disorders of pregnancy. *Best Practice & Research Clinical Obstetrics & Gynaecology*. 2011; 25(4):391-403.

2. Shao Y, Qiu J, Huang H, Mao B, Dai W, He X, et al. Pre-pregnancy BMI, gestational weight gain and risk of preeclampsia: a birth cohort study in Lanzhou, China. *BMC pregnancy and childbirth*. 2017; 17(1):400.
3. Jeyabalan A. Epidemiology of preeclampsia: impact of obesity. *Nutrition reviews*. 2013; 71(suppl_1):S18-S25.
4. Hussain W, Badar S, Abbas H, Imran M, Khan MA, Soomra MR. Obesity: A Risk Factor of Preeclampsia. *The International Journal of Frontier Sciences*. 2019; 3(2):104-7.
5. Shamsi U, Hatcher J, Shamsi A, Zuberi N, Qadri Z, Saleem S. A multicentre matched case control study of risk factors for preeclampsia in healthy women in Pakistan. *BMC women's health*. 2010; 10(1):14.
6. Soomro S, Kumar R, Lakhan H, Shaukat F. Risk Factors for Pre-eclampsia and Eclampsia Disorders in Tertiary Care Center in Sukkur, Pakistan. *Cureus*. 2019; 11(11).
7. Khowaja AR, Qureshi RN, Sheikh S, Zaidi S, Salam R, Sawchuck D, et al. Community's perceptions of pre-eclampsia and eclampsia in Sindh Pakistan: a qualitative study. *Reproductive health*. 2016; 13(1):39-44.
8. Motedayen M, Rafiei M, Tavirani MR, Sayehmiri K, Dousti M. The relationship between body mass index and preeclampsia: A systematic review and meta-analysis. *International Journal of Reproductive BioMedicine*. 2019; 17(7):463.
9. Mrema D, Lie RT, Østbye T, Mahande MJ, Daltveit AK. The association between pre pregnancy body mass index and risk of preeclampsia: a registry based study from Tanzania. *BMC pregnancy and childbirth*. 2018; 18(1):56.
10. Sohlberg S, Stephansson O, Cnattingius S, Wikström A-K. Maternal body mass index, height, and risks of preeclampsia. *American Journal of Hypertension*. 2012; 25(1):120-5.
11. Salman H, Hamid N, Zafar U, Marwat S, Khan M. Association of Preeclampsia with Obesity. *Journal of Middle East and South African Sciences*. 2019 (5): 34-7
12. Yousuf F, Naru T, Sheikh S. Effect of body mass index on outcome of labour induction. *Journal of the Pakistan Medical Association: JPMA*. 2016; 66(5):598.
13. Parveen S, Mumtaz S, Bashir SG. Frequency of Pre-Eclampsia in Obese Patients. *Pakistan Journal of Medical and Health Sciences*. 2017; 26:4.52.

14. Lopez-Jaramillo P, Barajas J, Rueda-Quijano SM, Lopez-Lopez C, Felix C. Obesity and preeclampsia: common pathophysiological mechanisms. *Frontiers in Physiology*. 2018; 9:1838
15. Knight M, Kurinczuk JJ, Spark P, Brocklehurst P. Extreme obesity in pregnancy in the United Kingdom. *Obstetrics & Gynecology*. 2010; 115(5):989-97.
16. Mbah A, Kornosky J, Kristensen S, August E, Alio A, Marty P, et al. Super-obesity and risk for early and late pre-eclampsia. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2010; 117(8):997-1004.
17. Dasgupta A, Harichandrakumar K, Habeebullah S. Pregnancy outcome among obese Indians-a prospective cohort study in a tertiary Care Centre in South India. *International Journal of Scientific Study*. 2014; 2(2):13-8.
18. Choudhry H, Choudhry A, Azam N, Jan S. Effects of Obesity on Pregnancy and its outcome. *Pakistan Armed Forces Medical Journal*. 2009; 59(3):315-9.
19. Endeshaw M, Abebe F, Worku S, Member L, Assress M, Assefa M. Obesity in young age is a risk factor for preeclampsia: a facility based case-control study, northwest Ethiopia. *BMC pregnancy and childbirth*. 2016; 16(1):1-11.
20. Mekie M, Mekonnen W, Assegid M. Cohabitation duration, obstetric, behavioral and nutritional factors predict preeclampsia among nulliparous women in West Amhara Zones of Ethiopia: Age matched case control study. *PLoS One*. 2020; 15(1):e0228127.

The Authors:

Dr. Zoofishan Qureshi,
Assistant Professor
Department of Community Medicine,
CMH Lahore Medical College, Lahore.

Prof. Muhammad Ashraf Chaudhry,
Head, Department of Community Medicine,
CMH Lahore Medical College, Lahore.

Dr. Nayyer Uzair,
Senior Demonstrator,
Department of Community Medicine,
Services Institute of Medical Sciences, Lahore.

Dr. Tariq Mukhtar Farani,
Assistant Professor,
Department of Surgery,
CMH, Lahore.

Dr. Uzair Mumtaz,
Associate Professor,
Department of Physiology,
Fatima Jinnah Medical University, Lahore.

Muhammad Umer Farooq,
Demonstrator Biostatistics,
Institute of Public Health, Lahore.

Corresponding Author:

Dr. Zoofishan Qureshi,
Assistant Professor
Department of Community Medicine,
CMH Lahore Medical College, Lahore.
E-mail: zimran195@gmail.com