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A Study on Factors Related to Hypertensive Disorders in Pregnancy in Ngaoundere (Adamawa Region, Cameroon)

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Abstract: *Background:* In sub-Saharan Africa, hypertensive disorders in pregnancy remain a major call for concern owing to their increasing incidence, gravity and associated complications. In Cameroon, the epidemiological reality of hypertensive disorders in pregnancy remains unknown in the majority of regions. *Objective:* This study aimed to identify the determinants of hypertensive disorders among pregnant women in a hospital milieu in Ngaoundere town. *Methods:* A cross-sectional study was carried out at the Ngaoundere Regional Hospital, the reference hospital facility of the Adamawa Region of Cameroon from May to June 2014. *Results:* In total, 160 pregnant women were examined during the period of study, among which 75 recorded a high blood pressure thus fulfilling our inclusion criteria. Age (P=0.013), previous twin pregnancy (P=0.013) and preeclampsia (P=0.013) were found to be significantly predictive of chronic hypertension. Religion (P=0.004) and multiparity (P=0.001) were identified as significant independent predictive risk factors of preeclampsia, History of preeclampsia (P=0.025) was identified as predictive risk factor for superimposed preeclampsia. *Conclusion:* Independent predisposing factors associated with hypertensive disorders in pregnancy in our milieu, which include advanced age, the notion of preeclampsia and history of twin pregnancy for chronic hypertension, parity and religion for preeclampsia, and history of preeclampsia for superimposed preeclampsia.

Keywords: Preeclampsia/Eclampsia, Hypertensive Disorders, Pregnancy, Cameroon

1. Introduction

Hypertensive disorders during pregnancy result in the occurrence of a heterogeneous group of pathological states with high blood pressure (HBP) in pregnancy being a common factor. According to Zezza and colleagues, these are the major causes of maternal and foetal morbidity and mortality [1]. Hypertensive disorders in pregnancy comprise four main manifestations: chronic high blood pressure, preeclampsia/eclampsia, non-proteinuria gestational high blood pressure and superimposed preeclampsia [2, 3]. Data from previous literature demonstrates that about 1% of pregnancies are complicated by a pre-existing hypertension, 5 to 6% by non-proteinuria gestational hypertension, and 1 to 2% by preeclampsia [4]. According to WHO, 9.1% of women develop a preeclampsia or gestational HBP during their pregnancy, with preeclampsia being the most common of the clinical outcomes affecting about 3 to 4% of all pregnant women in the world [5].

In sub-Saharan Africa, hypertensive disorders in pregnancy remain a major call for concern owing to their

increasing incidence, gravity and associated complications [6, 7, 8]. In Cameroon, the epidemiological reality of hypertensive disorders in pregnancy remains unknown in the majority of regions.

The lack of epidemiologic data in the Adamawa region of Cameroon and the need to better understand the factors related to hypertensive disorders in pregnancy towards the proposition of evidence-based preventive policies for maternal healthcare in our context, was the rationale of this study, with goal being to identify the determinants of hypertensive disorders among pregnant women in a hospital milieu in Ngaoundere town.

2. Methodology

2.1. Study Area and Population

The study was monocentric and cross-sectional, carried out at the Ngaoundere Regional Hospital, the reference hospital facility of the Adamawa Region of Cameroon. Adamawa is one of the ten regions of Cameroon having Ngaoundere as its administrative headquarter.

2.2. Selection Criteria

The target population was made up of pregnant women resident in the Adamawa region for a minimum of six month. The sampling was randomly and progressively done throughout the study period at the Gynaeco-Obstetric Service of the Ngaoundere Regional Hospital.

Included in this study were hypertensive pregnant women (Systolic BP >140 mmHg and/or Diastolic BP >90 mmHg) who attended these services during the study period.

Pregnant women presenting an obstetric or gynaecologic pathology unconnected to a high blood pressure or a proteinuria without high blood pressure or refused to consent to the study were exclude from this work.

2.3. Judging Criteria

The criteria used for the classification of participants under the different types of hypertensive disorders were those described by the Canadian Society of Gynaecologists and Obstetricians[3]:

2.4. Variables and Measurements

2.4.1. Socio-Demographic and Professional Characteristics
Age, matrimonial status, area of residence, religion, level of education, ethnicity and profession were collected using a semi-structured questionnaire.

2.4.2. Blood Pressure
The blood pressure was measured and interpreted in accordance with the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy recommendations[2]. This measurement was done with an electronic blood pressure machine (OMRON-HEM-712CN2, Serial number: 64167999LF, USA) in a sitting position, with the armband on the forearm elevated to the heart level. Paired measurements were taken on both the left and right arms with a time difference of 3 to 5 seconds, and the average measurement calculated and recorded. High blood pressure was defined as systolic blood pressure >140mmHg and/or diastolic blood pressure >90 mmHg.

2.4.3. Anthropometric Parameters
Height and weight measurement of participants were performed using a calibrated weight balance and height scale respectively.

2.4.4. Proteinuria
Urine protein detection and semi-quantification was performed on early morning urine samples of all participants using the MEDI-Test COMB II urine test strips.

2.5. Statistical Methods

The data collected were registered on the version 4.1 Cs Pro software and transferred on to the SPSS version 20.0 software for data processing and analyses. The descriptive statistic allowed us to determine the frequency of variables as well as the distribution of hypertensive disorders in pregnancy following variables such as socio-demographic, professional, family and medical history, and cardiovascular disease risk factors.

The Chi-square test was used to determine the association between variables and types of hypertensive disorders in pregnancy. Finally, a logistic regression model enabled us to verify the association between risk factors and hypertensive disorders of pregnancy and also permitted to confirm the associations observed in the bivariate analysis. Statistical significance was accepted at $P<0.05$.

2.6. Ethical Considerations

Participants were informed on the nature and interest of the study in the language best understood after which they voluntarily consented to participate in the study in writing. This research work was granted the approval of the Ethic Committee of the Ngaoundere Regional Hospital.

3. Results

In total, 160 pregnant women were examined during the study period. Among them, 75 recorded a high blood pressure thus fulfilling our inclusion criteria. Participants' age ranged from 14 to 40 years old with an average of 25.66 ± 6.17. 44% (n=33) of participants were aged between 14 and 24 year old and 14.7% (n=11) were 35 year old and above. Details of the participant characteristics are presented in Table 1.

Following bivariate analysis, chronic hypertension, was observed to be significantly associated with age (P=0.002), history of preeclampsia, (P=0.004) and history of high blood pressure (P<0.001). Also, gestational hypertension was significantly associated with history of diabetes (P=0.01) and history of paternal hypertension (P=0.04). Furthermore, significant associations were recorded between preeclampsia an age (p=0.044), religion (P=0.002), ethnicity (P=0.027),

parity (P<0.001), history of hypertension (P=0.006) and history of paternal hypertension (P=0.042). Moreover, superimposed preeclampsia was significantly associated with age (P=0.016), occupation (P=0.002), history of preeclampsia (P=0.005) and history of high blood pressure (P<0.001) (Table 2).

Results of multivariate analysis of results are shown in Table 3.

Table 1. *Distribution of Participants by Sociodemographic Characteristic and Type of Hypertensive Disorders.*

VARIABLES	ALL		C-HT[1]		G-HT[2]		PE[3]		S-PE[4]	
	N	%	N	%	N	%	N	%	N	%
Age										
14-19	12	(16,0)	1	(8,3)	1	(8,3)	10	(83,3)	0	(0,0)
20-24	21	(28,0)	3	(14,3)	6	(28,6)	12	(57,1)	0	(0,0)
25-29	23	(30,6)	2	(8,7)	6	(26,1)	10	(43,5)	5	(21,7)
30-34	08	(10,7)	3	(37,5)	2	(25,0)	2	(25,0)	1	(12,5)
5 et +	11	(14,7)	6	(54,5)	1	(9,1)	1	(9,1)	3	(27,3)
Marital Status										
Single	14	(18,7)	5	(35,7)	3	(21,5)	5	(35,7)	1	(7,1)
Married	61	(81,3)	10	(16,4)	13	(21,3)	30	(49,2)	8	(13,1)
Area of Residence										
Rural	15	(20,0)	1	(6,7)	5	(33,3)	7	(46,7)	2	(13,3)
Urban	60	(80,0)	14	(23,3)	11	(18,3)	28	(46,7)	7	(11,7)
Religion										
Catholic	19	(26,3)	8	(42,1)	4	(21,1)	4	(21,1)	3	(15,7)
Protestant	10	(13,3)	1	(10,0)	3	(30,0)	4	(40,0)	2	(20,0)
Muslim	43	(57,3)	5	(11,6)	8	(18,6)	26	(60,5)	4	(9,3)
Others	3	(4,0)	1	(33,3)	1	(33,3)	1	(33,3)	0	(0,0)
Level of Education										
Illiterate	16	(21,3)	3	(18,7)	2	(12,5)	9	(56,3)	2	(12,5)
Primary	19	(25,3)	4	(21,1)	4	(21,1)	9	(47,3)	2	(10,5)
Secondary	28	(37,3)	5	(17,9)	6	(21,4)	12	(42,8)	5	(17,9)
Higher	12	(16,0)	3	(25,0)	4	(33,3)	5	(41,7)	0	(0,0)
Ethnicity										
Fulani	26	(34,7)	3	(11,6)	6	(23,0)	14	(53,8)	3	(11,6)
Mboum	8	(10,6)	1	(12,5)	1	(12,5)	5	(62,5)	1	(12,5)
Gbaya	5	(6,7)	2	(40,0)	1	(20,0)	1	(20,0)	1	(20,0)
Bamileke	7	(9,3)	1	(14,3)	3	(42,8)	3	(42,8)	0	(0,0)
Dii	3	(4,0)	1	(33,3)	0	(0,0)	0	(0,0)	2	(66,7)
Others	26	(34,7)	7	(26,9)	5	(19,2)	12	(46,2)	2	(7,7)
Occupation										
Student	16	(21,3)	3	(18,8)	6	(37,5)	7	(43,7)	0	(0,0)
Housewife	40	(53,3)	6	(15,0)	8	(20,0)	22	(55,0)	4	(10,0)
Salary Earner	6	(8,0)	1	(16,7)	0	(0,0)	4	(66,6)	1	(16,7)
Informal Sector	13	(17,3)	5	(38,4)	2	(15,4)	2	(15,4)	4	(30,8)

[1]C-HT: Chronic Hypertension; [2]G-HT: Gestational Hypertension; [3]PE: Preeclampsia; [4]S-PE: Superimposed Preeclampsia

Table 2. *Association between Studied Variables and Hypertensive Disorders.*

VARIABLES	C-HT[1] (N=15)			G-HT[2] (N=16)			PE[3] (N=35)			S-PE[4] (N=9)		
	Value	df	P value	Value	df	P value	Value	df	P value	Value	df	P value
Age	16,582	4	0,002	2,247	4	0,69	9,779	4	0,044	12,207	4	0,016
Marital Status	3,196	1	0,074	0,045	1	0,833	0,214	1	0,644	0,226	1	0,635
Type of Marriage	1,587	1	0,208	3,467	1	0,063	0,262	1	0,609	0,844	1	0,358
Area of Residence	1,008	1	0,315	3,292	1	0,070	0,650	1	0,587	0,315	1	0,575
Religion	7,049	3	0,070	0,209	3	0,976	14,866	3	0,002	0,722	3	0,868
Level of Education	0,728	3	0,867	0,293	3	0,961	5,437	3	0,142	2,891	3	0,409
Ethnicity	1,985	5	0,851	3,619	5	0,605	12,684	5	0,027	7,611	5	0,177
Occupation	4,935	6	0,552	5,443	6	0,488	8,089	6	0,232	20,758	6	0,002
Parity	2,321	2	0,313	0,41	2	0,815	15,474	2	0,000	3,847	2	0,146
History of twin Pregnancy	0,424	4	0,515	0,456	1	0,500	0,023	1	0,878	2,901	1	0,089
History of Preeclampsia	11,096	2	0,004	0,578	2	0,749	1,154	2	0,562	10,585	2	0,005
History of Hypertension	74,213	2	0,001	3,292	2	0,193	10,203	2	0,006	59,819	2	0,001
History of Diabetes	0,21	2	0,901	9,156	2	0,010	3,863	2	0,145	0,121	2	0,941
Hypertensive Mother	2,66	2	0,264	4,262	2	0,119	3,725	2	0,155	1,047	2	0,593
Hypertensive Father	1,183	2	0,554	6,453	2	0,040	6,345	2	0,042	2,490	2	0,288
Alcohol Consumption	0,893	1	0,345	0,191	1	0,662	3,448	1	0,063	0,774	1	0,379

[1]C-HT: Chronic Hypertension; [2]G-HT: Gestational Hypertension; [3]PE: Preeclampsia; [4]S-PE: Superimposed Preeclampsia

Table 3. *Predictive Factors of Hypertensive Disorders (Multivariate Analysis).*

VARIABLES	C-HT[1] Odds Ratio	P value	G-HT[2] Odds Ratio	P value	PE[3] Odds Ratio	P value	S-PE[4] Odds Ratio	P value
Age				0,722		0,075		0,797
14-19	Ref.	0,013	Ref		Ref		0,000	
20-24	1,833		3,130		0,450		0,000	
25-29	1,048		3,892		0,455		Ref	
30-34	6,600		2,286		0,143		0,345	
35 et +	13,20		1,500		0,094		1,629	
Marital Status		0,084		0,833		0,644		0,638
Single	Ref.		Ref		Ref		Ref	
Married	0,358		0,867		1,282		1,664	
Area of Residence		0,335		0,079		0,422		0,578
Rural	Ref.		Ref		Ref		Ref	
Urban	2,777		0,355		0,673		0,629	
Religion	Ref.	0,111		0,976		0,004		0,986
Catholic	0,121		Ref		Ref		Ref	
Protestant	0,313		0,864		1,187		0,765	
Muslim	0,531		1,169		5,255		0,754	
Others			1,187		1,187		0,000	
Level of Education	Ref.	0,869		0,962		0,158		0,982
Illiterate	0,903		Ref		Ref		Ref	
Primary	0,574		1,419		0,577		0,667	
Secondary	0,656		1,100		0,370		0,902	
Higher			1,419		0,278		0,000	
Ethnicity	Ref.	0,869		0,804		0,127		0,439
Peulh	1,750		Ref		Ref		Ref	
Mboum	3,500		0,813		2,768		1,750	
Gbaya	0,933		0,722		0,246		1,556	
Bamileke	1,750		1,500		0,511		0,000	
Dii	1,531		0,000		0,000		4,000	
Others			0,492		0,450		0,406	
Occupation	Ref	0,620		0,631		0,107		0,641
Student	0,958		Ref		Ref		0,000	
Housewife	0,872		0,599		1,714		Ref	
Salary Earner	2,099		0,000		1,714		1,404	
Informal Sector			0,344		0,286		2,607	
Parity	Ref	0,330		0,816		0,001		0,225
0	1,548		Ref		Ref		Ref	
1	2,560		0,726		0,166		6,484	
≥2			0,708		0,236		6,321	
History of twin Pregnancy	Ref	0,013		0,999		0,878		0,133
Yes	0,131		0,000		Ref		Ref	
No			Ref.		0,836		0,162	
History of Preeclampsia	Ref	0,013		0,761		0,590		0,025
Yes	0,131		Ref		Ref		Ref	
No	0,438		1,077		2,973		0,116	
Do not know			2,50		2,500		0,000	
Hypertensive Mother	Ref	0,282		0,137		0,171		0,973
Yes	0,413		Ref		Ref		Ref	
No	0,369		0,343		0,707		1,213	
Do not know			0,306		2,074		0,000	
Hypertensive Father	Ref	0,563		0,141		0,056		0,521
Yes	0,532		Ref		Ref		Ref	
No	0,411		0,324		1,468		0,429	
Do not know			0,000		5,031		0,000	
Alcohol Consumption	Ref	0,354		0,663		0,072		0,394
Yes	2,068		Ref.		Ref		Ref	
No			1,339		2,780		2,504	

[1]C-HT: Chronic Hypertension; [2]G-HT: Gestational Hypertension; [3]PE: Preeclampsia; [4]S-PE: Superimposed Preeclampsia

4. Discussion

Several studies have been carried out in the past to identify the risk factors associated with hypertensive disorders of pregnancy [8, 9, 10, 11], however, just a few of such studies permit the prediction of risk factors associated with each type of hypertensive disorder in pregnancy in the same sample population.

The results of this work carried out on 75 pregnant women with hypertension enabled us to isolate the risk factors

associated with each type of pregnancy-related hypertension in our context.

4.1. Age

Preeclampsia accounted for 66.7% of young parturient participants (14 – 19 and 20 – 24 years) although the association between young age and preeclampsia was not significant thus contradicting previous reports [9, 12]. These results are close to the 68.4% rate reported by Buambo-bamanga et al. in a retrospective Congolese study [13]. The results however, differ from those of Zenebe's et al. that highlighted a high rate of hypertensive parturient in the 25 to 34 age group (52.5%) [8].

Older parturient participants (≥35 years old) made up the majority of patients (40%) suffering from chronic hypertension. Following multivariate analysis, the risk of chronic hypertension increased with age (P=0.013: OR=13.20). These results concur with current literature [14, 15, 16]. According to these authors, this alteration may be due to the progressive decrease in nitric oxide excretion and the occurrence of oxidative stress at the origin of an endothelial dysfunction which may be considered as a precocious indicator of atherothrombotic damage and cardiovascular events. Also, Taddei et al. suggested that advanced age is associated with endothelial dysfunction in both pregnant women with normal blood pressure and essential hypertension [17]. Moreover, several varying findings on the role of age as a risk factor to hypertensive disorders in pregnancy have been reported, with younger age being an associated risk factor to preeclampsia/eclampsia on one hand [9, 12] and advanced age (≥30 years old) on the other [18, 19].

4.2. Marital Status

The majority of study participants (83.1%) were married, results which are close to those reported by Tebeu et al. in a Cameroonian case-control study with 95% of participants being married [9]. However, these figures differ from the 52% reported by Mboudou et al. [20]. This high frequency of married women can be explained by the customs and beliefs of this region of Cameroon. Although the majority of parturient participants with high blood pressure were married, no association between marital status and any of the hypertensive disorders in pregnancy was recorded.

4.3. Area of Residence

In our study, we noticed a high proportion of hypertensive pregnant women living in urban areas (80%). This result differs from that of Zenebe et al. who reported that the proportion of hypertensive parturient favoured rural dwellers (56.5%) [8]. Our findings most probably stem from several factors including cultural, economic and geographic, favouring inaccessibility to hospital facilities. Also, we can assume that access to the study site was easier for urban than rural dwellers owing to its urban location.

Even though our results did not permit us to conclude on the link between the area of residence and hypertensive disorders in pregnancy, many studies suggest a significant association between the area of residence and gestational blood pressure [8, 21].

4.4. Ethnicity

The Fulani ethnic group represented the most part of our sample (34.7%), this owing to the fact that they are one of several indigenous ethnic groups in the Adamawa Region. Our results further show a significant association between ethnic group and preeclampsia (P=0.027). However, ethnicity fails in this study to be reported as a strong determinant of hypertensive disorders in pregnancy as the Fulani ethnicity being over represented in the study population was not taken into account at the beginning of the study, thus a possible source of bias.

4.5. Religion

The majority of our hypertensive parturient (57.3%) were of the Muslim religion which is in line with the 64.4% observed by Zenebe et al. in Ethiopia [8]. This can be explained by the fact that the study was carried out in a region of Cameroon where the Muslim religion is most geographically widespread. From the results obtained following multivariate analysis, it was observed that Muslim women were more predisposed to preeclampsia compared to Catholics (P=0.004: OR=5.225). This may be in part influenced by the style of life derived from this religion. Interestingly, results from a Norwegian study by Sorensen and colleagues demonstrated that there could be association between religious attendance and blood pressure [22].

4.6. Education Level

Participants with secondary school level of education were the most predominant (37.3%) in this study. This is close to the 43% recorded by Mboudou et al. in another Cameroonian study [20], but inferior to the 72.4% observed by Harioly et al. in a Malagasy study [23]. The high prevalence of participants with a low level of education observed in our work can be explained by the high frequency of early marriages in this part of Cameroon, which obliges the young halt education and focus on their matrimonial responsibilities.

Although we found no significant link between level of education and hypertensive disorders in pregnancy, recent studies carried out in Cameroon [9] and Ghana [24] demonstrated significant associations between educational level and hypertensive disorders in pregnancy. This disparity in outcomes may probably be due to the differences in study designs and methodology.

4.7. Occupation

In line with our results portraying occupation as a determinant of superimposed preeclampsia (P=0.002), many surveys reported a significant associations between profession and hypertensive disorders in pregnancy [24, 25],

although multivariate analyses did not permit us to confirm this link.

4.8. Parity

The majority of our pre-eclamptic patients were primiparae 65.8%, which is close to the 68.4% observed in a Congolese study [13] and likewise a study by Mboudou et *al* [20].

Compared to the primiparae, multiparous participants demonstrated a low risk to preeclampsia/eclampsia (P=0.001; OR=0.236). Many studies have confirmed the place of primiparity as a significant risk factor associated with preeclampsia/eclampsia in Africa, Asia and Europe respectively [9, 10, 26].

4.9. Twin Pregnancy

History of twin pregnancy was a risk factor observed to be associated with chronic hypertension (P=0.013). This finding corroborates with those of the previous studies in which the risk of gestational hypertension was 2 to 3 times higher in women with a history of twin delivery compared to those with mono-foetal pregnancy [27, 28, 29].

4.10. History of Preeclampsia

The prevalence of chronic hypertension was higher among women with a history of preeclampsia in this study, concurring with the findings of Oyati et *al.* where parturient women presenting preeclampsia/eclampsia constituted a high risk group for developing long term chronic hypertension [30].

Furthermore, preeclampsia was associated with superimposed preeclampsia (p=0.025), with parturient women without a history of preeclampsia being less predisposed to superimposed preeclampsia. According to Assis et *al.*, the risk of developing hypertension related to pregnancy is higher for women who had already suffered from hypertension during a previous pregnancy [31]. Furthermore, a recent report demonstrates that there is a significant link between history preeclampsia and superimposed preeclampsia [32].

5. Study Limitations and Implication for Future Research

Considering in particular the reduced sample size and the uneven distribution of participants between the types of hypertensive disorders, strong associations between predictive variables and types of hypertensive disorders are subject to variations. More so, given the fact that this study was carried out in only one geographical region and spanning a short period of time, inferences cannot be made to the other regions of the country owing to variations in educational awareness, cultural and socioeconomic characteristics to name a few, thus the need for a multicentric study involving the different regions of Cameroon.

6. Conclusion

Preeclampsia represents the most frequently encountered form of hypertensive disorders among pregnant women in our environment. In this study, we have also been able to significantly establish evidence of independent predisposing factors associated with hypertensive disorders in pregnancy in a Cameroonian hospital milieu, which include advanced age, the notion of preeclampsia and history of twin pregnancy for chronic hypertension, parity and religion for preeclampsia, and history of preeclampsia for superimposed preeclampsia.

Family history of hypertension, history of diabetes, ethnicity and occupation were also observed to represent contributing risk factors to hypertensive disorders in our study.

Authors' Contributions

OPM conceived the study and wrote report; CB and JON participated in data collection, data entry, analysis and discussion; OPM, DC, MTT supervised and provided direction for the study, reviewed study report for submission and publication; AHNK and AY also finalized the revision of the paper for submission. All authors approved the revised manuscript.

Conflict of Interest

There is no conflict of interest in this research study.

Acknowledgments

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