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Factors contributing to Hypertension in Pregnancy among mothers attending Antenatal Clinic in Kisii Teaching and Referral Hospital, Kisii County, Kenya

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***Abstract*— Globally, over half a million women within reproductive age die each year of pregnancy related causes with ninety-nine (99%) percent of these deaths occur in the developing countries, (WHO, 2010). In Kisii Teaching and Referral Hospital Pregnancy-Induced Hypertension continues to be a major obstetric problem in present day healthcare practice. The prevalence has risen from 5% to 8% for the last two years that has led to an increase in mortality and morbidity in both the expectant mothers and infants, (KTRH Health Records).**

***Index Terms*—About four key words or phrases in alphabetical order, separated by commas.**

I. Introduction

Globally, over half a million women within reproductive age die each year of pregnancy related causes (WHO, 2010). Ninety-nine (99%) percent of these deaths occur in the developing countries (Meis, 2002). In Kisii County, the TFR in rural areas is 4.5 and fertility rate by age higher in rural areas across all age groups with female mean age at first birth of below 19 years (KDHS, 2014 and World Fertility Report, 2013). Between six and eight per cent of all women have an unresolved problem of PIHTN (KDHS, 2014).The most common causes of these maternal deaths include complications of pregnancy and child birth including hemorrhage, sepsis, complications of unsafe abortions, and hypertensive disorders during pregnancy and obstructed labour (WHO, 2004). Pregnancy Hypertension is a common medical problem encountered during pregnancy, complicating six to eight percent of pregnancies causing of either fetal or maternal mortality or both due to multiple end organ failure (Cunning *et al* 2005). Research has shown that pregnancy induced hypertension complications is associated with family history of preeclampsia and chronic hypertension, (Duncan et *al*., 2001). The knowledge of the most important risk factors in our population could be useful to identify the patients who have higher chances to develop the hypertensive disorders, and, subsequently, adequate prenatal care could contribute to decrease this mortality ratio (Yang Q, *et* al., 2004). Placental abruption and uterine bleeding of unknown origin are etiologically distinct obstetric complications with respect to hypertensive disorders during pregnancy (Ananth*et al*., 1977).

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II. Literature Review

Pregnancy Induced Hypertension

Pregnancy-Induced Hypertension is one developing after 20 weeks gestation without other signs of preeclampsia. It is a known cause of premature delivery, intrauterine growth restriction (IUGR), placental abruption and fetal death, as well as maternal mortality and morbidity (Gombe N et al., 2011). It is characterized by either blood pressure levels of 140/90 mm Hg or higher after 20 weeks gestation, or a blood pressure rise greater than 30/15mmhg from early or pre pregnancy baseline or a rise of mean arterial pressure of more than 105 mm Hg. This due to the development of arterial high pressure in a pregnant mother after 20 weeks of gestation which may or may not have protein in urine and has a blood pressure of or more than 140/90 mmHg (National Guidelines for Quality Obstetrics 2004). Of all the pregnancy related complications in the world, pre-eclampsia and eclampsia present 10% major causes of maternal and prenatal morbidity and mortality,with pre-eclampsia affecting 5-7 % of all pregnancies, (WHO 2007; Srinivas SK *et al.,* 2007). Hypertensive disorders during pregnancy is among the leading cause of maternal and foetal mortality in obstetric practice that can prevent the baby from getting enough blood and oxygen harming their liver, kidney, brain, and heart, causing end organ damage, (Palacios C *et al*., 2011).

Socio-Demographic factors contributing to Pregnancy Hypertension

According to a previous study on age influence on pregnancy induced hypertension. Results showed that extremes of maternal age cannot be demonstrated as a risk factor in our study since our sample is matched by age nevertheless, it is an established risk factor for PIHTN. (Ros HS et al.,1998). Pregnant women with this history of preecclampsia have been associated with pregnancy induced hypertension and should be carefully monitored in the prenatal care and postpartum (Mutze S *et al.,* 2008). In another study by O'Brien TE, *et al.,*(2003), overweight in pregnancy has been identified as a risk factor for pregnancy induced hypertension. Studies have also shown that null-parity has a two-fold increase in the risk of developing hypertensive disorders in,(Audibert F et al., 2010). Level of education and socio-economic status has been associated to increased hypertension in pregnancy,

(Alexander s *et al.,* 2003). The study did not adjust for important confounding factors in the relationship between low social economic status and pre-eclampsia, such as weight gain during pregnancy**.**

Knowledge, attitude and practices influencing Pregnancy induced Hypertension

Maternal cigarette smoking has been associated with an increased risk of a number of adverse pregnancy outcomes, including placental abruption, placenta previa, and premature rupture of the membranes, pre-term birth, IUGR, and perinatal death whose risk has been shown to decrease with spirited awareness to pregnant mothers smoking, (Qiuying*et al.,*2006).Similar public health interventions focusing on prevention of pregnancy related conditions have reduced prevalence of the diseases in society, (Schmidt *et al*., 2012).

High dose of ethanol consumption most commonly causes hepatic, gastrointestinal, nervous and cardiovascular injuries leading to physiological dysfunctions. Research has shown that chronic ethanol consumption (more than three drinks per day, 30 g ethanol) is associated with an increased incidence of alcohol induced hypertension in pregnancy, (Li TK *et al.,* 2004).

According to a previous study in Canada on exercise during pregnancy protects against hypertension and macrosomia, a randomized controlled trial including 765 healthy pregnant women, physical activity has been shown to control pregnancy induced pregnancy, (Ruben B, *et al*., 2015). .

Obstetric Factors

Multiple pregnancies doubles the risk of preeclampsia however, in our findings this association was not established, likely due to low number of cases in both groups of subjects associated with a reduced sample size as a whole. (Ros HS *et al.,* 1998).Oral contraceptives are known to act at different levels of the female reproductive tract, i.e. cervical mucus thickening, tubal motility, changes in endometrial lining (i.e. by decreasing the possibility of implantation, should conception occur) and ovulation suppression. However, in terms of exposure to spermatozoa, the main difference in a woman taking contraceptives is that the characteristics of cervical mucus may confine the semen to the vagina (Gratacos*et al.*, 1996).

III. METHODOLOGY

This was a case control studydesign among mothers of reproductive age (15-45 years) visiting Kisii Teaching and Referral Hospital (KTRH) Anti-Natal Clinic who have been pregnant or and are currently pregnant with PIHTN irrespective of the outcome attending MCH/FP clinic. The study utilized 172 mothers (cases) who have had a history of hypertension in pregnancy and 172 (controls) ones who have no episode of hypertension in pregnancy. A random systematic sampling procedure will be used to select the respondents from visiting mothers out of 202 mothers attending KTRH for ANC care. Piloting was done in a neighboring County Teaching and Referral Hospital of Nyamira and structured questionnaire with both closed and open ended questions was used to collect socio-demographic data.

IV. RESULTS

The Socio- Demographic Characteristics of the Study Participants

A total of 344 women (172 cases and 172 controls) were enrolled in the study. There was a significant statistical difference in PIHTN based on age strata with most of the cases 131 (76.2%) being < 20 years and the control 127 (98.3%) being between >20 years (p = 0.0001), see table 1.

Table 1: Socio-Demographic Characteristics of Study Participants

Characteristics	Cases (n+72)%	Controls (n+72)%	P-value
Age			
≤ 20 years	131 (76.2)	169 (98.3)	0.000
> 20 years	41 (23.8)	3 (1.7)	
Marital status			
Single	47 (27.3)	25 (13.4)	0.000
Married	127 (72.7)	149 (86.6)	
Parity			
Nulliparous	124 (72.1)	138 (80.2)	
Multiparous	48 (27.9)	34 (19.8)	0.000
Residence			
Sub-urban	77 (44.8)	110 (63.9)	0.000
Rural	41 (23.8)	13 (7.6)	
Urban	54 (31.4)	49 (28.5)	
Education Level			
None	0	0	
Primary	43 (25.0)	31 (18.0)	
Secondary	35 (20.3)	37 (21.5)	0.000
Tertiary	94 (54.7)	104 (60.5)	
Religion			
Christian	157 (91.3)	166 (96.5)	
Muslim	15 (8.7)	6 (3.5)	0.037
Occupation			
House wife	161 (93.6)	168 (97.7)	
Salaried	11 (6.4)	4 (2.3)	0.000
BMI			
Normal	47 (27.3)	25 (13.4)	0.000
Abnormal	125 (72.1)	49 (86.6)	

Knowledge associated with pregnancy induced hypertension among mothers attending KTRH

As shown in table 2 most of the cases 106(61.6%) and controls 169(98.3%) defined PIHTN as increase in blood pressure during pregnancy (p=0.000). Regarding the causes of PIHTN, most of the cases believed that it is caused by contraceptives 124(72.1%), physical inactivity 48(27.9%) and not alcohol nor cigarette smoking while the controls believed the causes of PIHTN were by contraceptives 138 (80.2%), physical inactivity, equally none supported alcohol nor cigarette smoking (p=0.000).

Table 2: Knowledge of Cases and Controls influencing PIHTN

Characteristics	Cases (n=172)%	Controls (n=172)%	P. Value
Definition of PIHTN Increase of blood pressure during pregnancy. Increase of blood pressure.	106 (61.6) 66 (38.4)	169 (98.3) 3 (1.7)	0.000
Causes of PIHTN Contraceptive use Physical inactivity Cigarette smoking Alcohol consumption	 124 (72.1) 48 (27.9) 0 (0%) 0 (0%)	 138 (80.2) 34 (19.8) 0 (0%) 0 (0%)	0.000
Family history of HTN No Yes	131 (76.2) 41 (23.8)	169 (98.3) 3 (1.7)	0.037
Previous history of HTN No Yes	152 (88.4) 20 (11.6)	171 (99.4) 1 (0.6)	0.037
History of diabetes No Yes	164 (95.3) 8 (4.7)	167 (97.1) 5 (2.9)	0.000
Signs of PIHTN Headache Dizziness Chest pain	 124 (72.1) 48 (27.9) -	 138 (80.2) 34 (19.8) -	

Attitude and practices of cases and controls

As shown in table 3, a majority of the cases 6 (9.3%) had used hormonal contraceptives as compared to controls 3 (1.7%) who had used hormonal contraceptives. And majority of the cases 1 (0.6) had unwanted pregnancy as compared to none of the controls who had no unwanted pregnancy (p=0.048). Majority of the cases 164 (95.3) had irregular physical activity while majority of the controls 167 (97.1) had irregular physical activity too (p=0.000).

Table 3: Attitude and practices of cases and controls with PIHTN

Characteristics	Cases (n=172)%	Controls (n=172)%	P. Value
Cigarette Smoking No Yes	156 (90.7) 6 (9.3)	169 (98.3) 3 (1.7)	0.000
Alcohol consumption No Yes	169 (98.3) 3 (1.7)	172 (100) -	0.000
Physical activity None Regular Irregular	 - 8 (4.7) 164 (95.3)	 - 5 (2.9) 167 (97.1)	 0.000

Obstetric characteristics of cases and controls with PIHTN

Regarding history of twin pregnancy influencing hypertension, majority of the cases 171 (99.4) supported no equally the controls 172 (100) had no twin pregnancy (p=0.048). Majority of the cases 41 (23.8) had history of pregnancyby a new partner while a few of the controls 3 (1.7%) had history of pregnancy by a new partner(p=0.000). Majority of the cases 3(8.4%) had history of hormonal contraceptive use while a few of the controls 3 (1.7%) had history of hormonal contraceptive use(p=0.000). History of twin pregnancy is not statistically significant in influencing PIHTN (p>0.05). Contraceptive use and history of pregnancyby a new partner characteristics in the study, were statistically significant in influencing PIHTN (p<0.05).

Table 4: Obstetric characteristics of cases and controls with PIHTN

Twin Pregnancy No Yes	171 (re.4) 1 (0.6)	172 (100) -	0.048
Hormonal Contraceptive Use No Yes	106 (61.6) 366(8.4)	169 (98.3) 3 (1.7)	0.000
Pregnancy by a new partner No Yes	131 (76.2) 41 (23.8)	169 (98.3) 3 (1.7)	0.000
Parity			
Nulliparous	124 (72.1)	138 (80.2)	
Multiparous	48 (27.9)	34 (19.8)	0.000

Association between PIHTN with socio demographic, obstetric and practice factors of cases and controls

Associations of PIHTN with several factors are presented in table 5. Cases were 29.5(10.3-94.3) times to have used hormonal contraceptives. Cases with physical inactivity were 1.63 (0.47-5.86) times more likely to have PIHTN. Majority of the cases were 17.0 (5.0 – 73.2) times more likely to have been in age < 20 years as compared to controls. Cases with abnormal BMI were 2.2 (1.3-3.8) times more likely to have PIHTN. This study further revealed cases were 5.8 (1.6-25.3) times more likely to have smoked cigarettes. In addition, cases who had sexual relationship with other partners were 17.0 (5.0-73.2) times more likely to have PIHTN. Further analysis revealed that cases who had consumed alcohol were 29.5 (10.3-94.3) times more likely to have PIHTN. Cases with primary education were 1.5 (0.9-2.7) times more likely to have PIHTN. Conclusively, there was a significant statistical association with PIHTN based on the above practice factors; hormonal contraceptives use, irregular physical activity, consumed alcohol or smoked cigarettes (p<0.05). But twin pregnancy had no statistical association with PIHTN (p>0.05).

DISCUSSION

This was a case control study carried out in 172 cases and 172 age matched controls to find out the factors associated with PIHTN. This study focused on identifying factors affecting pregnancy induced hypertension in pregnant women. Age of

mothers who were in age range <20 years, nulliparous were 1.5 (1.0-3.5) times more likely develop pregnancy induced hypertension (PIH) as compared to their counter parts. This is consistent with previous studies in Brazil on Screening for preeclampsia using first-trimester serum markers and uterine artery Doppler in nulliparous women, where by results showed that generally, PIHTN is regarded as a disease of first pregnancy and its frequency ranges between 2% and 7% in healthy nulliparous women.Nulliparity is well established as a risk factor for hypertensive disorders in pregnancy (Audibert F *et al*., 2010). The early age of mothers and first pregnancy has effect on hypertension during pregnancy attributed to hormonal changes and their effects.

Pregnant mothers who have family history of pregnancy induced hypertension were17 (5.0-73.2) times more likely develop PIH as compared their counter parts. This finding is consistent with study conducted in Brazil on genes and the preeclampsia syndrome, a multivariate analysis showed that family history of PE, diabetes and chronic hypertension are independent risk factors for hypertensive diseases in pregnancy. The family and the previous history of PE increased the risk for this complication in our patients. Indeed, the genetic component in pathophysiological abnormalities of preeclampsia was suggested. Preeclampsia was reported to be more common in daughters of preeclampsia women and in pregnancies fathered by sons of preeclampsia women hence suggesting the involvement of both maternal and fetal genes in the syndrome. The study concluded that pregnant women with this history should be carefully monitored in the prenatal care and postpartum (Mutze S *et al*., 2008). This is attributed to the effect of body genes and nothing much can be done to improve this.

Regarding previous history of pregnancy induced hypertension AOR 22.5 (3.0-170) the cases were more likely develop PIH as compared their counter parts. This finding is consistent with study conducted have suggested that both chronic hypertension and pre-eclampsia are associated with placental abruption. Results showed that the incidence of PIHTN was tenfold among women with chronic hypertension (OR 10.8) and slightly more than twofold for women with pre-eclampsia (OR 2.4), compared with normotensive women (incidence, 0.9) found that a history of chronic hypertension was associated with a threefold increase in the risk of placental abruption but not with pregnancy-induced hypertension. Findings from other studies were consistent with the results of and also support the theory that hypertension is a causative or a predisposing risk factor for PIHTN.Women who have history of hypertension in the first pregnancy have seven times more likely developing preeclampsia in a second pregnancy and the risk is increase as there pregnancy increase (Epidemiology 2010).

Regarding maternal body mass index >30 kg/m^2 AOR the cases were 9.90 (4.29-22.86) times more likely develop pregnancy induced hypertension as compared to their counter parts. As Maternal body mass index increase the risk of hypertension typically doubled with each 5–7 kg/m^2 as indicated in different literatures. In a systematic review of 13 cohort studies reveals that linear rise in the risk of preeclampsia with increasing pregnancy BMI. This was consistent to a previous study in Brazil on BMI and hypertension in pregnancy, which showed that however, the mean BMI was higher in hypertensive women, and it is a definite risk factor for developing pregnancy-induced hypertensive disorders, including preeclampsia disorders (O'Brien TE, *et al*., 2003). Risk increases with BMI and the possible explanation is the increased shear stress due to hyper dynamic circulation associated with obesity. Actions in public health could prevent and treat obesity and, consequently, could prevent hypertensive disorders.

Regarding diabetes mellitus AOR the cases were1.63 (0.47-5.86) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurs with a previous study in Brazil on gestational *diabetes mellitus and* association with preeclampsia, which results showed that preexisting diabetes *mellitus* is also a risk factor for preeclampsia. Women with preexisting chronic hypertension also have an increased risk of preeclampsia. In the present study, diabetes, and particularly, preexisting chronic hypertension were risk factors for preeclampsia in women. Thus, actions in the public health focused to prevent these diseases are important to also prevent preeclampsia (Schmidt *et al.,* 2012). Actions in public health could prevent and treat diabetes mellitus and consequently could prevent hypertensive disorders.

Regarding twin pregnancy the cases were AOR 1.63 (0.47-5.86) times more likely develop pregnancy induced hypertension as compared to their counter parts. This was not consistent to a previous study in Brazil on comparison of risk factors for pre-eclampsia and gestational hypertension, a population-based cohort study was used. Results showed that there were no significant differences in multifetal gestation and smoking habits, characteristics that were described in some reports as risk factors (Ros HS *et al.,* 1998). Multiple pregnancies doubles the risk of preeclampsia however, in our findings this association was not established, likely due to low number of cases in both groups of subjects associated with a reduced sample size as a whole.

Regarding social economic status AOR the cases were 2.87 (0.9-10.9) times more likely develop pregnancy induced hypertension as compared to their counter parts. This was consistent to a previous study in Brazil on Social deprivation and poor access to care as risk factors for severe pre-eclampsia. Regardless of the indicator of social deprivation, the study found that low educational level was significantly more frequent in the group of cases. Results showed that the burden of PIHTN is concentrated in socially disadvantaged women, thus health services should be more responsive to the specific needs of these women. Women who do not receive prenatal care have a four-fold increase in the risk of developing hypertensive disorders in pregnancy. Women who are adequately assisted prenatally can detect earlier these possible risk factors; therefore, they can assume preventive actions, decreasing the chance of developing the disease.

Regarding social education level AOR the cases were1.5 (0.9-2.7) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurred to a previous study in a Brazilian population which revealed that low degree of schooling and

socioeconomic status is factors that hinder access to prenatal care. Investments in public health intended to improve the prenatal access, mainly in the group of women with low schooling and socioeconomic status can decrease the levels of hypertensive disorders of pregnancy in our population (Alexander S *et al*., 2003). This is attributed to poor health seeking behaviors due inadequate knowledge.

Regarding cigarette smoking 5.8 (1.6-25.3) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurred to a previous study in China on Maternal cigarette smoking and the risk of pregnancy-induced hypertension and eclampsia, where results showed that, Pregnancy-induced hypertension (PIH) is a major pregnancy complication, which may cause premature delivery, intrauterine growth restriction (IUGR), placental abruption, and fetal death, as well as maternal mortality and morbidity. (Qiuying*et al*., 2006).Therefore, health education should be provided to the population on effects of cigarette smoking to pregnancies.

Regarding alcohol consumption, the cases were 29.5 (10.3-94.3) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurred to a previous study in United States on alcohol use disorders and mood disorder; the study noted that chronic high dose ethanol consumption most commonly causes hepatic, gastrointestinal, nervous and cardiovascular injuries leading to physiological dysfunctions. A cause and effect relationship between regular alcohol consumption and blood pressure elevation (hypertension) was first suggested. (Li TK *et al.,* 2004). It demonstrated that chronic ethanol consumption (more than three drinks per day, 30 g ethanol) is associated with an increased incidence of hypertension and an increased risk of cardiovascular diseases. The magnitude of the increase in blood pressure in heavy drinkers averages about 5 to 10 mmHg, with systolic increases nearly always greater than diastolic increases. Therefore, health education should be provided to the population on effects of alcohol to pregnancies.

Regarding physical activity the cases1.63 (0.47-5.86) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurred to a previous study in Canada on exercise during pregnancy protects against hypertension and macrosomia, arandomized controlled trial including 765 healthy pregnant women was carried out. From the total, 382 women were randomized into an exercise group, and the other 383 women received standard care. The control group received a three days/week exercise program designed by experts from Faculty of Sciences for Physical Activity and Sport (INEF) at UPM. Results showed that pregnant women who did not exercise are 3 times more likely to develop hypertension. Likewise, women from the control group were also 2.5 times more likely to give birth to a macrosomic infant. A relevant cause could have been responsible for these results: control group women were 1.5 times more likely to gain excessive weight than women from the exercise group. These results confirm the huge potential of physical exercise as an exceptional preventive element of anomalies and diseases that can establish the health of future populations in the case of pregnancy processes (Ruben B*, et al*., 2015).

Regarding oral contraceptive use cases were 29.5 (10.3-94.3) times more likely develop pregnancy induced hypertension as compared to their counter parts. This positively concurred to a previous study on oral contraceptives which are known to act at different levels of the female reproductive tract, i.e. cervical mucus thickening, tubal motility, changes in endometrial lining (i.e. by decreasing the possibility of implantation, should conception occur) and ovulation suppression. (Gratacos*et al.*, 1996) especially for working class women with a change in lifestyle

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The current study shows that all mothers who have current pregnancy induced hypertension above half have leg edema. There is lack of awareness on major danger sign of pregnancy like vaginal bleeding, bilateral edema, convulsion and fever and headache. Age of mothers < 20 and > 20 years, those who have on awareness on risk of hypertension, those who has chronic medical illness, prime gravid, frequent salt consumption , body mass index >30 mg/kg^2 , and history of previous pregnancy induced hypertension were identified significant factors for pregnancy induced hypertension.

There is need to advise the unmarried individual to make the right decisions for marriage to avoid separation or divorce and single mothers were higher in numbers compared to married couples. There is need to empower women because from the study it emerged that those with poor income like students and small scale business were susceptible of developing the disease, most likely due to economic constrains.

Recommendation for action

Special emphasis should be given for mothers who have pre existing chronic medical illness, old age and prime gravid to have early recognition and readiness for better management of pregnancy induced hypertension. Health education should be given for mothers during ANC especially on danger sign of pregnancy and reducing feeding of foods that aggravate hypertension during pregnancy like excesses intake of salt. There is need to advise young ladies (teenagers) to withhold from becoming pregnant in order to limit their chances of developing hypertension related diseases because from the study it emerged that they were more vulnerable to the disease. There is need to advise the unmarried individual to make the right decisions for marriage to avoid separation or divorce and single mothers were higher in numbers compared to married couples. There is need to empower women because from the study it emerged that those with poor income like students and small scale business were susceptible of developing the disease, most likely due to economic constrains. From the study it can as well be recommended that women especially within reproductive ages should be advised not to drink alcohol as it increases ones chances of developing pregnancy hypertension. The researcher also recommends need for other researches of the same field to establish the relationship of his variables with others.

Recommendation For future studies

Further research should be conducted to see the effect of pregnancy induced hypertension on birth outcome.

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