International Journal of Science and Technology Research Archive

ISSN: 0799-6632 (Online)

Journal homepage: https://sciresjournals.com/ijstra/

(RESEARCH ARTICLE)

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Maternal and fetal morbidity and mortality among pregnancies complicated by pre-eclampsia in Omdurman Maternity hospital, Sudan

Rowda Ali Musa Musa * and Alya Yousif Abdalla Mohamed

Family physician, Sudan Medical Specialization Board, Sudan.

International Journal of Science and Technology Research Archive, 2023, 04(01), 173–181

Publication history: Received on 04 January 2023; revised on 14 February 2023; accepted on 16 February 2023

Article DOI: https://doi.org/10.53771/ijstra.2023.4.1.0030

Abstract

Background: Maternal mortality and morbidity are one of the biggest problems worldwide. Every day approximately 830 women die from preventable causes related to pregnancy and child birth. Ninety nine percent of these deaths occur in developing countries of which more than half are in sub Saharan Africa and one third in South Asia. Preeclampsia may lead to prematurity, still birth, intrauterine growth retardation and perinatal death. Consequently early diagnosis of preeclampsia and close observation are imperative. Despite advances in medical practice pre-eclampsia still remains a leading cause of maternal and prenatal morbidity and mortality.This study was conducted at Omdurman Maternity Hospital (OMH) in Sudan to assess the mortality and morbidity among the pre-eclampsia mothers admitted for delivery and among the babies delivered to them

Material and methods: It was a prospective cross sectional hospital based study conducted at Omdurman Maternity Hospital (OMH) in Sudan. All the pregnant women with preeclampsia who delivered during June – December 2020 in the hospital were the study population. Sample size was calculated by using this equation, N = Z2X P (1-P)\ e2, Where N = Sample Size. Z = Value 1.96., P = Prevalence. Total 97 women meeting the inclusion criteria was the sample size. Systematic sampling method was applied to collect the files of women admitted in preeclampsia ward. Data were retrieved from the files of the patients which consisted of sociodemographic information, medical and obstetric history, family history, factors associated with preeclampsia and the outcome of the treatment, maternal and prenatal morbidity and mortality. The data were entered and analyzed by using SPSS, version 21 .Descriptive statistics were presented using counts, proportions (%), and mean ± standard deviation whenever appropriate. The comparison study was done by using chi square. A p-value cut off point of 0.05 at 95% CI was used to determine statistical significance.

Results: The data from the files of 97 patients with preeclampsia were retrieved for the analysis. Majority of them were in the age group of 20 years or less Almost fifty percent (N=48) were nulliparous while 20.6 %(N=20) were having 2 children, 12.4% having three children and 17.5% had 4 and more children. The gestational age of majority of the patients (64.9%) attending the hospital was between 36-38 weeks. Only 19.6% of the patients were having past history of pre-eclampsia. Ninety nine percent of the patients did not have the family history of preeclampsia. Thirty seven percent of the patients were suffering from severe hypertension at admission while thirty eight percent were suffering from moderate hypertension and only 24.7% were suffering from mild hypertension. The blood pressure at the time of delivery was recorded as normal among the 9.30% of the patients, while mild among 26.80% moderately high among 29.9% and very high among 33% of the patients. As far as the investigations are concerned the vast majority of the patients (96.9%) had 1+ to 3+ protein Urea while 3.1% were having more than 3+ protein Urea in the urine. The majority of the pregnant women (59.8%) had blood hemoglobin level higher than 11 gm. /dl while 35.1% had between 9-11 mg/dl and only 4.1% with blood hg level less than 9gm/dl. Most of the patients (84.5%) underwent caesarian section for delivery. Almost eighty nine percent of the mothers totally recovered after delivery while 9.3% suffered temporal disability and 2.1% by permanent disability. As far as the infant outcome is concerned 68% were born on term while

* Corresponding author: Rowda Ali Musa Musa

18.6% as preterm, 8.2% IUFD and 5.2% as term +A life. Thirty three percent of the baby born was of normal weight while majority of them (64.90%) were underweight and only 2.10% were overweight.

Conclusion: As far as mortality and morbidity among the mothers and the newborn baby is concerned, though no mortality was reported among the baby and the mothers. Morbidity such as IUFD and low birth weight were reported among babies while majority of the patients with pre-eclampsia underwent caesarian section for delivery and very few mothers suffered from temporal and permanent disability. However the more investment must be made in women's health needs to reduce the problem and health service providers need to give due attention to high-risk women.

Keywords: Pre-eclampsia; Pregnancies; Mortality; Morbidity

1 Introduction

Maternal mortality and morbidity are one of the biggest problems worldwide. Every day approximately 830 women die from preventable causes related to pregnancy and child birth. Ninety nine percent of these deaths occur in developing countries of which more than half are in sub Saharan Africa and one third in South Asia. Globally preeclampsia is the third leading cause of pregnancy related deaths, superseded only by hemorrhage and sepsis. [1] Preeclampsia is a pregnancy –specific, multisystem disorder that is characterized by the development of new onset hypertension and proteinuria after 20 weeks of gestation and resolving less than 10 days after birth.[2] Preeclampsia increase prenatal mortality 5-fold and kill 76,000 women yearly worldwide .[3] The disorder complicate approximately 5-7% of hypertensive disorder of pregnancy, if left untreated it can develop into eclampsia, the life threatening occurrence of seizure during pregnancy. Preeclampsia is associated with increased risk of placental abruption, acute renal failure, cerebrovascular and cardiovascular complications, disseminated intravascular coagulation, and maternal death. Preeclampsia may lead to prematurity, still birth, intrauterine growth retardation and perinatal death. Consequently early diagnosis of preeclampsia and close observation are imperative. Despite advances in medical practice pre-eclampsia still remains a leading cause of maternal and prenatal morbidity and mortality.[4]

It has been observed that up to 30% or more of women with chronic (preexisting) hypertension or gestational hypertension also develop preeclampsia; women with mild chronic (preexisting) hypertension have 20% risk of developing superimposed preeclampsia and those with chronic severe hypertension have 50% risk of superimposed preeclampsia. Women with chronic (preexisting) hypertension and end organ disease, severe hypertension or secondary hypertension are at greatest risk for superimposed preeclampsia.[5]

Although some researchers found that there might be some dietary and mineral deviancies associated with preeclampsia, in study conducted in Ghana revealed that women with preeclampsia had considerably lower serum calcium and magnums level [6,7]**1**. Also study in kassala found that severe anaemia was associated with preeclampsia and the risk of preeclampsia was 8 times higher in women with severe anaemia, also preterm deliveries and still birth significantly increased with severe anaemia. Physiologically, research has linked preeclampsia to the following physiologic changes: alterations in interaction between the maternal immune response and the placenta, placental injury, endothelial cell injury, altered vascular reactivity, oxidative stress, and imbalance among vasoactive substances, decreased intravascular volume and disseminated intravascular coagulation. **[8]**

The morbidity and mortality of preeclampsia related to development of eclampsia, the life threatening occurrence of seizure during pregnancy. Placental abruption, ante partum hemorrhage, acute renal failure, cerebrovascular and cardiovascular complications, disseminated intravascular coagulation, and maternal death. Prematurity, still birth, intrauterine growth retardation, low birth weight and prenatal death can also occur. One research in soba hospital Sudan found that maternal and prenatal morbidity and mortality of preeclampsia related to52% were preterm, 53% were small for gestational age, 86% had birth asphyxia, 20% had thrombocytopenia, 38% had sepsis and neonatal mortality rate was 6%.**[9]** While another study done in kassla revealed that 11.8% of women with preeclampsia develop eclampsia, 9.2% had severe preeclampsia, and 6.5% superimposed preeclampsia, also higher rate of preterm delivery and one maternal death. **[10]** Another hospital base study done in Indian women with preeclampsia to monitor for outcomes this study reported that 13.9% develop ante partum hemorrhage and 23.6% of neonate was premature. **[11]** Although comparative study done on maternal mortality associated with preeclampsia in Africa, Asia, Latin America the Caribbean ,were found that , the maternal mortality are similar in Africa, Latin America the Caribbean , despite considerably higher mortality in Africa. With preeclampsia is greatest in Asia, This report suggest that 10-15% of maternal deaths due to preeclampsia and 10% are associated with eclampsia.**[12]** In prospective cohort hospital base study of persistent hypertension following preeclampsia revealed that woman with severe preeclampsia more likely to experience persistent hypertension after 6 weeks from delivery and 7.3 times more likely to develop persistent hypertension than women with mild preeclampsia. **[13]** Another prospective cohort study in Tanzania on recurrence of

prenatal death, preterm birth and preeclampsia, the study found that women with pervious history of preeclampsia had 21.2% risks of developing prenatal death, 17% preterm birth, delivery of low birth weight, chronic hypertension, gestational hypertension and 24.6% develop preeclampsia in their subsequent pregnancy. [14]

Globally maternal mortality declined 44% from 385 deaths per 100,000 live births in 1990 to 216 in 2015. Although maternal death and new born death are closely linked more than 3 million babies die every year and additional 2.6 million babies are still birth. Sudan is one of the 10 countries in the region with highest maternal mortality rate, estimate 311per 100.00 live birth and also neonatal mortality rate in Sudan estimated about 32, 31, 31, 30, 30 from 2011-2015 per 100,000 live birth in a given years. [15] There is an extremely high maternal mortality in Sudan with pre-eclampsia accounting 4.2% of obstetric complication and 18.1% of maternal deaths. And there for Pre-eclampsia should be detected and appropriately managed before the onset of convulsion (Eclampsia) and other live threatening complications. [5]

2 Material and methods

It was a prospective cross sectional hospital based study conducted at Omdurman Maternity Hospital (OMH) in Sudan. All the pregnant women with preeclampsia who delivered during June – December 2020 in the hospital were the study population. A population file of pregnant women suffered from preeclampsia admitted to hospital and have complete records was the inclusive criteria. Records that did not fit inclusion criteria and women with essential hypertension were excluded from the study. Sample size was calculated by using this equation,

$$N = Z^2X\ P\ (1\text{-}P)\backslash\ e^{2,}$$

Where
N = Sample Size.
Z = Value 1.96.,
P = Prevalence. e = 0.06 .

So, N = 3.84x (0.06) (0.94)\0.0025=87 +10 (for missing data).

A total of 97 women meeting the inclusion criteria was the sample size. Systematic sampling method was applied to collect the files of women admitted in preeclampsia ward. Data were retrieved from the files of the patients which consisted of sociodemographic information, medical and obstetric history, family history, factors associated with preeclampsia and the outcome of the treatment, maternal and prenatal morbidity and mortality. The data were entered and analyzed by using the statistical package for social sciences, version 21 (SPSS, Chicago, IL, USA).Descriptive statistics were presented using counts, proportions (%), mean ± standard deviation whenever appropriate. The comparison study was done by using chi square. A p-value cut off point of 0.05 at 95% CI was used to determine statistical significance. Ethical approval and permission was taken from the ethical committee of Omdurman Maternity and Child hospital, Sudan. Informed consent was taken from the participants.

3 Results

The data from the files of 97 patients with preeclampsia were retrieved for the analysis. Seven percent of the patients were in the age group of 20 years or less ,fourteen percent in the age group of 21 to 24 years ,thirty four percent (N=33) were in the age group of 25-29 years , 19.6% (N=19) in the age group of 30-34 years and 24.7%(N=24) were in the age group of 35 years and above. As far as parity is concerned almost fifty percent (N=48) were nulliparous while 20.6 %(N=20) were having 2 children, 12.4% having three children and 17.5% had 4 and more children. The gestational age of majority of the patients (64.9%) attending the hospital was between 36-38 weeks while twenty eight percent of the patients were below 36 weeks pregnant 5.2% were 39-40 weeks pregnant and only 1% was more than 40 weeks pregnant. Majority of the participants (87.6%) lived in Khartoum while the rest from other area. Hundred percent of the participants were married. The majority of the patients (57.7%) were primary educated while 25.8% were secondary educated 14.4% were graduate. Only 2.10% were uneducated. The vast majority of the patients (90.7%) were house wife while 8.20% were professional and only 1% was skill worker. Only 19.6% of the patients were having past history of pre-eclampsia. Ninety nine percent of the patients did not have the family history of preeclampsia More than forty eight percent of the patients were having family history of hypertension. The details of the sociodemographic characteristics of the patients are shown in table1.

Table 1 The sociodemographic characteristics of the participants

Variables	No.	percentage
Age groups		
Less than 20 -20 years	7	7.2
21-24 years	14	14.4
25-29 years	33	34.0
30-34 years	19	19.6
35 and more than 35 years	24	24.7
Parity		
Nulliparous	48	49.5
Para 2	20	20.6
Para 3	12	12.4
Para 4 and more	17	17.5
Gestational age		
Less than 36	27	27.8
36-38 weeks	63	64.9
39-40 weeks	5	5.2
>40 weeks	2	2.1
Location		
Khartoum	85	87.6
Other area	12	12.4
Educational qualification		
Illiterate	2	2.1
Primary educated	57	57.70
Secondary educated	25	25.80
Graduate	13	14.40
Occupation		
Housewife	88	90.70
Professional	8	8.20
Skill worker	1	1.10
History of pre-eclampsia		
Yes	19	19.6
No	78	80.4
Family history of essential hypertension		
Yes	47	48.50
No	50	51.50

3.1 Outcome of delivery

Thirty seven percent of the patients were suffering from severe hypertension at admission while thirty eight percent were suffering from moderate hypertension and only 24.7% were suffering from mild hypertension. The blood pressure at the time of delivery was recorded as normal among the 9.30% of the patients, while mild among 26.80% moderately high among 29.9% and very high among 33% of the patients. As far as the investigations are concerned the vast majority of the patients (96.9%) had 1+ to 3+ proteins Urea while 3.1% were having more than 3+ protein Urea in the urine. The majority of the pregnant women (59.8%) had blood hemoglobin level higher than 11 gm./dl while 35.1% had between 9-11 mg/dl and only 4.1% with blood hg level less than 9gm/dl. Most of the patients (84.5%) underwent caesarian section for delivery while 3.10%, 11.30% and 1% underwent vacuum extraction, normal delivery and forceps delivery respectably. Almost eighty nine percent of the mothers totally recovered after delivery while 9.3% suffered temporal disability and 2.1% by permanent disability. As far as the infant outcome is concerned 68% were born on term while 18.6% as preterm, 8.2% IUFD and 5.2% as term +A life. Thirty three percent of the baby born was of normal weight while majority of them (64.90%) were underweight and only 2.10% were overweight. The details of the outcome of the delivery are shown in table 2.

Table 2 The outcome of deliveries among the participants

Variables	Number	Percentage
Status of hypertension at admission		
Mild	24	24.7
Moderate	37	38.2
Severe	36	37.1
Status of hypertension at delivery		
Normal Blood pressure	9	9.30
Mild	26	26.80
Moderate	29	29.90
High	33	34.00
Protein Urea		
!+ to 3+	94	96.9
More than 3+	3	3.1
Blood Hg level		
More than 11gm /dl	58	60.4
9 gm./dl-11gm/dl	34	35.4
Less than 9 gm./dl	5	4.2
Mode of Delivery		
Normal	11	11.30
Caesarian	82	84.50
Vacuum extraction	3	3.10
Forceps delivery	1	1.10
Condition of mother (post-delivery)		
Total recovery	86	88.70
Disability (temporal)	9	9.30
Disability (Permanent)	2	2.00

Status of infant at birth		
Full term delivery	68	68.0
Preterm delivery	16	18.6
IUFD	8	8.2
Term +A life	5	5.2
Weight of baby at birth		
Normal	32	33.0
Low birth weight	63	64.90
Overweight	2	2.10

3.2 Fetal morbidity and pre-eclampsia

Preterm delivery was significantly higher among the infants born to mother suffering from severe hypertension than those with mild and moderate hypertension (0% vs.83.3% vs.16%, P=0.01).Similarly IFUD was also significantly more among the infants delivered to mother suffering from severe hypertension at admission than those with moderate and mild hypertension (0%vs. 50% vs. 50%, P=0.01). Low birth weight among the fetus was also significantly more among the mothers with severe hypertension than those with moderate , mild and normal blood pressure (3.17% vs. 41.27% vs.55.56%, P=0.04).The details of the fetal morbidity associated with different level of hypertension is shown in table 3.

Table 3 The relationship of neonatal morbidity with the different level of hypertension among the mothers at the time of admission

Variable	**Level of blood pressure at admission**			
	Mild	**Moderate**	**Severe**	**P value**
Status of infant at birth				
Full term delivery	24 (50.0)	23 (41.66)	21(8.34)	0.01
Preterm delivery	0(0.0)	5(83.33)	11(16.67)	
IUFD	0(0.0)	4(50.0)	4(50.0)	
Term +A life	0(0.0)	5(100.0)	0(0.0)	
Weight of baby at birth				
Normal	22 (68.75)	10(31.25)	0	0.04
Low birth weight	2(3.17)	26(41.27)	35(55.56)	
Overweight	0	1(50.0)	1(50.0)	

3.3 Association of morbidity among the mothers with different level of hypertension

The temporal disability was significantly more common among mothers with moderate hypertension than with mild hypertension and severe hypertension (55.55% vs. 0.0% vs. 44.45%, P=0.002).Similarly the permanent disability was significantly more prevalent among the mothers with moderate hypertension (100% vs. 0.0% vs. 0.0%, P=0.002).Caesarian section was also significantly more common among the mothers with moderate and severe blood pressure as compared to mild blood pressure (42.68% vs. 41.47% vs. 15.85%, P=0.01). Protein urea (!+ to 3+)in the urine of the women with moderate and severe hypertension was significantly more than those with mild hypertension e among the moderate and severe hypertension (38.30% vs.36.18% vs.25.53%, p=0.04).The details of the morbidity among the women admitted with pre-eclampsia is shown in table 4.

Table 4 The association of morbidity among women admitted for delivery with different level of hypertension

Variables	Level of Blood pressure at admission			
	Mild	**Moderate**	**severe**	**P value**
Condition of mother (post-delivery)				
Total recovery	24(27.91)	30(34.88)	32(37.21)	0.002
Disability (temporal)	0(0.0)	5(55.55)	4(44.45)	
Disability (Permanent)	0(0.0)	2(100.0)	0(0.0)	
Mode of Delivery				
Normal	11 (100.0)	0(0.0)	0(0.0)	0.01
Caesarian	13(15.85)	35(42.68)	34(41.47)	
Vacuum extraction	1(25.0)	2(50.0)	1(25.0)	
Forceps delivery	0(0.0)	0(0.0)	1(100.0)	
Protein Urea				
!+ to 3+	24 (25.53)	36(38.30)	34(36.17)	0.04
More than 3+	3(50.0)	0(0.0)	3(50.0)	

4 Discussion

The present study was conducted on the pregnant pre-eclampsia patients attending Omdurman Maternity Hospital (OMH) in Sudan to find out the mortality and morbidity among the mothers and the newborn due to pre-eclampsia .However no mortality was reported in this study but few morbidity among the mother and the new born were significant. The result revealed that pre-eclampsia was more prevalent among 25-29 years age group which is near to study in India [16] where 46.8% of women with pre-eclampsia were (21-25) years old. This might be due to early marriage in Sudan. However one Ethiopian study has found that this occurred in older age (more than or equal 35 years). [15] Like other studies the pre-eclampsia was significantly more among the nulliparous women in our study [17, 18] except leslie et al [19] who reported that majority of pre-eclampsia occurred mainly in multiparous and only 14% in nulliparous. The present study has shown that pre-eclampsia were more prevalent among the women in 36-38 weeks of gestation , singleton pregnancy on the contrary that multiple gestation was a known risk factor of pre-eclampsia. This might be due to small sample size. The study also found that there was no association between pre-eclampsia and family history of pre-eclampsia. However in one meta-analysis the researchers have found that family history of pre-eclampsia was associated with the occurrence of pre-eclampsia (OR 1.68, 96% CI 1.26-2.11). [20] In the present study the majority of the study subjects had blood hemoglobin level up to 11 mg /dl. However the Meta-analysis study has shown that the pregnant women having anaemia had 3.22 times higher risk of getting pre-eclampsia.[20] According to clinical data the present study found that pre-eclampsia occurred more in moderate to severe hypertension 38.1%, 33.1% pre delivery and during delivery respectively, this explains the presence of fetus has a role in elevation of blood pressure and after commencement of delivery the percentage were decreased so also after 24h from delivery blood pressure returned to normal among 40.2% of the mothers. The morbidity and mortality of pre-eclampsia in baby were related to pre maturity 18.6%, IUFD were 8.2%, two times association with low birth weight compared to normal birth weight (33.0%) and there was no early neonatal death which might be due to early treatment of pre-eclampsia and good care in nursery unit. However Bilano VL et al[7] has reported incidence of neonatal death to be 4.2% in their study. Caesarian section as a mode of delivery was reported among 84.5% of the women with pre-eclampsia in the present study which might be explained the need of women for less time to prevent complication on mother and baby and because most of women presented with moderate to severe pre-eclampsia and quick intervention were needed. This was also reported in other study which has found that pre-eclampsia was associated with higher rate of induction of labor among 58% of pregnant women with pre-eclampsia.[14]

5 Conclusion

The risk of preeclampsia was more among 25-29 years age group , among primigravida, women in 36-38 weeks of gestation and occurred more in moderate to severe hypertension pre-delivery and during delivery . As far as mortality

and morbidity among the mothers and the newborn baby is concerned, though no mortality was reported among the baby and the mothers. Morbidity such as IUFD and low birth weight were reported among babies while majority of the patients with pre-eclampsia underwent caesarian section for delivery and very few mothers suffered from temporal and permanent disability. However the more investment must be made in women's health needs to reduce the problem and health service providers need to give due attention to high-risk women.

Compliance with ethical standards

Acknowledgments

I would like to thank my colleagues who helped me in this research. Our sincere thanks go to the staffs of Omdurman Maternity hospital who helped me in collecting the valuable data needed for this study.

Disclosure of conflict of interest

No conflict of interest

Statement of ethical approval

The present research work does not contain any studies performed on animals /humans/subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] World Health Organization. Maternal mortality. Fact sheet N348. WHO.2015.

[2] Witlin AG, Sibai BM. Magnesium sulphate therapy in preeclampsia and eclampsia. Obstet Gynecol 1998; 92:883-89.

[3] Duley L. Maternal mortality associated with hypertensive disorders of pregnancy in Africa, Asia, Latin America and the Caribbean. Br J Obstet Gynaecol.1992; 99:547-553.

[4] Mackay AP, Berg CJ, Atrash HK. Pregnancy related mortality from preeclampsia and eclampsia. Obstet Gynecol 2001; 97:533-38.

[5] Zhang J, Zeisler J, Hatch MC, Berkowitz G. Epidemiolog of pregnancy-induced hypertension. Epidemiol Rev. 1997; 19:218-32.

[6] Aabidha P M, Cherian AG, and Helan J. Maternal and fetal outcome in preeclampsia in a secondary care hospital in south india, Family Med Prim Care, 2015; Vol 4, 257-260.

[7] Bilano VL, Ota E, Ganchimeg T, Mori R, Souza JP (2011) Risk factors of preeclampsia\ eclampsia and its adverse outcomes in low-and middile-income countries: A WHO Secondary Analysis. PLOS ONE 8.

[8] Goldenberge R, Mucclre E, Emily R. reducing maternal mortality from preeclampsia and eclampsia in low-resource countries, Inter J of Obse & Gyn, vol 113(2):91-95, May, 2011.

[9] Vasquez D, Das neves A, Zakalik G. Characteristics and outcomes of critically ill obstetric patientswith hypertensive disease of pregnancy in argentina, Inter J of Women Cardio Health, vol 2(3): 188-189, July, 2012.

[10] Cohen J, Beddaoui M, Kramer M. Maternal Antioxidant Levels in Pregnancy and Risk of Preeclampsia and Small for Gestational Age, PLOS J, Agust, 2015. Doi:10.1371\J Pone, 0135192.

[11] Zubaida M.F, Elhassan M.E, Duria A.R. Persistant hypertension following pre-eclampsia at Medani Hospital Sudan, doi:http:// dx.doi.org\10.1016\J.ijgo.2015.11.014.

[12] Ishag A , Abdelrahium O.H , Omer A. M , Placenta previa and pre-eclampsia, doi:10.3389\F Phys.2013.00032.

[13] Abdelmarouf H.M , Asma A. D , Yousif H. M , Serum calcium level as a marker of PIH , http://www.sud jm . net\ issue\ 2-4\ htmi \5.

[14] Bakheit K .H , Ghebre K , Zaiger G , Elbashir M.I , Erythrocyte antioxidant enzymes and plasma antioxidant vitamins in Sudanese women with pre-eclampsia , J of Obse and Gyna , vol (30), issue (2):147-150 , 2010

[15] Aabidha P M, Cherian AG, and Helan J. Maternal and fetal outcome in preeclampsia in a secondary care hospital in south india, Family Med Prim Care, 2015; Vol 4, 257-260.

[16] Bilano VL, Ota E, Ganchimeg T, Mori R, Souza JP (2011) Risk factors of preeclampsia\ eclampsia and its adverse outcomes in low-and middile-income countries: A WHO Secondary Analysis. PLOS ONE 8.

[17] Ali A, Adam I , Abdalla M, Hypertensive disorders of pregnancy in Kassla Hospital, Eastern Sudan. KH. Med J. 2011; 04: 656-659.

[18] Ali A, Rayis D, Elbashir M, Abdella T. Severe anaemia is associated with a higher risk for preeclampsia and poor perinatal outcomes in Kassla Hospital, eastern Sudan. Ali et al. BMC Research Notes 2011, 4:311. On line http:\\www. biomedcentral.com\1756-0500\4\311.

[19] Lesile et al. Prediction of preeclampsia, J of Obse & Gyn, vol23 (1): 45-47, Feb, 1999.

[20] Meazaw MW, Chojenta C, Muluneh MD, Loxton D (2020) Systematic and meta-analysis of factors associated with preeclampsia and eclampsia in sub-Saharan Africa. PLoS ONE 15(8): e0237600. https://doi.org/10.1371/journal.pone.0237600