بسم الله الرحمن الرحيم

Republic of the Sudan

Ministry of Higher Education and scientific Research

University of Shendi

Faculty of Graduate Studies and Scientific Research

Minerals (Ca^{+2}, Mg^{+2}, Na^{+}, K^{+}) Level in Women with Preeclampsia

By

Nimat Abdelhaleem Ali Ahmed

BSc. (Shendi University)

A thesis submitted in partial fulfillment for the requirements of Master Degree in Laboratory Sciences (*Clinical Chemistry)*

Supervisor

Dr. Haj Hamed Allzain Mohamed Bulla

Assistant Professor of Biochemistry-Shendi University

July 2018

الآية

قال الله تعالى :

بسم الله الرحمن الرحيم

﴿وَوَصَّيْنَا الْإِنسَانَ بِوَالِدَيْهِ إِحْسَاناً حَمَلَتْهُ أُمُّهُ كُرْهاً وَوَضَعَتْهُ كُرْهاً وَحَمْلُهُ وَفِصَالُهُ ثَلَاثُونَ شَهْراً حَتَّى إِذَا بَلَغَ أَشُدَّهُ وَبَلَغَ أَرْبَعِينَ سَنَةً قَالَ رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَأَصْلِحْ لِي فِي ذُرِّيَّتِي إِنِّي تُبْتُ إِلَيْكَ وَإِنِّي مِنَ الْمُسْلِمِينَ﴾

صدق الله العظيم

سورة الأحقاف الآية (١٥)

Dedication

To those

Who give me the best of life without payment

To my father and mother for their patience and

support

To my husband

To my brothers and sister

To my teachers

To all my friends

ACKNOWLEDGMENT

All

thanks to Allah from the start to the end…..

And pray for Prophet Mohammed peace be upon him

I would like to acknowledge the contribution of my

Supervisor:

Dr: Haj Hammed Allzain Mohamed Bulla

Who guide me throughout my way and helped me to make this research as accurate and useful as possible.

And I'm grateful to my friends and all those who contributed their time and helped me.

My thanks also extend to my college and my teachers

List of abbreviations

Ca+2	Calcium
Mg+2	Magnesium
Na+	Sodium
K+	Potassium
PIH	Pregnancy induced hypertension
SBP	Systolic blood pressure Potassium
DBP	Diastolic blood pressure
FGR	Fetal growth resistant
HELLP	Hemolysis, elevated liver enzyme and low platelets count
PRES	Posterior Reversible Encephalopathy syndrome
RUQ	Right upper quadrant
ACOG	American College of Obstetricians and Gyynaecologists
LDH	Lactate dehydrogenase
PC	Platelets count
DK	Posterior Reversible Encephalopathy Syndrome
VLBW	Very Low Birth Weight
PG	Prostaglandin
NO	Nitrous Oxide
CO	Cardiac Output
SVR	Systemic Cardiac Resistant
BBB	Blood Brain Barrier
BMI	Body Mass Index
LMWH	Low molecular weight heparin
PROM	Preterm rupture of membranes
SOMANZ	Society of obstetric medicine of Australia and zeal and

NICE	National Institute for health and clinical Excellence
ACE	Angiotensin Converting-Enzyme
AR	Angiotensin Receptor
NNT	Number Need of Treat
NMDA	N-Methyl-D-Aspartate
PT	Prothrombin time
PTT	Partial thromboblastin time
CSE	Combined spinal epidural
ADH	Anti diuretic hormone
GA	Gestational age
SPSS	Statistical package for social science

Abstract

The study was conducted in Shendi town during the period of April to July 2018, and aimed to compare minerals level (Ca+2,Mg+2,Na+,K+) between women with preeclampsia and control.

A total 80 venous blood samples were collected in lithium heparin anticoagulant containers (50 preeclamptic women and 30 normotensive) .

Mean serum calcium 9 for normotensive pregnant women was statistically comparable to the preeclamptic women 8.2 .

Mean serum magnesium 1.9 for normotensive pregnant women was statistically compared to PW 1.3 However, the magnesium level was significantly lower in preeclamptic pregnant women than in their normotensive counterparts *P* value (0.02) .

Mean serum sodium 136.8 for normotensive pregnant women and 136.8 in preeclamptic women.

Mean serum potassium 4.11 for normotensive pregnant women and 3.94 in women with preeclampsia .

The results shows that there was significant variation between potassium level of women with preeclampsia and control *P* value (0.00).

The results shows that there was significant variation between magnesium level of women with preeclampsia and control *P* value (0.02).

Also some result shows that there was no significant variation in sodium level *P* value (0.95) and calcium level pv(0.89) .

الخلاصــة

أجريت هذه الدراسة بمدينة شندي في الفترة ما بين شهر ابريل ٢٠١٨ وشـــهر يوليـــو ٢٠١٨ وهدفت لمقارنة مستوي معادن الدم (الكالسيوم–الماغنيزيوم –الصوديوم –البوتاسيوم) بـــين الحوامل بتسمم الحمل والحوامل الطبيعية.

تم جمع عدد٥٠عينة دم وريدي في مضاد تجلط هيبارين وتم حفظهـــا فـــي ظـــروف مثاليـــة لحمايتها من التلوث ومن ثم تم قياس مستوي معادن الدم الكالـــسيوم والمـــاغنيزيوم بواســـطة جهاز الاسبكتروفوتوميتر والصوديوم والبوتاسيوم بواسطة جهاز قياس الشوارد و٣٠ عينـــة كنترول . كما تم قياس معدل تركيز الدم والجلكوز والبروتين في البول .

تم تحليل البيانات باستخدام برنامج الحزم الإحصائية للعلوم الاجتماعية أوضـــحت النتـــائج أن هناك فرق ذو دلالة إحصائية بين متوسط تركيز الماغنيزيوم والبوتاسيوم بين الحوامل بتسمم الحمل والحوامل الطبيعيين.

أظهرت نتائج التحليل الإحصائي عدم وجود فرق ذو دلالة إحصائية فـــي تركيـــز الكالـــسيوم والصوديوم.

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1.1. Introduction

Pre-eclampsia is a disorder that occurs only during pregnancy and affects both the mother and the fetus. According to the World health Organization, preeclampsia is a major cause of both maternal and fetal neonatal morbidity and mortality.

The incidence rate of pre-eclampsia stands at 3-10% globally. Taking into account of the numerous studies conducted, the aetiology of this condition remain unknown. Although factors such as obesity, diabetes, calcium (Ca2+) deficiency advanced maternal age, oxidative stress, placental ischaemia, genetic factors and immune maladaptation have been implicated. Arole for altered calcium metabolism in the pathogenesis of this disorder is suggested by epidemiologic evidence linking low dietary level of calcium with increased incidence of pre-eclampsia. Changes in intracellular calcium and magnesium concentrations seem to be involved in the pathogenesis of preeclampsia. On the basis of the vasodilating therapeutic effects of magnesium salts, it is suggested that a deficiency in magnesium contributes to the development of vasoconstriction in pre-eclampsia. Therefore the objective of the study is to determine the of electrolyte imbalance by estimating the levels of serum Na+, K+, Mg++ and Ca2+ in pre-eclamptic pregnant women in their third trimester of pregnancy.

Total body calcium =1000g . 99%is bound in the skeleton and the rest is distributed through the interacellular fluids.

Importance of calcium:

Bone and teeth formation, Enzyme regulation, Blood clotting (co factor for factors vii ,ix ,x) concentration, cell growth and division and maintenance of plasma membrane stability .

Potassium is the major interacellular cation in the body, with total amount of 3000mmol, of which about 98% is ineracellular.

Function of potassium in the body include regulation neuromuscular excitability, concentration of the heart, Intra cellular fluid volume, and hydrogen ion concentration.

Sodium is one of the body's electrolytes, which are minerals that the body needs in relatively large amounts. Electrolytes carry an electric charge when dissolved in body fluids such as dlood.

Most of body's sodium is located in blood and in the fluids around cells. Sodium helps the body keep fluids in a normal balance . Sodium plays a key role in normal nerve and muscle function .

Magnesium is fourth most abundant cation in the body and second most abundant intracellular ion .

Role of magnesium:

- Co factor of more than 300 enzymes, including enzyme involved protein synthesis , glycolysis.
- Magnesium is important in the maintenance of ribosomes, nucleic acids and some proteins .
- Enzyme metabolisim.
- Blood pressure regulation.

1.2 Rationale

Preeclampsia is condition observed during pregnancy and threatness the life of both mother and fetus. Preeclampsia and its complication is considered one of the commonest obestrical complication in Sudan and constitutes a major source of morbidity and mortality worldwide overall 10% -15% of maternal death are directly associated with preeclampsia and eclampsia

the electrolytes: calcium, magnesium, sodium and potassium contribute significantly in the functioning of the vascular smooth muscles, the present study was designed to evaluate the role of these electrolytes in the genesis of PIH.

Due to what mentioned in above we did our study in Shendi town to focus in electrolyte change in women with preeclampsia.

1.3. Objectives

1.3.1. General objective

To find out the relationship of serum levels of calcium, magnesium, sodium and potassium in pre-eclamptic pregnancies compared to normal pregnancies.

1.3.2. Specific objectives

1. To measure serum levels of Ca2+ in women with preeclampsia.
2. To measure serum levels of Mg2+ in women with preeclampsia.
3. To measure serum levels of Na+ in women with preeclampsia.
4. To measure serum level of K+ in women with preeclampsia.
5. To measure hemoglobin concentration in women with preeclampsia.
6. To detect urine albumin in women with pre-eclampsia .
7. To detect urine glucose in women with pre-eclampsia.
8. To measure body mass index in women with pre-eclampsia.

Chapter two

Literature review

2. Literature review

2.1. Hypertension

During pregnancy is defined as a systolic blood pressure (SBP) ≥ 140 mmHg and/or a diastolic blood pressure (DBP) ≥ 90 mmHg and is classified into four categories preeclampsia, chronic hypertension, chronic hypertension with superimposed preeclampsia, and gestational hypertension [(1)].

Hypertension is considered to be mild, moderate or severe when SBP is ≥ 140, 150 or 160 mmHg or DBP is ≥ 90,100 or 110 mmHg, respectively [(2)].

2.2. Preeclampsia

was usually defined as new-onset hypertension (i.e. SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg) and proteinuria (> 0.3 g/day) arising after 20 weeks of gestation in a previously normotensive woman. Elevated BP should be recorded on two measurements at least four hours apart. Proteinuria is defined as the excretion of at least 300 mg of protein in a 24 hour urine collection. Alternatively, a urine protein (mg/dL)/creatinine ratio (mg/dL) ≥ 0.3 has good sensitivity (98.2%) and specificity (98.8%) as a diagnostic tool [(3)]. Conversely, a positive qualitative dipstick test for proteinuria provides too variable results to be considered as a reliable diagnostic tool of proteinuria. It can be used if no other method is readily available. In that case only, a 1+ dipstick result is considered as the cut-off for the diagnosis of proteinuria.

Since recently, in recognition of the syndromic nature of preeclampsia, proteinuria is no longer considered as mandatory for the diagnosis of preeclampsia [(4,5)]. Consequently, in the absence of proteinuria, preeclampsia can be diagnosed as newonset hypertension associated with:

- Thrombocytopenia < 100.000/μL.
- Elevated liver transaminases (> twice the normal values).

- Impaired renal function (with serum creatinine > 1.1 mg/dL or doubling of serum creatinine level in the absence of any other renal disease).
- Pulmonary edema.
- New onset visual or cerebral disturbances.

2.3. Severe preeclampsia

Was usually defined as preeclampsia associated with any of the following:

- Severe hypertension (i.e. SBP ≥ 160 mmHg and/ or DBP ≥ 110 mmHg).
- Thrombocytopenia < 100.000/μL.
- Impaired liver function with liver transaminases higher than twice the normal values.
- Severe and persistent right upper quadrant (RUQ) or epigastric pain not accounted for by any other diagnosis.
- Renal insufficiency defined as serum creatinine >1.1 mg/dL or a doubling of serum creatinine in the absence of other renal disease.
- Massive proteinuria > 5 g/day.
- Pulmonary edema, – new-onset cerebral or visual disturbances.
- Fetal growth restriction (FGR).

However, recent studies have demonstrated minimal to no influence of the severity of proteinuria on pregnancy outcome in preeclampsia; management of FGR is similar in pregnant women with or without preeclampsia [4, 6].

Therefore, massive proteinuria (> 5 g/day), and FGR are no longer criteria of severe preeclampsia (Table 2). Diagnosing severe preeclampsia is of paramount importance, insofar as it has a major impact on medical treatment and timing of delivery as compared to preeclampsia without severe features. Recently, and according to the dynamic character of preeclampsia, the American College of Obstetricians and Gynaecologists (ACOG) has discouraged the diagnosis of "mild preeclampsia", and proposed the diagnosis of "preeclampsia without severe features".

2.4 Gestational hypertension

Is defined as SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg after 20 gestation weeks in the absence of proteinuria, or any of the aforementioned systemic findings, and resolving before 12 postpartum weeks.

2.5. Chronic hypertension

Corresponds to hypertension existing before pregnancy, or appearing before 20 gestation weeks, and persisting more than 12 postpartum weeks.

2.6. Superimposed preeclampsia

Is new-onset proteinuria appearing after 20 gestation weeks in a previously hypertensive woman.

2.7. Eclampsia

Is defined as generalized tonico-clonic seizure that is not attributable to another cause, and occurring within the course of preeclampsia. Eclampsia generally spontaneously resolves within approximately 60 sec, or within less than 3 to 4 min. Eclampsia has a recurrence rate of about 10% without appropriate treatment.

2.8. HELLP

Is the acronym for Hemolysis, Elevated Liver enzymes, and Low Platelets count. It is a common complication of severe preeclampsia (10- 20%). Even if HELLP should be suspected when confronted with clinical signs such as epigastric or RUQ pain, nausea, and vomiting, the diagnosis of HELLP syndrome relies on laboratory findings. These include microangiopathic hemolysis with schizocytes, increased lactate dehydrogenase (LDH) (twice the normal value), bilirubin > 1.2 mg/ dL, low haptoglobin, liver transaminases > twice the normal values, and platelet count (PC) < 100.000/μL.

2.9. PRES

Is the acronym for Posterior Reversible Encephalopathy Syndrome, and is commonly seen in patients with eclampsia.

Epidemiology, morbidity, and mortality associated with preeclampsia. Preeclampsia complicates 5 to 8% of all pregnancies. This represents 8.5 million cases a year worldwide. This pathology remains one of the three leading causes of maternal death. The majority of these maternal deaths are related to cerebral hemorrhage that is secondary to poorly controlled hypertension (SBP > 160 mmHg) [1, 2]. Renal failure, pulmonary edema, liver failure or rupture, seizures (eclampsia), disseminated intravascular coagulation (DIC), retinal detachment; cortical blindness, abruptio placentae, and hemorrhage represent other complications of preeclampsia. All contribute to preeclampsia-associated maternal morbidity and mortality. Five percent of severe preeclamptic patients are admitted to an ICU. Finally, preeclampsia is known to increase the risk of developing a cardiovascular disease later in life by a factor of 2.

Regarding the fetus and the neonate, preeclampsia is responsible for 5% of stillbirths in infants without congenital abnormalities, accounts for 8-10% of the overall preterm birth rate, and for 15-20% of the overall FGR and very low birth weight (VLBW) [7].

2.10. Pathophysiology of preeclampsia

2.10.1 Abnormal placental development

As opposed to normal pregnancy, preeclampsia is characterized by an immunologically-initiated impaired trophoblast invasion of the spiral arteries between 8 and 16 gestation weeks. This abnormal invasion of placenta nourishing arteries leads to a failure of their remodeling. Failed remodeling impairs the transformation of small high resistance muscular arteries into large capacitance vessels. Consequently, the utero-placental blood flow progressively fails to meet

the needs. Placental ischemia ensues, with oxidative stress, inflammation, apoptosis, and structural damage [8].

2.10.2. Angiogenic imbalance

As a consequence of placental ischemia, secondary mediators are released. During normal pregnancy, placental growth factor (PlGF) and vascular endothelial growth factors (VEGF) are potent proangiogenic substances. They enhance the vasodilating properties of prostaglandins (PG) and nitrous oxide (NO), and promote endothelial health. In preeclampsia, several anti-angiogenic factors are produced. They are responsible for angiogenic imbalance, impaired vasodilation and an endothelial dysfunction. The soluble fms-like tyrosinekinase (sFlt-1) antagonises VEGF and PlG. Soluble endoglin (sEng) antagonises TGF-β, and blocks NO. This imbalance between pro and anti-angiogenic factors produces generalized endothelial dysfunction, microangiopathy, and vasospasm. These rise to the various signs and symptoms of this multisystemic disease, which become clinically evident after 20 gestation weeks [8, 9].

2.10.3 Hemodynamic alterations in preeclampsia

The underlying mechanism of hypertension in preeclampsia remains somewhat controversial. Different hemodynamic states have been described in preeclamptic patients. These range from low cardiac output (CO) with increased systemic vascular resistance (SVR) to a hyperdynamic state with increased CO associated with an increased stroke volume and a moderate increase in SVR [10,15]. These different hemodynamic situations might be related to the early or late onset of preeclampsia, as well as to its severity [16]. Use of cardiac output, and not only blood pressure, as an endpoint when treating severe preeclampsia might improve the hemodynamic management of these patients [17, 18]. The routine use of invasive hemodynamic monitoring (arterial line, pulmonary artery catheter, or devices estimating CO from the invasive arterial pressure waveform such as LiDCO® (LiDCO Group PLc, London, UK) PiCCO® (Pulsion Medical Systems, Munich,

Germany), or Vigileo (Edwards Lifesciences, Irvine, CA, USA)) is not common practice for preeclampsia management. Invasive techniques estimating CO do not have any proven benefits on maternal outcome, and may be associated with adverse events [19].

Echocardiography may provide useful information but necessitates a trained operator, and does not allow continuous measurement [20].

Recent non-invasive techniques based on pulse wave analysis for continuous assessment of CO and SVR might be associated with a better hemodynamic management and a better risk/ benefit profile [17, 18, 21]. Their impact on overall outcome needs to be evaluated on a larger scale.

2.10.4 Eclampsia

Eclampsia occurs in 0.5% of pre-eclamptic patients without severe features, and in 2-3% of severe preeclampsia. This corresponds up to 10/10000 deliveries in developed countries, and up to 157/10000 deliveries in developing countries [22]. Eclamptic seizures contribute substantially to maternal morbidity and mortality. Several prodromal symptoms such as severe headache, altered mental status, blurred vision, and hyperreflexia with clonus may precede the onset of seizures. However, in 40% of eclampsia cases, no prodromal signs are present. Two different pathophysiologic mechanisms may underlie these neurologic symptoms. Vasospasm associated with hypertension and cerebrovascular overregulation might induce localized ischemia and cytotoxic edema. Alternatively, loss of cerebral autoregulation, hyperperfusion, and increased blood brain barrier (BBB) permeability may induce hypertensive encephalopathy, and vasogenic edema [23, 24]. Reversibility of neurologic signs and radiologic findings is in favor of the latter hypothesis. Radiologic findings have been described as the posterior reversible encephalopathy syndrome (PRES). A recent study has evidenced PRES in almost every eclamptic patient. Furthermore, PRES has been identified in multiple areas of

the brain in a series of cases where severe hypertension was not a constant feature[25, 26].

2.11. Risk factors

Prediction and prevention of preeclampsia several factors are associated with an increased risk of preeclampsia:

antiphospholipid syndrome (risk ratio (RR): 9.72), past history of preeclampsia (RR: 7.19), pregestational diabetes (RR: 3.56), multiple gestation (RR: 2.93), nulliparity (RR : 2.91), family history of preeclampsia (RR :2.90), body mass index (BMI) > 30 before pregnancy (RR : 2.47), age ≥ 40 years (RR :1.96), pre-existing hypertension (RR: 1.5), pre-existing renal disease, and pregnancy interval > 10 years [27, 28]. Use of risk factors as predictive tools for preeclampsia has only modest success. Biomarkers of preeclampsia and its severity have also been proposed [8, 29]. Placental expression and serum levels of sFlt-1 in preeclamptic women are increased during active disease, as compared with normal pregnancy. Serum levels of sFlt-1 are directly correlated with the severity of the disease. PlGF is low during preeclampsia. This is due to its binding to sFlt-1. A plasma sFlt-1/PlGF ratio ≥ 85 is associated with adverse outcomes and delivery within two weeks of presentation[30].

The sFlt-1/PlGF ratio could allow classifying the severity of the disease. Similarly, Bnatriuretic peptide has been suggested as a marker of preeclampsia. Preeclamptic patients have higher levels of natriuretic peptide than non preeclamptic patients. Larger prospective studies are needed to determine if elevated concentrations predict development of preeclampsia and its complications [31].

Up to now, the use of these biomarkers as parts of a screening test remains investigational.

Women at high risk of preeclampsia should receive low dose aspirin daily from gestation week 12 to 37. Its prophylactic effect may be the result of the inhibition of thromboxane production. Studies indicate a small reduction in the incidence and

morbidity of preeclampsia, with no difference in bleeding complication rates. Conversely, neither nutritional supplements (such as calcium, folic acid, vitamins C and E, fish oils, or garlic), nor drugs such as progesterone, nitric oxide donors, diuretics, or low molecular weight heparin (LMWH) have shown efficacy at preventing preeclampsia. Restriction of dietary salt and restriction of physical activity in addition to bed rest during pregnancy have no effect on preeclampsia prevention [(4)]. Statins, by stimulating hemoxygenase expression, inhibit sFlt-1 release and promote VEGF. Studies to explore a possible benefit of statins are currently being carried out [(9)].

2.12. Management of preeclampsia

The only etiologic treatment of preeclampsia is fetus and placenta delivery. Timing of delivery must take into account the gestational age, severity of preeclampsia, as well as maternal and fetal conditions. Current treatments aim at avoiding maternal complications such as cerebral hemorrhage, pulmonary edema, and eclampsia. Treatment is essentially based on antihypertensive therapy and magnesium sulfate (MgSO4).

During the last 6 years, guidelines aiming at improving outcome of women with preeclampsia have been published by several scientific societies. They provide a robust common basis with minor between-societies differences [(4, 6, 7, 27, 32)] .

At the time of diagnosis, the initial objective is to assess the severity of the disease. In addition to blood pressure and proteinuria measurement and recording, clinical signs of severity must be searched for. Neurological symptoms such as headache, blurred vision, or altered mental status must be considered, as well as epigastric pain or RUQ pain, nausea and vomiting, oliguria, and dyspnea. Laboratory evaluation must assess platelet count, schizocytes count, serum creatinine, liver transaminases, bilirubin, LDH, haptoglobin, and coagulation tests.

Fetal assessment relies on fetal heart rate, fetal weight, amniotic fluid volume, biophysical profile, and umbilical artery Doppler velocimetry.

2.12.1 Management of preeclampsia without severe features

Recommendations for the management of preeclampsia without severe features before 37 weeks of gestation are mainly based on expert opinion. Fluorinated steroids should be administered in patients before 34 weeks of gestation, in order to favor fetal maturation. Antihypertensive treatment remains controversial in patients with mild to moderate hypertension [33]. Prevention of eclampsia with MgSO4 is not recommended in preeclamptic patients with no severe features. Bed rest does not improve outcome. Preeclamptic patients with no severe features should be closely monitored. Monitoring includes several evaluations of maternal condition and fetal well-being. Maternal condition is assessed through inventory of clinical symptoms, at least twice weekly. Blood pressure should be measured frequently, and lab tests should be performed weekly, including platelet count and liver enzyme levels. Fetal well-being should be assessed daily by the mother herself (screening of fetal movements), fetal heart rate monitoring, at least twice a week, and ultrasound scanning to evaluate amniotic fluid volume, fetal growth, and umbilical artery velocimetry.

2.12.2 Management of severe preeclampsia

Women with severe preeclampsia must be admitted to a maternal high dependency unit, a labor and delivery ward, or a regular intensive care unit.

Severe preeclampsia is an indication for prompt delivery in women with gestational age above 34 weeks. Before 24 weeks, it is recommended to terminate the pregnancy immediately. In women with severe preeclampsia between 24 and 34 weeks, steroids are recommended to favor fetal maturation. In that case, delivery must be delayed for 48 hours, whenever possible.

In selected women who are cared for in specialized units, expectant management of preeclampsia can be considered. Expectant management includes antihypertensive treatment in patients with severe hypertension, and MgSO4 to prevent eclamptic seizures.

However, it must be kept in mind that, while expectant management of severe preeclampsia improves neonatal outcome, it is not associated with any benefit to the future mother.

Delaying delivery in women with severe preeclampsia can be associated with several complications such as ICU admission (27.6%), HELLP syndrome (11%), recurrent severe hypertension (8.5%), pulmonary edema (2.9%), eclampsia (1.1%), and sub-capsular hematoma of the liver (0.5%). Regarding fetal and neonatal complications, delaying delivery can lead to non-reassuring fetal heart rate (50%), fetal growth retardation (37%), prenatal death (7.3%) and/or abruptio placentae (5.1%) [34].

Contra-indications to expectant management beyond 48 hours include fetal growth retardation (< 5th percentile), severe oligohydramnios, reverse end-diastolic flow in the umbilical artery as assessed by Doppler ultrasound, new-onset or increasing renal dysfunction, liver disease, coagulation disorders, preterm rupture of membranes (PROM), and preterm labor.

In case of uncontrollable severe hypertension, eclampsia, pulmonary edema, disseminated intravascular coagulation, abruptio placentae, non-reassuring fetal status, or fetal demise, it is recommended to proceed to delivery as soon as possible after maternal stabilization.

Expectant management of severe preeclampsia can be considered in pregnancy between 24 and 34 gestation weeks, with controlled hypertension, moderately and transiently abnormal lab tests and fetal weight above the 5th percentile.

2.12.3 Antihypertensive treatment in preeclampsia

Antihypertensive therapy of non-severe hypertension: a controversy the purpose of treating severe hypertension is to prevent complications such as intracranial hemorrhage, hypertensive encephalopathy, and pulmonary edema. There is no worldwide consensus regarding the management of non-severe hypertension,

insofar as the evidence of an improvement of maternal and neonatal outcome by treatment is lacking [33].

Society of Obstetric Medicine of Australia and New Zealand (SOMANZ) guidelines consider that antihypertensive treatment can be initiated when blood pressure ranges from 140/160 mmHg SBP and/or 90/100 mmHg DBP [27]. National Institute for Health and Clinical Excellence (NICE) guidelines recommend treating hypertension when SBP > 150 mmHg and DBP > 100 mmHg[7], and the last ACOG task force report on hypertension in pregnancy recommend treating women with SBP ≥ 160 mm Hg or DBP ≥ 110 mm Hg [4]. In 2010, a Cochrane review concluded that the benefit of treating mild to moderate hypertension was unclear [33]. Oral labetalol, nifedipine or nicardipine, methyldopa, and clonidine can be used for the treatment of non-severe hypertension. Angiotensinconverting-enzyme (ACE)-inhibitors and angiotensin receptor (AR)-blockers are contraindicated.

Antihypertensive therapy of severe hypertension

Treatment is recommended for SBP ≥ 160 mmHg and/or DBP ≥ 110 mmHg with a target between 130 and 150 mmHg for SBP, and between 80 and 100 mmHg for DBP [7]. General agreement exists on the need to avoid precipitous decreases in blood pressure, which could affect utero-placental blood flow. A decrease of 10 to20 mmHg every 10 to 20 min has been suggested by some authors [35]. The most frequently recommended medications for the treatment of severe hypertension during pregnancy are hydralazine, labetalol, calcium channel blockers and clonidine.

Among antihypertensive medications that are considered to be safe in this context, no evidence supports one drug over another. Consequently, choice should be based on the clinician's experience and available resources. However, nitroprusside, diazoxide, ketanserin, chlorpromazine should be avoided. MgSO4 is not considered as an effective treatment for very high blood pressure (although this is indicated for prevention and treatment of eclampsia) [36].

2.12.4 Management of HELLP syndrome

Corticosteroid administration to favor fetal maturation reverses HELLP-associated laboratory abnormalities in subgroup of patients, and might prolong pregnancy for 3-14 days. However, there is no evidence for a maternal or perinatal corticosteroid-related improved outcome. Expectant management of HELLP syndrome beyond 48 hours remains an experimental approach, and is not recommended [37]. Medical treatment of HELLP syndrome relies on antihypertensive treatment and MgSO4. Platelet transfusion should be considered if PC falls below 20.000/μL, in case of bleeding, and to achieve a PC of 40-50.000/μL in case of caesarean section [6]. Randomized controlled trials have provided evidence of improvement in platelet count with corticosteroids, but no improved overall maternal outcome. In clinical settings where an improvement of platelet count is considered useful, corticosteroids could be used [38]. Worsening of hemolysis, thrombocytopenia, and liver dysfunction is common during the first 24-48 postpartum hours. A rise in PC > 100.000/μL usually occurs at day 3 post nadir, or day 6 postpartum.

2.12.5 Prevention and management of eclampsia

Treatment of eclamptic seizures consists in the administration of MgSO4 and in the treatment of hypertension. The Collaborative Eclampsia Trial showed a 67% reduction of recurrent seizures in eclamptic women treated with MgSO4, as compared with those treated by phenytoin. There was a 52% reduction in recurrence as compared to diazepam. For women with eclampsia, MgSO4 should be continued for at least 24 hours after the last seizure [39].

Delivery is the only curative treatment. So far, any other treatment is palliative. Expectant management of eclampsia to prolong gestation for fetal benefit is associated with a substantial increase in maternal and perinatal morbidity and mortality. Delaying delivery for 24-48 hours in order to allow the administration of corticosteroids prior to 34 gestation weeks has been reported in one retrospective study, but the safety of such an approach has not been proved. Induction of labor is

sometimes possible after maternal stabilization, and in case of an expected delivery within 24 hours. Cesarean section can be considered before 32 gestation weeks, or in case of unfavorable cervix. MgSO4 is the cornerstone of the prevention and treatment of eclampsia. Its use is associated with a 50% reduction of eclampsia episodes in severe preeclampsia. It also reduces the risk of maternal death. The number needed to treat (NNT) to observe 1 beneficial effect is 50 for severe preeclampsia patients, whereas it rises to 100 for patients with preeclampsia without severe features [(40)].

In case of severe preeclampsia arising in the postpartum period, the administration of MgSO4 is also recommended for at least 24 hours. The effect of MgSO4 is likely multifactorial, including both vascular and neurological mechanisms. Magnesium is a calcium antagonist and induces vasodilation. In addition, MgSO4 may decrease blood brain barrier (BBB) permeability and limit vasogenic edema [(41)]. In addition, MgSO4 has anticonvulsant properties, which may be related to its N-methyl-D-aspartate (NMDA) glutamate receptor antagonist activity. The adverse effects of MgSO4 consist in flushing, palpitations, nausea, vomiting, sedation, respiratory depression, and cardiac arrest [(42)].

These side effects follow a dose-response relationship and occur more frequently in patients with impaired renal function. Close monitoring of the patellar reflex, oxygen saturation, respiration rate, urine output, blood pressure, heart rate and level of consciousness is recommended to detect toxicity. Routine serum magnesium measurement is not necessary. In case of toxicity, calcium gluconate administration is recommended (1g over 10 minutes). MgSO4 must be continued during labor or Csection, and during the first 24 postpartum hours. Despite theoretical concerns about potential synergistic cardiac depression, the simultaneous administration of MgSO4 with calcium channel blockers is not contraindicated [(43)].

2.12.6 Fluid management

Pulmonary edema is a potential complication of preeclampsia. Decreased colloid osmotic pressure, increased capillary permeability, increased hydrostatic pressure, and cardiac diastolic dysfunction may all contribute to this complication [11, 44, 45]. Preeclampsia is also regarded as a hemodynamic state of depleted intravascular volume, submitting the patient to a higher risk of renal failure. The intravenous administration of fluids to increase plasma volume or to improve renal perfusion is not recommended in women with normal renal function. In case of oliguria, variable invasive monitoring has been proposed to guide fluid therapy. This invasive monitoring may be associated with several complications. Echocardiography and pulmonary ultrasound, allowing interstitial fluid imaging (B lines), may provide useful information to guide fluid therapy in this situation, where the risk of renal failure must be balanced against the risk of pulmonary edema.

2.12.7 Timing of delivery

For women with chronic hypertension and no additional maternal or fetal complications, delivery before 38 0/7 gestation weeks is not recommended.

For women with mild gestational hypertension or preeclampsia without severe features, and no other indication for delivery, expectant management with maternal and fetal monitoring is suggested until the 37 0/7 gestation week. At or beyond 37 0/7 WG, delivery rather than continued observation is suggested. Delivery should be planned within 24- 48 hours.

In case of severe preeclampsia at or beyond 34 0/7 gestation weeks and in case of unstable maternal or fetal conditions, irrespective of gestational age, delivery is recommended soon after maternal stabilization. In case of severe preeclampsia before fetal viability (24 gestation weeks), delivery after maternal stabilization should be performed. In that case, expectant management should not even be considered. When gestation is less than 34 0/7, with stable maternal and fetal

conditions, expectant management can only be undertaken at facilities with adequate maternal and neonatal intensive care resources. In any case, for women with preeclampsia, a decision of delivery should not be based on the amount or change in the amount of proteinuria.

HELLP syndrome before fetal viability is an indication of delivery, shortly after maternal stabilization. When those patients are at or beyond 34 gestation weeks, it is recommended to proceed to delivery soon after initial maternal stabilization. In between gestational age of fetal viability and 33 6/7 gestation weeks, it is suggested to delay delivery for 24-48 hours, but only if maternal and fetal conditions remain stable and allow completing a course of corticosteroids for fetal benefits.

2.12.8 Mode of delivery

For women with preeclampsia, the mode of delivery should be determined by the fetal gestational age, fetal presentation, cervical status, and maternal and fetal condition. Caesarean delivery is therefore not mandatory. Cervix ripening with induction of labor should be considered when possible. After 32 gestation weeks, a 60% vaginal birth rate is achievable [46].

Anesthesia and analgesia for the preeclamptic parturient

a. Coagulopathy and regional techniques:

The risk of spinal hematoma associated with a coagulopathy has always been a concern in preeclamptic women. Preeclampsia is associated with an increased incidence of thrombocytopenia, and potentially other coagulation abnormalities. On the other hand, spinal hematoma is less frequent in parturient women as compared to the general population. The very few cases reported in obstetrics are associated with HELLP syndrome [47].

Several studies have addressed the incidence of thrombocytopenia and coagulopathy in preeclampsia, and demonstrate a maximal 10% incidence of thrombocytopenia (<100.000/μL) in pre-eclamptic patients. Increase in prothrombin time (PT), partial thromboplastin time (PTT), or decreased fibrinogen

have only been described in severe preeclampsia associated with a thrombocytopenia below 100.000/μL. These data lead to the conclusion that, in preeclampsia, the sole monitoring of platelet count, and reserving PT, PTT and fibrinogen monitoring for patients with thrombocytopenia, is a safe policy [48, 49].

Guidelines suggest that monitoring platelet count in pre-eclamptic patients (as opposed to normal pregnancy) reduces maternal anesthesia complications [50].

A stable platelet count >75.000/μL in the absence of other coagulation abnormalities is usually considered safe for neuraxial techniques. Some authors consider a platelet count of 50.000/ μL as acceptable for spinal anesthesia [32].

b. Neuraxial analgesia for labor

Unless contraindicated, preeclampsia is considered to be a medical indication for epidural or combined spinal epidural analgesia (CSE) during labor. These techniques not only provide optimal analgesia, but also give better maternal hemodynamic control. In addition, an in situ epidural catheter during labor may avoid the risks associated with general anesthesia, should an emergency cesarean section become necessary during labor.

c. Neuraxial anesthesia for cesarean delivery

Unless contraindicated, neuraxial anesthesia is the technique of choice for cesarean delivery. Neuraxial anesthesia provides satisfactory hemodynamic stability, and avoids the risks associated with general anesthesia in preeclamptic patients. These risks include the potential presence of a difficult airway, and severe hypertension associated with tracheal intubation. For many years, the fear of profound hypotension caused by the sympathetic blockade in patients with increased vascular resistance and depleted intravascular volume precluded the use of spinal anesthesia, and favored the use of epidural anesthesia. However, numerous studies have demonstrated that spinal anesthesia in preeclamptic women is associated with less hypotension, less vasopressor requirement, and minimal changes in CO [51-53]. It has also been demonstrated that regional anesthesia for cesarean section in

preeclamptic women is associated with a two times higher stroke-free survival rate, as compared to general anesthesia [54]. Therefore, spinal anesthesia can be safely used in this population [55]. Combined spinal-epidural anesthesia is also an appropriate technique for these patients [56]. Epidural anesthesia is the technique of choice when a cesarean section is required during labor under epidural analgesia.

d. General anesthesia for cesarean section

In case of contraindications to neuraxial anesthesia (i.e. pulmonary edema, coagulopathy, altered consciousness following eclamptic seizures), general anesthesia may be required for cesarean delivery. General anesthesia may lead to several difficulties. Intubation can be complicated by airway edema, while a severe hypertensive response may result from laryngoscopy and tracheal intubation. Opioids (remifentanil, fentanyl, sufentanil) must be used in combination with antihypertensive drugs (labetalol, esmolol, MgSO4) in order to blunt the blood pressure response to this noxious stimulation [27]. For women treated with MgSO4, monitoring neuromuscular blockade is necessary, insofar as MgSO4 potentiates and prolongs the effects of nondepolarizing muscle relaxants.

e. Uterotonic agents in preeclampsia

For patients with preeclampsia, slow administration of 3 IU of oxytocin is recommended as the first line uterotonic measure. It must be followed by an infusion at the lowest effective rate, in order to avoid acute vasodilation, tachycardia, increased cardiac output, and fluid retention (antidiuretic hormone (ADH) effect) [57-59]. Carbetocin is associated with the same side effects as oxytocin [60]. Given its vasoconstrictive effects, ergometrine is usually considered to be contra-indicated in preeclampsia [61].

2.13 Management during the postpartum period

2.13.1 Management of postpartum hypertension:

In women with preeclampsia, blood pressure usually decreases within 48 hours after, but may rise again after 3-6 postpartum days. Preeclampsia may also appear

up to 4 weeks after delivery. It is therefore recommended to closely follow blood pressure after delivery [62]. Antihypertensive treatment is suggested if SBP remains above 150 mmHg and/or DBP persists above 100 mmHg, on at least two occasions at least 4-6 hours apart. Persistent SBP of 160 mmHg or DBP of 110 mmHg or higher should be treated within 1 hour. As opposed to during pregnancy, some ACE-inhibitors (captopril and enalapril) are considered to be safe during breast feeding. Conversely, clonidine is best avoided in the nursing mother. The use of methyldopa is controversial during that period. The choice of the antihypertensive agent should be based on the clinician's familiarity with the drug. The use of furosemide may decrease the need for other antihypertensive therapy, but more data are necessary before recommending this treatment [63]. When blood pressure is adequately controlled for at least 48 h, medication can be reduced progressively. Resolution may take several weeks. During the postpartum period, non-steroidal anti-inflammatory drugs should be avoided.

2.13.2. Thromboprophylaxis

Preeclampsia is a risk factor for thrombosis, particularly if additional risk factors are present (BMI > 30, age > 35, multiparity). Unless contraindicated, postpartum thromboprophylaxis with low molecular weight heparins should be given, particularly in case of antenatal bed rest for more than four days, or after caesarean section [6, 27].

2.13.3 Medical follow-up

Women with a history of preeclampsia or eclampsia are at higher risk (approximately twofold) of early cardiac, cerebrovascular, peripheral arterial disease, and cardiovascular mortality [64].

For women with a history of preeclampsia, yearly assessment of blood pressure, lipids, fasting blood glucose, and body mass index is suggested [4].

3. Previous Studies

1-Mineral levels in Women with Pre-Eclampsia in Third Trimester of pregnancy

1. Assistant Professor 3. Associate Professor, Department of Biochemistry 2. Associate Professor, Department of Obstetrics and Gynaecology, Motilal Nehru Medical College, Allahabad, U.P, India.

The mean serum K+levels were elevated in study group as compared to control group 4.95± 0.99 vs 4.38±0.80 mEq/L. Levels were significantly higher inpre-eclamptic group as compared to normotensive ($p< 0.0001$) mean serum Ca2+ levels were significantly lower in preeclamptic group as compared to normotensive group. The percentage decrease in study group in 7.52% ($p< 0.05$). Mean serum Na+ levels were almost same in both group. This difference was not statistically significant ($p<0.1$). Mean serum Mg2+ levels were slightly lower in preeclamptic group when compared to normotensive group levels and were statistically significant ($p<0.05$). The percentage decrease in preeclamptic group was 3.4%.

2- Levels of Serum Calcium and Magnesium in Pre-eclamptic and Normal Pregnancy:

A Study from Coastal India.

The present study enrolled 120 pregnant women. No significant the pre-eclamptic subjects and the healthy controls. There were no cases of maternal or fetal death or of maternal renal or hepatic insufficiencies.

The mean age of women with pre-eclampsiawas higher than normotensive controls. The systolic and diastolic blood pressure was significantly higher in cases compared to controls. The period of gestation was significantly higher in the normotensives compared to pre-eclamptics.

The serum calcium concentration was significantly lower in the pre-eclamptic cases compared to the normotensive controls , whereas the levels of serum magnesium showed a marginal difference in both the groups which was statistically not significant.

3- Serum calcium and magnesium levels in women presenting with pre-eclampsia and pregnancy-induced hypertension: a case–control study in the Cape Coast metropolis, Ghana.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were significantly raised in women with PIH . Women with hypertensive disorders (PE and PIH) had significantly lower serum calcium and magnesium levels than those in the control group. Of those with PIH, SBP correlated positively with BMI and Ca2+ correlated positively with Mg2+. This was similar amongst the PE group for SBP and BMI as well as for Ca2+and Mg2+ but was not significant. Multivariate analysis showed that women aged ≥40 years were at a significant risk of developing PIH .

4-Serum magnesium and calcium in preeclampsia: a comparative study at the Korle-Bu Teaching Hospital, Ghana

There was a statistically nonsignificant difference in serum magnesium and total calcium in preeclamptic women compared to normal pregnant women.

5- Serum total calcium, magnesium, sodium and potassium in Sudanese women with preeclampsia.

The mean age of the pre-eclamptic patients was 29.4 ± 5.2 years (range 19-40) , while in pre-eclamptic group under magnesium sulfate treatment with magnesium sulfate was 29.2±4.9 year, and in control group was 29.6±4.6 years with p value (0.89, 0,78 respectively).

In comparison with the controls, women with preeclampsia had significantly lower in means of serum total calcium, magnesium, and potassium, and increase in mean of serum sodium in women with preeclampsia compared to control group .

6- Serum Calcium, Magnesium, Zinc and Copper Levels in Sudanese Women with Preeclampsia

There was no significant difference between the two groups in their age, gestational age, parity and body mass index. Zinc and copper levels were not significantly

different between the two groups. In comparison with the controls, women with preeclampsia had a significantly lower median (inter-quartile) serum calcium and higher levels of magnesium]. In binary logistic regression, lower calcium and higher magnesium levels were associated with preeclampsia.

There were no significant correlations between levels of hemoglobin and these trace elements.

7- Comparison of Serum Calcium and Magnesium Between Pre-eclamptic and Normotensive Pregnant Nigerian Women in Abakaliki, Nigeria

Ugwuja EI, Famurewa AC1 , Ikaraoha CI

Department of Chemical Pathology, Faculty of Clinical Medicine, Ebonyi State University, 1 Department of Medical Biochemistry, Faculty of Basic Medical Sciences, Federal University Ndufu-Alike Ikwo, Abakaliki, Ebonyi, Nigeria

The mean age, gestational age, and BMI values for normotensive pregnant women and PW. The mean age 27.55 (4.23) for normotensive pregnant women was not significantly different (P = 0.08) from the mean age 29.45 (3.70) for PW. There were statistically significant differences between the weight, height, and BMI for normotensive pregnant women and PW.

Mean serum calcium 14.02 (5.68) for normotensive pregnant women was statistically comparable to the PW 13.99 (3.29). However, the magnesium level was significantly lower in pre-eclamptic pregnant women than in their normotensive counterparts .The mean PCV for normotensive and pre-eclamptic pregnant women showed no statistically significant difference.

Chapter three

Materials and Methods

3. Materials and methods

3.1. Study design

This is a hospital cross sectional study design based on venous blood samples of pregnant women in Shendi to measure serum levels of calcium, magnesium, sodium, and potassium in pre-eclamptic pregnancies compared to normal pregnancies.

3.2. Study area

The study was conducted at Shendi town in Sudan, during the period from March to July 2018. Shendi is a town in northern Sudan, situated on the east bank of the Nile 150 km northeast of Khartoum. Shendi is also about 45 km southwest of the ancient city of Meroe. Located in the River Nile state, Shendi is the centre of the Ja'aliin tribe and an important historic trading centre. Its principal suburb on the west bank is Al-Matamma. A major traditional trade route across the Bayuda desert connects Al-Matamma to Marawi and Napata, 250 km to the northwest.

3.3. Ethical considerations

Procedure of venous blood sampling was explained to the participants. All participants were informed about the research objectives and procedures during the interview period. A written valid consent was obtained from all participants.

3.4. Blood Sampling

5 ml of venous blood was collected from each participant. Serum was separated directly from the plain container by centrifugation at (300 rpm) for 5 minutes.

3.5. Study population

The study samples comprised 80 samples (50 pre-eclamptic women as cases and 30 healthy volunteers' pregnant women as control group). Both groups were duration of gestation matched. Those with diabetes mellitus, hypertension, Blood disorder, women that take medication may be affect the parameters under study were excluded. Permission of this study was obtained from to local authorities in

the area of the study. An informed consent was obtained from each participant in the study after explaining objectives of the study.

3.6. Inclusion Cineraria

Patients with an onset of hypertension more than 140/90 mmHg during the third trimester of pregnancy, Excretion of more than 300 mg of urinary Protein per 24 hrs, edema.

Control- pregnant women with normal Blood Pressure , absence of proteinuria and without any other systemic or endocrine disorder and age-matched with the cases. All subjects included were in their third trimester (gestational age of ≥24 weeks).

3.7. Exclusion criteria

Exclusion criteria Patients with congestive heart failure, Diabetes mellitus, kidney disease, thyroid and parathyroid disorders, cirrhosis of the liver , alcoholics and any other systemic disease were excluded from the study.

3.8. Data collection tools

The primary data will be collected by using questionnaire

3.9. Method

3.9.1.Materials

Sterile syringe.

Dettol.

Cotton.

Plain container.

5 ml of venous blood was collected from each participant. Serum was separated directly from the plain container bycentrifugation at (300 rpm) for 5 minutes. .three levels of control sera were run with every batch of the assays to ensure accuracy and quality assurance

Serum magnesium was assayed by the Xylidyl blue method

Principle of the method :

Magnesium in the sample react with xylidyl blue in alkaline medium forming acoloured complex that can be measured by spectrophotometry EGTA is included in the reagent to remove calcium interference .

Serum Calcium was assayed by Methyl thymol blue method.

Principle of the method

Calcium in the sample react with methylthymol blue in alkaline medium forming acoloured complex that can be measured by spectrophotometry . Hydroxyquinoline in the reagent to avoid magnesium interference.

Serum Sodium was assayed by selective chromogen

Principle of the method

The present method is based on reaction of sodium with aselective chromogen producing achromophore whose absorbance varies directly at the concentration of sodium in test .

Serum potassium was assayed by using sodium tetraphenylborn.

Principle of the method

The amount of potassium is determined by using sodium tetraphenylboron in a specifically prepared mixture to produce acolloidal suspension .The turbidity of which is proportional to the concentration of potassium in the range of 2-7 mEq/l.

Hemoglobin concentration was measured by cyanmethemoglobin method

Principle of the method

Hemoglobin reagent is based on cyanmethemoglobin method that has been adopted as a standard method . In this method , erythrocytes are lysed by astromalitic agent in the presence of a surfactant and release their hemoglobin in to solution .Hemoglobin is oxidized to methemoglobin by ferricyanide and methemoglobin by ferricyanide and the methemoglobin is converted to cyanmethemoglobin by

addition of KCN .the absorbance of cyanmethemoglobin is measured at 540 nm and colour intensity is prortional to hemoglobin concentration.

Urine albumin and glucose by using urinealysis strip.

Protein

The test is based on the protein-error-of-indicators principle. Anion on the specific PH indicator is absorbed by cation on protein molecule , which make the indicator ionize and present color change at critical point of color .

Glucose

The testis specific for glucose,no substance excreted in urine other than glucose is known to give appositive result . Indillute urine contain less than .28 mmol/l ascorbic acid ,as alittleas 2.2 mmol/l glucose may produce acolour change that might me interpreted as positive. Ascorbic acid concentrations of 2.8 mmol/l or grater and /or high acetoacetic concentrations (1.0 mmol/l) may influence test. Small amounts of glucose may normaiiy be excereted by the kidney . these amount are usually bellow the sensitivity of this test.

3.9.2 Data analysis

Data was analyzed using SPSS computer program, the mean and standard deviation were obtained and the independent 't.test' used for comparison (p value of ≤ 0.05) was considered significant.

Chapter four

Results

4. Results

Age:

Table(4-1) The Distribution of study group according to Age

The age	Frequency	Percent
(17-24) years	9	18%
(25-33) years	14	28%
(34-40) years	21	42%
More than 40 years	6	12%
Total	**50**	**100%**

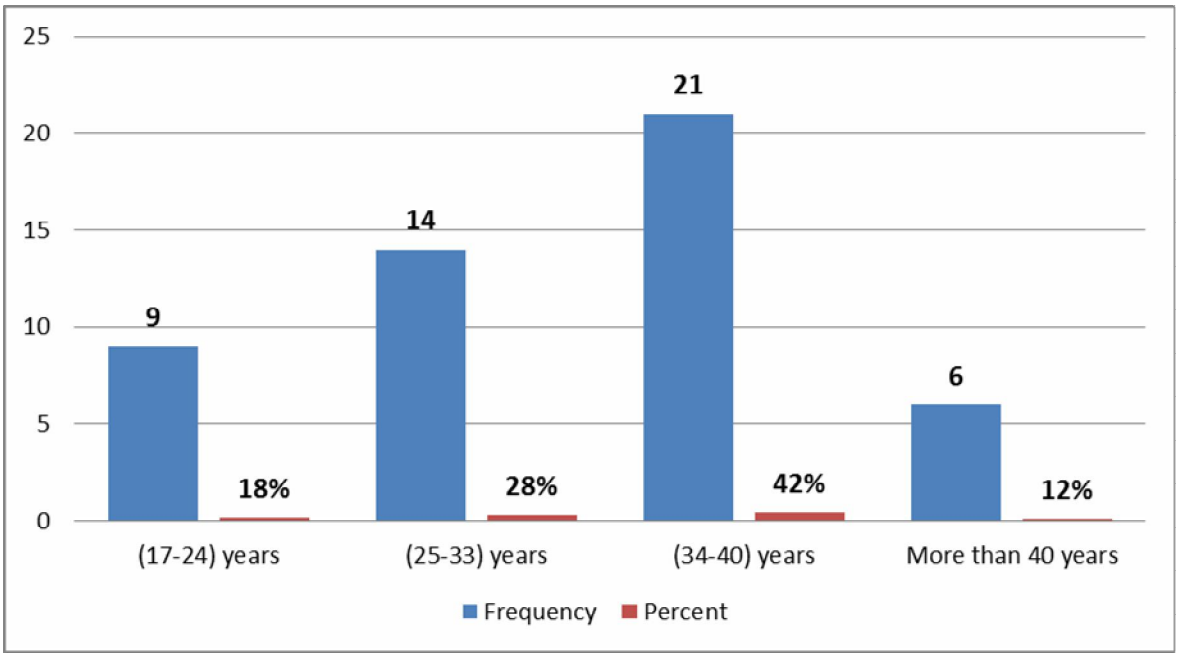

Figure (4-1) The frequency of study group according to Age

Table(4-2) Mean of Body mass index $^{(kg/m\ 2)}$ in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	26.5	0.02	Significant
Control	30	25.6		

Table (4-3) Mean of Gestational age $^{(week)}$ in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	32.7	0.913	Not Significant
Control	30	32.0		

Table (4-4) Mean of Number of pregnancy in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	1.88	0.696	Not Significant
Control	30	1.86		

Table (4-5) Mean of Systolic pressure (mmHg) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	151.2	0.02	Significant
Control	30	106.2		

Table (4-6) Mean of Distolic pressure (mmHg) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	102.6	0.40	Not Significant
Control	30	73.8		

Table(4-7)Mean of Albumin in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	2.8	0.00	Significant
Control	30	.00		

Table (4-8) Mean of Haemoglbin concentration (g/dl) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	11.5	0.03	Significant
Control	30	10.2		

Table (4-9) Mean of Calcium concentration (mg/dl) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	8.2	0.89	Not Significant
Control	30	9.0		

Table(4-10) mean of Magnesium concentration (mg/dl) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	1.3	0.02	Significant
Control	29	1.9		

Table(4-11) Mean of Sodium concentration (mmol/l) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	136.8	0.95	Not Significant
Control	30	136.8		

Table (4-12) Mean of Potassium concentration (mmol/l) in test and control:

Samples	Frequency	Mean	PV	The correlation
Test	50	3.94	0.00	Significant
control	30	4.11		

Chapter five

Discussion

Conclusion

Recommendations

5.1. Discussion

A cross sectional descriptive study was conducted in Shendi to measure minerals (Ca+2, Mg+2 , Na+ , K) level in women with preeclampsia, in period from April to July.

The result displayed in table 4.2 showed the mean of BMI in women with preeclampsia was 26.5 and control was 25.6 (P.value 0.02).this result showed that BMI increased in women with pre-eclampsia . this result was agreement with the finding reported by (hauger ,Gibbons ,Vik and belizan ,2008)

Also the mean of systolic pressure in women with preeclampsia was 151.2and control was 106.2 this results showed that systolic pressure was increased in women with pre-eclampsia (P.value 0.02). this result was agreement with the finding reported by(Redmon ,Beilin , Bonnar and Wilkinson 1976)

The result illustrated in table 4.7 revealed that albumin increased in pre-eclamptic women P.value (0.000).

Also table 4.8 showed the mean of Hb in women with preeclampsia was 11.5 g/dl and control was 10.2 g/dl.

The mean of Mg+2 in women with preeclampsia was 1.3 and control was 1.9 this results showed that preeclampsia decreased serum magnesium (P.value 0.02), this result was agreement with the finding reported by Mmohanned Abdala Elhassan Sidahmed ,Nuha Eljaily Abubaker and Gada Elfadil (sudan 2016)

The mean of K+ in women with preeclampsia was 3.94 and control was 4.11this results showed that preeclampsia decreased serum potassium (P.value 0.00), this result was agreement with the finding reported by Mmohanned Abdala Elhassan Sidahmed ,Nuha Eljaily Abubaker and Gada Elfadil (Sudan 2016)

Also result in table 4.11 showed no association between preeclampsia and Na+, P.value (0.95) this results were in agreement with the finding reported by Ebenezer Owusu Darwka (Ghana)

The mean of Ca+ level in women with preeclampsis was 8.1 and control was 9.2 this results showed that preeclampsia not effect on Ca+ (P.value 0.89), this result was agreement with the finding reported by Ugwuja El, famurewa AC ,IkaraohaCI (Nigeria 2013)

5.2 Conclusion

On the basis of these results the study it could be concluded that

- The most common age group women with pre-eclampsia was (34-40) years.

- All women with preeclampsia come in last few months of pregnancy (7,8,9) third trimester with high blood pressure and albumin in urine in spite of taking treatment of high blood pressure, and on their first pregnancy.

- Pre-eclampsia effect on minerals level, decreasing Mg^{+2} and K^{+} level.

-There is no association between pre-eclampsia and Na^{+} and Ca^{+2} level.

5.3 Recommendations

1- Using little or no added salt in meals.

2- Drinking 6-8 liters of water a day.

3- Exercise regularly.

4- Taking calcium supplement.

5- Getting plenty of fruits and veggies and that is low in salt.

6- Getting foods that are jam packed with magnesium during pregnancy such as green leafy, vegetables, nuts, seeds, fish ,beans and avocados.

Chapter Six

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Appendixes

1.6 References

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Appendix II

Medical laboratory faculty

Questionnaire about minerals (Ca+2,Mg+2,Na+,K+) level in women with preeclampsia

Name :----------

Age :----------

Residence :----------

Telephone :----------

Social data:

Level of education:

Primary ( ) secondary ( ) graduate ( ) post graduate ( )

Family income:

Less than 1000S.P ( ) 1000-2000 ( ) more than 2000 S.P ( )

Hypertensive: Yes ( ) No ( )

Diabetic: Yes ( ) No ( )

Number of pregnancy: ( )

Gestational age: ( )

Previous obestitric data: Yes ( ) No ( )

Befor pre-eclampsia: Yes ( ) No ( )

Pretermdelivery: Yes ( ) No ( )

Macrosoma: Yes ( ) No ( )

Mother data:

Weight :

High:

Body mass index:

Bloodpressure:

Protein urea:

Urine for sugar:

Haemoglobin:

Result:

Ca+2:

Mg+2:

Na+:

K+

Appendix II

إقــرار بالموافقــة

الاسم :----------

العمر :---------- العنوان :----------

أوافق بمحض إرادتي بالمشاركة في البحث العلمي المتعلق بدراسة معدل الأملاح (الكالسيوم – الماغنيزيوم – الصوديوم– البوتاسيوم) لدي الحوامل المصابة بتشنج الحمل.

الطالبة: نعمات عبد الحليم علي احمد

بعد أن شرح لي بأنه لا يترتب عليه أي أذى جسدي أو نفسي واعلم أن المشاركة في هذا البحث لن تؤثر بأي حال من الأحوال الصحية .

البحث بإشراف:

د. حاج حمد بله

التوقيع : ---------- التاريخ :----------