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Certification and Approval sheet

Title of the thesis

The Impact of Multivitamins on Hypertension Risk in Pregnant Women

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The Impact of Multivitamins on Hypertension Risk in Pregnant Women

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Lastly, I would like to thank my colleagues for accompanying me on this academic journey. Sharing this experience with them made the path more manageable and enjoyable.

Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation 1. HDP……...…… Hypertensive Disorders of Pregnancy

Abbreviation 2. GH ……...…...…. Gestational Hypertension

Abbreviation 3. PIH ……...……Pregnancy-Induced Hypertension

Abbreviation 4. BP ……..Blood pressure

Abbreviation 5. BMI ……...……Body Mass Index

The Impact of Multivitamins on Hypertension Risk in Pregnant Women

Abstract

Background: Globally, hypertensive disorders of pregnancy (HDP) are considered one of the main causes of maternal and fetal morbidity and mortality during pregnancy. Gestational hypertension (GH) is a category of the HDP, and consider the most prevalent, affecting 5–8% of women in excellent health. However, the effect of multivitamins on the risk of hypertension in pregnant women has not been thoroughly investigated in Libya. **Objectives:** The objective of this study is to explore how multivitamin use impacts the risk of gestational hypertension among pregnant women in Benghazi Libya. **Method:** A cross-sectional observational study was conducted among Pregnant women attending prenatal care at Benghazi hospitals and clinics from the end of November 2024 to April 2025. The total sample size was 135, and the data were collected by conducting face-to-face interviews using structured questionnaire. The data were entered and analysis with SPSS version 21. Those variables with a p-value less than 0.05 were considered statistically significant. **Results:** A total of 138 pregnant women attending prenatal care at Benghazi hospitals and clinics were approach to participate, only one participant (0.7%) reported not using any supplements. And 22 out of 135 women (16.3%) were diagnosed with gestational hypertension during their current pregnancy. However, no statistically significant relationship between multivitamin intake and hypertension was found (p value = 0.658). in contrast, when analyzing the frequency of multivitamin intake, a statistically significant association was found (p value = 0.012)**,** additionally, a longer duration of multivitamin use (more than 6 months) was associated with a reduced risk of gestational hypertension (p value = 0.013 Exp (B) = 0.214), suggesting a protective effect. **Conclusion:** the findings suggests that although general multivitamin use is not directly related to increased risk of gestational hypertension, the duration and frequency of prenatal multivitamin intake do have a significant impact on outcome. Additionally other factors such as family history and previous pregnancy history and hemoglobin level were found to influence the development of pregnancy induced hypertension. These findings highlight the need for a more comprehensive approach to antenatal care.

Keywords: Hypertensive disorders of pregnancy (HDP) **-** Gestational hypertension (GH) **–** multivitamin - pregnancy-induced hypertension (PIH).

Chapter – 1

Chapter 1

1. Introduction

1.1.Background

Globally, hypertensive disorders of pregnancy (HDP) are considered one of the main causes of maternal and fetal morbidity and mortality during pregnancy. [1] Approximately 5% to 10% of pregnancies worldwide are complicated by hypertensive pregnancy disorders. Gestational hypertension (GH) also referred to as pregnancy-induced hypertension (PIH) is a category of the HDP, and consider the most prevalent, affecting 5–8% of women in excellent health. [2] moreover, GH is a condition characterized by clinic maternal systolic blood pressure of 140 mm Hg or higher and/or diastolic blood pressure of 90 mm Hg or higher on two or more occasions separated by at least four hours. [3] In addition to the elevated blood pressure, the GH include the woman who had normal blood pressure before 20 weeks of pregnancy and no proteinuria (excess protein in the urine). [4]

Preeclampsia is the major complication of GH, a more sever condition that involves elevated blood pressure along with sings of damage to organs, most often the kidney and liver, it is recognized globally as the sixth leading cause of maternal death.[5] Other maternal complications related to PIH include HELLP syndrome (Low Platelet count, Hemolysis, Elevated Liver enzymes), cerebrovascular events including hemorrhagic stroke, placental abruption, pulmonary edema, liver injury, disseminated intravascular coagulation (DIC), and central nervous system dysfunction. fetal and neonatal complications include low birth weight, preterm delivery, intrauterine growth restriction (IUGR), and raised probability of stillbirth and neonatal death. moreover, PIH has been associated with long-term health consequences for both mother and child.

Females with a history of PIH are at higher risk of developing chronic hypertension, diabetes, cardiovascular diseases, and kidney disease in later years. similarly, children born from PIH complicated pregnancies may experience increased blood pressure, impaired cognitive function, and increased risk to metabolic disorders in adulthood. [6] The exact cause of GH remains unknown; however, several risk factors have been identified, including diabetes, age younger than 20 or older than 40, and multiple pregnancies (twins or triplets). [7]

Many pregnant women do not meet the recommended daily intake of micronutrients through dietary means [8]; however, adequate consumption of vitamins and minerals is crucial for both maternal and fetal health. Deficiencies in these vitamins or minerals can adversely affect the mother's health and potentially cause permanent damage to the fetus. [9]

Taking supplements is very common during the pregnancy, Cohort studies indicates that, the percentage of pregnant women taking multivitamins (excluding folic acid alone) range from 78% to 98% in countries such as the United States, Canda and Australia. [10] Among the most essential nutrients, folic acid, magnesium, and vitamin D play key roles in maintaining the health of both the mother and fetus during pregnancy. Folic acid, also known as vitamin B9, is especially important in the prevention of neural tube defects, such as spina bifida and anencephaly. It is strongly recommended that women take at least 400 mcg of folic acid daily before conception and throughout the first trimester of pregnancy to reduce the risk of these birth defects. [11] Furthermore, folic acid supplementation is necessary for women with epilepsy in order to minimize the teratogenic effects of anti-seizure drugs, which can disrupt the metabolism of folate. The risk of birth abnormalities linked to epilepsy medications is greatly reduced by maintaining proper folate levels. [12] Magnesium, another essential nutrient, plays an important role in maintaining normal blood pressure and nerve function during pregnancy. furthermore, Magnesium is involved in regulating various biochemical processes, including

muscle contraction and blood vessel function, both of which are essential during pregnancy to support healthy fetal development and prevent maternal complications. [13]

However, the effect of multivitamins on the risk of hypertension in pregnant women has not been thoroughly investigated in Libya. While global research on the topic has yielded mixed findings, with some studies suggested a negative impact of multivitamin use on hypertension risk during pregnancy and others finding no such association. Thus, the current study aims to assess the impact of multivitamins on hypertension risk among pregnant women.

1.2. Literature review

1.2.1. The association between Multivitamins and gestational hypertension/ pregnancy-induced hypertension.

Fogacci S, (2020) A meta-analysis of 13 cohort studies and one randomized clinical trial, totaling 309882 pregnant women, revealed that taking multivitamins containing folic acid during pregnancy was not linked to the risk of gestational hypertension. Conclusion shows that calcium, vitamin D, resveratrol, and sodium/potassium are the nutraceuticals currently encountering greater evidence in the treatment and prevention of hypertensive disorders during gestation, while treatment with folic acid, zinc, and melatonin is only supported by preliminary data. [14]

In contrast, Chen S. (2019), A Chinese study performed a secondary data analysis, using data from a double-blind randomized controlled trial that was conducted from 2006 to 2009 to examine the effects of multiple micronutrient supplements on adverse pregnancy outcomes when given to pregnant women with no or mild anemia. According to the findings, the incidence of pregnancy-induced hypertension was 7.1% (423/5923), 6.3% (374/5933), and 6.3% (372/5914) for pregnant women who took folic acid alone, iron-folic acid and multiple micronutrient supplements, respectively. Finally, it was found that, in comparison to folic acid

supplements alone, iron-containing multiple micronutrient supplementation was linked to a lower risk of pregnancy-induced hypertension in pregnant women aged 20 to 24. [15]

However, Brown B, (2020), a narrative review published by oxford university with the aim of evaluating the Safety and efficacy of supplements in pregnancy. The review findings summarize that calcium supplementation strongly recommended to the pregnant to reduce the blood pressure, also the magnesium playing a role in hypertension during pregnancy, in the other hand the vitamin d is associated higher risk of hypertension in pregnancy, finally mentioned the omega 3s role in regulating the blood pressure. [10]

On the other hand, Shim et al. (2016) a meta-analysis conducted in Korea to evaluate the impact of folic acid and multivitamin use during pregnancy on the risk of developing of hypertensive disorder of pregnancy. To independently reviewers collect different studies design from Scopus and difference databases including data from six trails involving 201,661 participants, the meta-analysis findings shows that multivitamin containing folic acid or folic acid alone was not significantly effective in reducing gestational hypertension or preeclampsia incidence. [17]

1.2.2. The association between folic acid and gestational hypertension/ pregnancy-induced hypertension.

Qian Li, (2020) prospective cohort in China, with the aim of investigation whether FA supplement use is associate with GH and preeclampsia, a total of 4853 participants has been collected with detailed data on periconceptional folic acid use and the diagnosis of GH or preeclampsia, pregnant women were recruited within 16 weeks of gestation at their first prenatal visits and followed up regularly. The funding shows that among the study participant, 1161 developed GH while 161 were diagnosed with preeclampsia. The higher risk of GH demonstrated in the women who consume High-dose (≥800 μg/d) FA supplement use from pre

pregnancy through mid-pregnancy. And the findings suggest that high-dose FA supplement use for long duration should be avoided for general women planning or capable of pregnancy. [18]

Although, Maria P.G, (2018) a study assessed the effects of duration and timing of folic acid containing supplement use on the risk for hypertension disorder in pregnancy (GH and preeclampsia), the data were collected from 3247 women participating in the MotherToBaby cohort studies across the United States and Canada. The findings shows that Preeclampsia and gestational hypertension were not substantially correlated with either an early or late supplementation initiation. However, longer periods of folic acid-containing supplement use were associated with a significant decrease in the likelihood of developing these conditions. [19]

Furthermore, Asres, A.W., (2021) a case control study conducted in public hospitals in the Wolaita Sodo zone, Ethiopia with the aim of determine the association between iron-folic acid supplementation and pregnancy-induced hypertension (PIH). A total of 492 pregnant included in the study of which 164 were cases and 328 were controls. The findings of the study summarize that There is no significant association between iron-folic acid supplementation and PIH, while the pregnant women with high hemoglobin levels had higher odds of PIH as compared to those without it. [20]

On the other hand, Zhiwen Li, (2013) a cohort study in China conducted with the aim of examination whether maternal supplementation with folic acid alone during early pregnancy can prevent the occurrence of gestational hypertension and preeclampsia. Among the 193 554 women (47.9% took folic acid, 52.1% did not), the findings show that the incidence of gestational hypertension and preeclampsia was 9.7% and 2.5% respectively for women who took folic acid, and 9.4% and 2.4% respectively for women who did not use it. [21]

However, Cheng Liu, (2018) a meta-analysis study collects 13 cohort studies and one randomized controlled study with the aim of assess the relationship between folic acid

supplementation in pregnancy and risk of preeclampsia and gestational hypertension. Among the total of 160,562 women with folic acid supplementation and 149,320 women without folic acid supplementation during pregnancy, the results shows that there is no association between the supplementation of folic acid and gestational hypertension. [22]

1.2.3. The association between vitamin D supplementation and gestational hypertension/ pregnancy-induced hypertension.

Subramanian A, (2021) A randomized control trail study in Bangladesh with the aim of examination the dose dependent vitamin D supplementation impact on pregnancy blood pressure from mid-to-late gestation. A total of 1298 healthy woman enrolled at 17 -24 weeks gestation. The pregnant were randomized to in receive one of four doses: placebo, 4,200IU/ weeks 16,800 IU/week or 28,00 IU/week. Blood pressure measurements were taken at enrollment and subsequently at 24 weeks 30 weeks and weekly from weeks until delivery. The findings showed that vitamin D supplementation did not significantly affect systolic blood pressure of diastolic blood pressure at 24 or 30 weeks of gestation. however, by 36 weeks the highest dose (28,000 IU/ week) was associated with slightly higher BP compared to the placebo group, the change was not statistically significant ($p > 0.10$). the study concluded that vitamin D supplementation starting in mid-pregnancy did not reduce maternal blood pressure and only marginally increased it at the highest dose in late pregnancy. finally, these study finding does not support the use of vitamin D to manage or lower the blood pressure during pregnancy. [23]

1.2.4. The association between Calcium supplementation and gestational hypertension/ pregnancy-induced hypertension.

Gomez F. et al. (2024) carried out a study on calcium supplementation for the prevention of hypertensive disorders in pregnancy, particularly in the population with low dietary calcium intake. The study examined the impact of calcium supplementation in gestational hypertension

and preeclampsia. The world health organization (WHO) recommends calcium supplementation of 1.5-2g/day, but recent findings suggest that even 500mg /day may be effective in reducing the risk of hypertensive disorders. The study highlighted that inadequate calcium intake is associated with vascular dysfunction and increased risk of gestational hypertension and preeclampsia. Findings indicated that calcium supplementation improved maternal vascular adaptation, reducing the likelihood of hypertension related complications. The study concluded that calcium supplantation is a cost-effective intervention for reducing hypertensive disorders in pregnancy, particularly in low- and middle-income countries where calcium intake is often insufficient. [24]

However, a narrative review published by the American Society for Clinical Nutrition, analyzed the correlation between dietary calcium intake and pregnancy induced hypertension (PIH), including gestational hypertension and preeclampsia. Epidemiological studies indicate that low calcium intake is related to an increased risk of PIH, potentially due to calcium's role in vascular smooth muscle relaxation and blood pressure regulation.

The study reviewed meta-analyses and clinical trials on calcium supplementation during pregnancy. A number of results indicated that calcium supplementation (1000–2000 mg/day) contributes to blood pressure reduction, especially in women consuming insufficient dietary calcium. On the other hand, large-scale studies such as the Calcium for Preeclampsia Prevention (CPEP) trial showed no considerable decrease in PIH risk among women with sufficient dietary calcium (~1100 mg/day). Meta-analyses recommend that supplementation is most beneficial for high-risk groups and those with insufficient dietary calcium.

Furthermore, biochemical studies demonstrated that gestating women with PIH show altered calcium metabolism, including reduced calcium levels in blood cells, which may play a role in vascular dysfunction and increased blood pressure. Nevertheless, these findings, the study

summarized that calcium supplementation is beneficial primarily for women with low calcium intake but may not be effective in preventing PIH. [25]

Chapter – 2

Chapter 2

2. Aim of study

The objective of this study is to explore how multivitamin use is associated with the risk of gestational hypertension among pregnant women in Benghazi Libya.

Chapter - 3

Chapter 3

3. Chapter 3 – Methodology

3.1.Study design.

It is a cross-sectional observational study to investigate the multivitamin intake and developing hypertension among pregnant women. Cross-sectional design was chosen as the study design to evaluate the exposure (multivitamin intake) and the outcome (gestational hypertension) simultaneously at one-point time. This study design was chosen because it is commonly used to answer epidemiological questions to determine the relationship between potential risk factors and health issues in a defined population.

3.2.Study setting.

The study was conducted at Benghazi Hospitals and clinics, which a healthcare center that provides prenatal services for pregnant mothers. The study population was from the outpatient pregnant women visiting the clinic for their prenatal regular visit. Data collection was carried out in the clinics through patient interviews, which helped to collect the related clinical and demographic details.

3.3. Study population.

The target population for this study included Pregnant women attending prenatal care at Benghazi hospitals and clinics from the end of November 2024 to April 2025

3.3.1. Inclusion Criteria.

Participants were eligible for inclusion if they met the following criteria:

- Pregnant women aged between 16 and 45 years.
- Women who are pregnant from the sixth month onward until the time of delivery, or those who have just given birth.
- Willingness to participate

3.3.2. Exclusion Criteria

The following participants were excluded:

- Women with a documented diagnosis of preeclampsia, essential hypertension, or chronic hypertension before pregnancy.
- Women with chronic conditions that could influence blood pressure, such as diabetes mellitus, kidney disease, or cardiovascular disorders.
- Women with severe pregnancy complications that could affect the study outcome unrelated to hypertension (e.g. uncontrolled gestational diabetes).

3.4. Sample Size Determination

The sample size for this study was determined using an online sample size calculator. The calculation was based on the following parameters:

- **Confidence level:** 95% (Z = 1.96)
- **Population Proportion:** 10%
- **Margin of error:** 5%
- **Population size:** 3,144 (based on hospital statistics for the number of cases attending the obstetrics and gynecology clinic)

3.5.Data collection procedures

The data collection was done by conducting a face-to-face interview with the pregnant mothers who attended the antenatal clinics in Benghazi. A structured questionnaire using Google forms was made to help the interviewer collect the standardize data. A pilot study has been done with seven pregnant women to check the clarity and reliability of the questionnaire before carrying out the full data collection.

3.5.1. Variables Collected

The questionnaire covered the following key variables:

- **Demographic Data:** Age, gestational age.
- **Pregnancy History:** Number of previous pregnancies, history of gestational hypertension or preeclampsia.
- **Lifestyle Factors:** physical activity, dietary habits
- **Multivitamin Use:**
    - Type of multivitamin used.
    - Duration of multivitamin use during pregnancy.
- **Hypertension Status:**
    - Blood pressure readings recorded during antenatal visits.

3.6. Data Management and Quality Control

To ensure data accuracy and reliability, the following measures were implemented:

- **Face to Face Interviews:** The researcher conducted direct interviews with participants to ensure complete and accurate responses.
- **Confidentiality Measures:** Participants responses were recorded electronically using Google Forms and anonymized for privacy.

- **Pilot Testing:** The questionnaire was pre tested on 7 pregnant women to refine the questions and improve clarity.

3.7. Data Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21. The following statistical tests were applied:

1. **Descriptive Analysis:**
    - Frequencies and percentages for categorical variables.
2. **Bivariate Analysis:**
    - **Chi-square test** (χ^2) was used to examine associations between categorical variables.
3. **Multivariate Analysis:**
    - **Binary logistic regression** was performed to determine the odds ratio (OR) for developing hypertension among multivitamin users versus non-users.
    - A **p-value <0.05** was considered statistically significant.

3.8. Ethical Considerations

This study was conducted in full compliance with ethical principles and guidelines outlined by the **Libyan International Medical University's Research Ethics Committee** and in accordance with the **Helsinki Declaration**.

- **Ethical Approval:** Prior to data collection, ethical clearance was obtained from the university's Research Ethics Committee (Certificate Reference No.: **MCP-2024-00255**, Project No.: **MHS-14-D-00298**).

- **Informed Consent:** Participants were fully informed about the study's purpose, methodology, potential risks, and their right to withdraw at any stage. Verbal consent was obtained before participation.
- **Confidentiality & Data Protection:**
    - No personally identifiable information was collected.
    - Data was anonymized and securely stored, accessible only to the principal investigator.
    - All records were handled in compliance with institutional data protection policies.
- **Compliance & Monitoring:**
    - The research adhered strictly to the approved protocol.

Chapter – 4

Chapter 4

4. Results

This chapter presents the findings of the study conducted from late November to April. A total of 138 pregnant women attending prenatal care at Benghazi hospitals and clinics were approach to participate, however, three declined because of pregnancy related fatigue during the later months. Therefore, the final sample size consists of 135 participants, with the response rate of 97.8%.

4.1. General overview of study variables

4.1.1. Demographic characteristics

The demographic characteristics of the study participants are summarized in Table (1). The distribution of participants in terms of age, the largest age group was 31–35 years 45 participants (33.3%), followed by 26–30 years 35 participants (25.9%). Regarding Employment status was almost evenly distributed, with 75 (55.6%) of participants being unemployed and 60 (44.4%) employed at the time of the study. According to the stage of pregnancy, the highest proportion of participants were in the 9th month 64 (34.1%), followed by the 8th month 40 (29.6%), while 10 (7.4%) had just delivered. As for reproductive history, the number of pregnancies varied among participants. approximately one-fourth 60 participants (24.4%) had experienced five or more pregnancies, 28 participants (20.7%) reported four pregnancies, 24 participants (17.8%) had three, 20 participants (14.8%) had two, and 30 participants (22.2%) were in their first pregnancy. Concerning complications in previous pregnancies, 93 (68.9%) of participants indicated they had no complications, while 30 (22.2%) were first time pregnancy. lastly, a notable proportion 79 (58.5%) of participants reported a family history of hypertension.

4.1.2. Maternal multivitamin use

Multivitamin supplementation during pregnancy was a common practice among the study participants, with 134 out of 135 women (99.3%) indicating that they had used prenatal multivitamins. while only one participant (0.7%) reported not using any supplements. Regarding usage frequency, the majority show that participants adhered to a once-daily intake regimen with 100 participants (74.1%). At the same time, 13 (9.6%) reported irregular intake, as shown in figure 1. In terms of duration of Multivitamin supplement use, 98 participants (72.6%) reported using prenatal vitamins for more than six months, and 34 (25.2%) for three to six months, as shown in figure 2. About the timing, 100 participants (74.1%) began using supplements during the first trimester, 21 (15.6%) during the second trimester, and 13 (9.6%) before conception.

Table 1 demographic characteristics of pregnant participants.

		Frequency	**Percent%**
Age Group	18-25	25	18.5%
	26-30	35	25.9%
	31-35	45	33.3%
	36-40	22	16.3%
	Above40	8	5.9%
Employment status	Employed	60	44.4%
	Unemployed	75	55.6%
Current Pregnancy month	Just delivered	10	7.4%
	6th	14	10.4%
	7th	25	18.5%

	8th	40	29.6%
	9th	46	34.1%
Number of Pregnancies	1	30	22.2%
	2	20	14.8%
	3	24	17.8%
	4	28	20.7%
	5_or_more	33	24.4%
Complications in Previous Pregnancies	Yes	12	8.9
	No	93	68.9
	First time pregnancy	30	22.2
Family History of Hypertension	Yes	79	58.5
	No	56	41.5

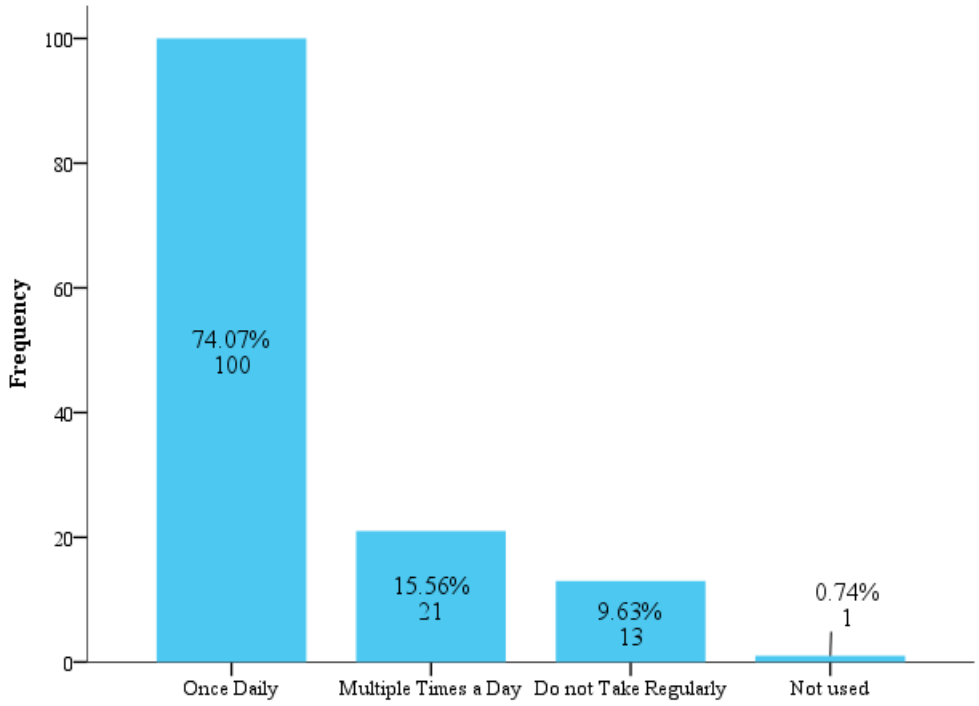

Figure 1 frequency of multivitamin supplement use

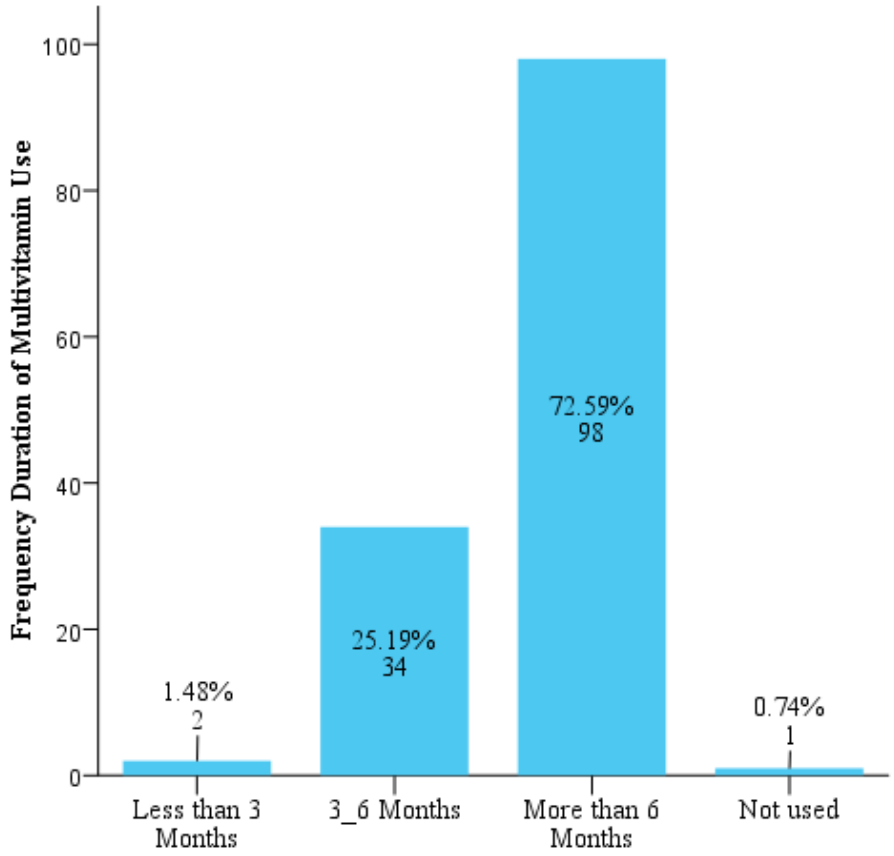

Figure 2 duration of multivitamin use

Out of the 135 pregnant women surveyed, the most commonly used prenatal multivitamin was the combination of prenatal multivitamin plus Omega-3 along with folic acid, which was used by 33 (24.4%) participants. It is important to note that folic acid was commonly prescribed for a duration of three months to the majority of participants. However, this was subsequently by the standalone prenatal multivitamin plus Omega-3 product, used by 21(15.6%) participants in addition to the original prenatal multivitamin without Omega-3 was also used among 21 (15.6%) participants as shown in figure3. Lastly, a group of 10 (7.4%) pregnant women used a combination of folic acid, vitamin D, vitamin B12, and Omega-3. Another group of 9 (6.7%) participants utilized a prenatal multivitamin with Omega-3, folic acid, iron, and vitamin D.

4.1.3. Dietary habits and lifestyle during pregnancy

A significant majority of participants 98 out of 135 (72.6%) reported good physical activity during pregnancy as shown in figure 4. When participants asked about their consumption of caffeinated beverages, 48 participants (35.6%) reported complete avoidance of such drinks. On the other hand, 43 participants (31.9%) consumed caffeinated beverages daily, while 44 (32.6%) consumed them a few times per week. Diet during pregnancy demonstrated that the majority (118 out of 135; 87.4%) followed a predominantly high-carbohydrate diet as shown in figure 5. Only 10 participants (7.4%) reported maintaining a balanced diet that included appropriate proportions of carbohydrates, proteins, and fats. When asked about specific foods or drinks avoided during pregnancy, the majority of participants 123 (91.1%) stated that they did not actively avoid any particular food items as shown in figure 6.

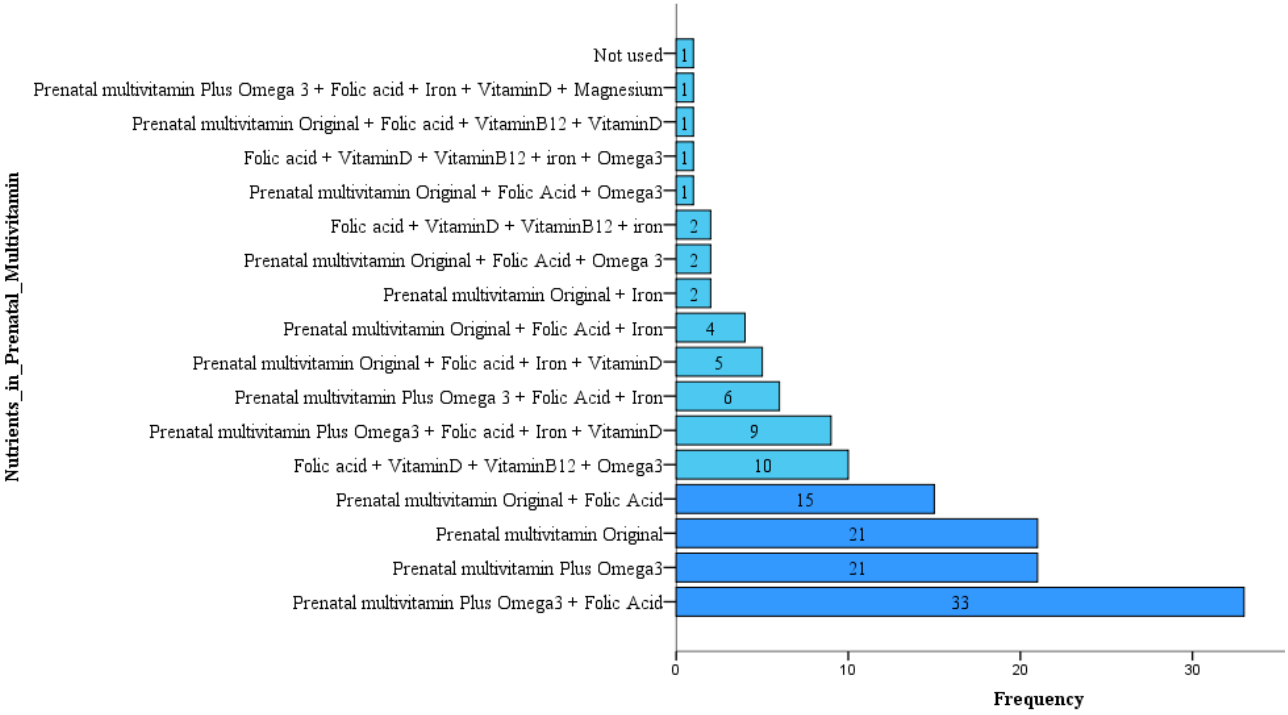

Figure 3 illustrates the frequency distribution of different nutrient combinations of multivitamin supplements used by pregnant women.

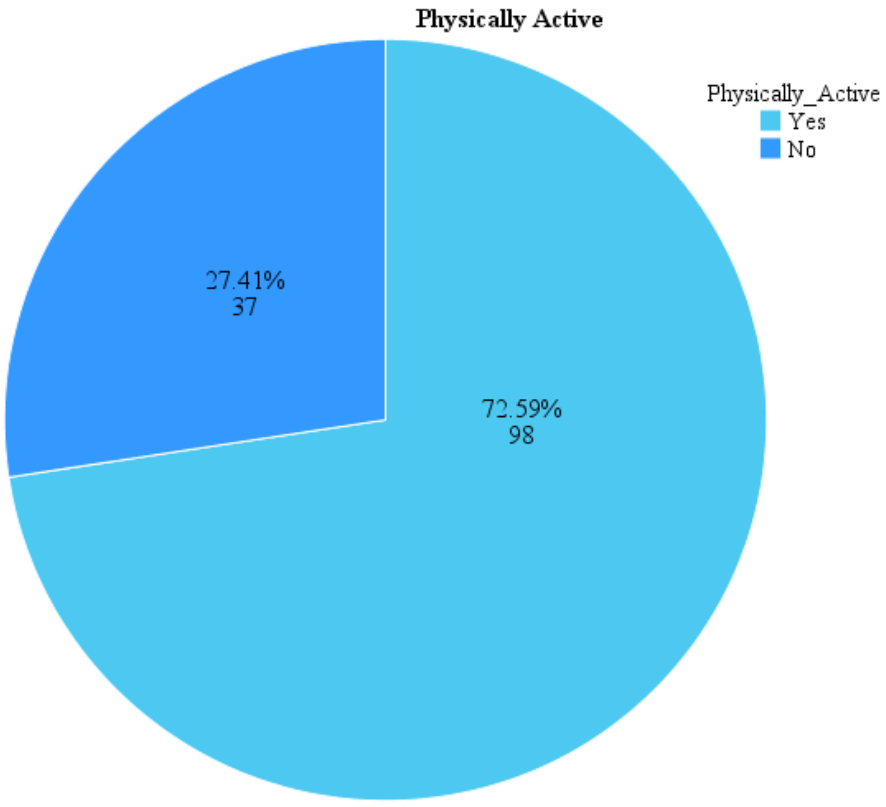

Figure 4 shows distribution of physical activity among participants

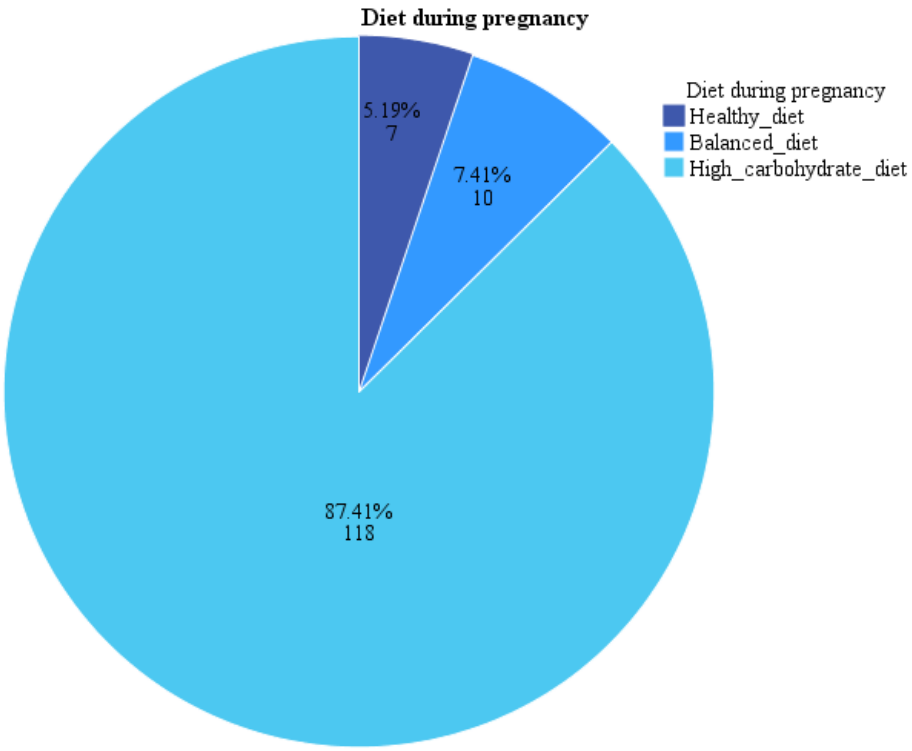

Figure 5 shows distribution of participants diet during pregnancy

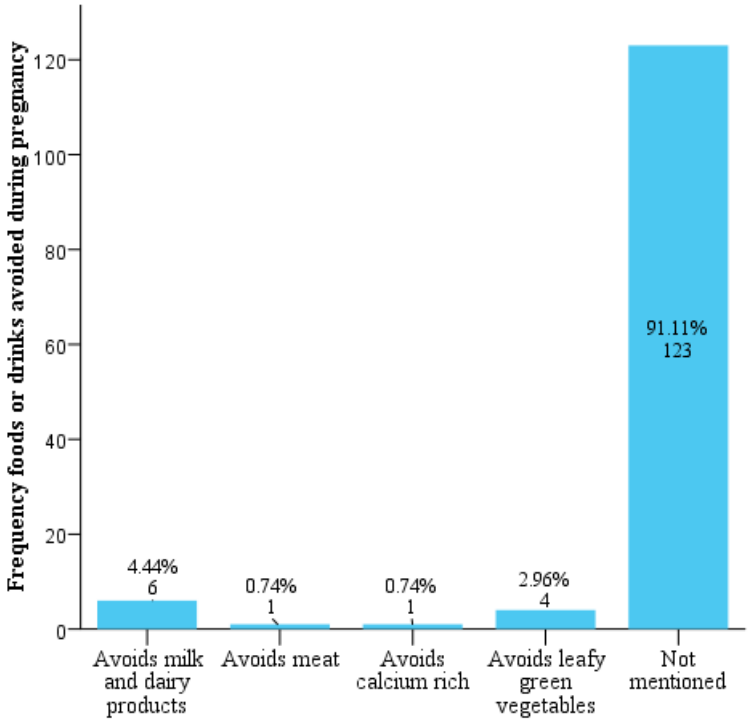

Figure 6 shows distribution of participants foods or drinks avoided during pregnancy.

4.1.4. Gestational hypertension and health

Among the participants, 22 out of 135 women (16.3%) were diagnosed with gestational hypertension during their current pregnancy. And 19 out of 22 participants (14.1%) reported using antihypertensive medication as part of their management plan. while the other not use or manage through non-pharmacologic approaches.

Each participant reported her blood pressure status during the month of pregnancy in which she completed the questionnaire. In the 6th month, 14 (10.4%) participants were assessed: 10 (71.4%) had normal blood pressure, and 3 (21.4%) had gestational hypertension, as shown in Table 2. In the 7th month, 2 (8%) out of 25 participants had gestational hypertension. For the 8th month, 39 participants were assessed: 6 (15.4%) were pre-hypertensive, and 3(7.7%) had gestational hypertension. lastly in the 9th month, 57 participants were assessed: 55 (96%) had normal blood pressure, and only 1 (1.8%) had gestational hypertension.

Table 2 represents distribution of blood pressure readings categories across gestational stages.

		Frequency	Percent%
6^{th} month	Normal Bp 120_80mmHg	10	71.4%
	Gestational hypertension 140_90mmHg	3	21.4%
	Sever hypertension more than 140_90mmHg	1	7.1%
7^{th} month	Normal Bp 120_80mmHg	21	84.0%
	Pre hypertension 130_80mmHg	1	4.0%
	Gestational hypertension 140_90mmHg	2	8.0%
	Sever hypertension more than 140_90mmHg	1	4.0%
8^{th} month	Normal Bp 120_80mmHg	29	74.4%

	Pre hypertension 130_80mmHg	6	15.4%
	Gestational hypertension 140_90mmHg	3	7.7%
	Sever hypertension more than 140_90mmHg	1	2.6%
9th month	Normal Bp 120_80mmHg	55	96.5%
	Pre hypertension 130_80mmHg	1	1.8%
	Gestational hypertension 140_90mmHg	1	1.8%

Lastly, hemoglobin levels were assessed to evaluate maternal nutritional and hematological status. the majority of participants (102 women, 75.6%) had hemoglobin levels within the normal range, indicating no signs of anemia. However, a group showed varying degrees of anemia as shown in figure 7.

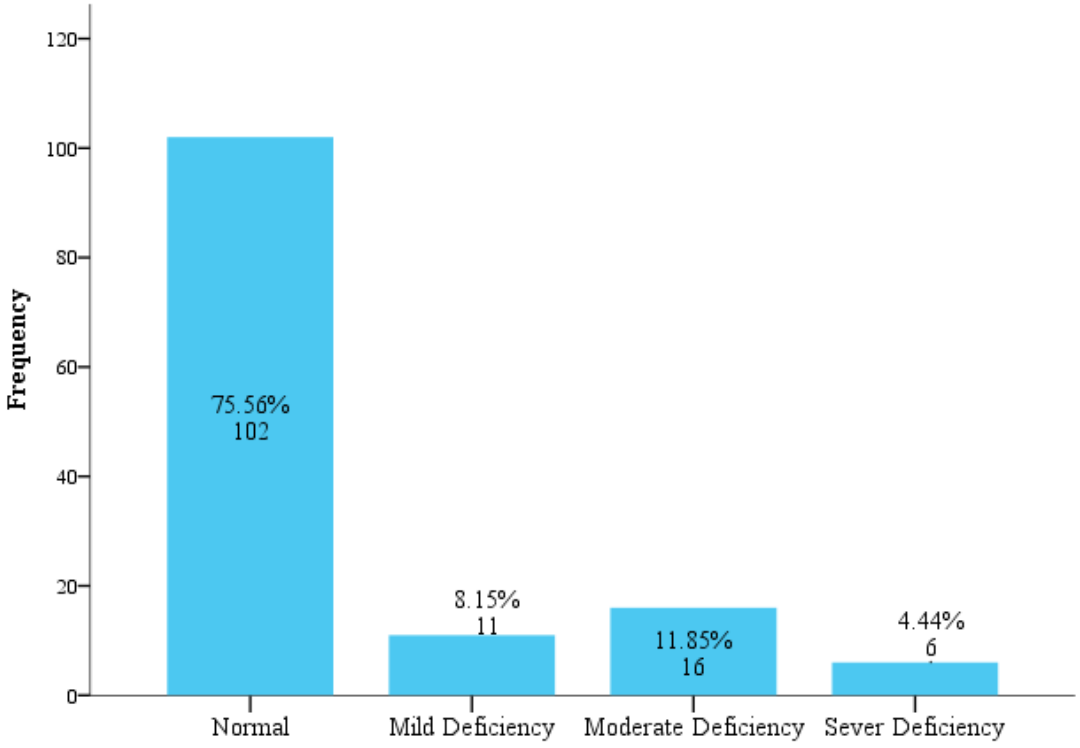

Figure 7 shows distribution of participants hemoglobin level.

4.2. Statistical Analysis of Associations

4.2.1. Association between multivitamin use and gestational hypertension.

A Pearson Chi-square test was used to examine whether general multivitamin use was associated with a diagnosis of hypertension during pregnancy. The results revealed no statistically significant relationship between overall multivitamin intake and hypertension (p value = 0.658). However, when analyzing the frequency of multivitamin intake, a statistically significant association was found (p value = 0.012) as shown in table 3. moreover, the association between multivitamin use and maternal blood pressure was further explored in table 4, which displays the results of chi-square tests assessing the association between the frequency of multivitamin intake and blood pressure readings during the 7^{th} and 9^{th} months of pregnancy. The findings revealed statistically significant association at both stages. These results further support the potential effect of multivitamin supplementation frequency on blood pressure regulation especially during the later months of pregnancy.

4.2.2. Association between having family history with hypertension and gestational hypertension.

A strong and statistically significant association as shown in table 5 was identified between having a family history of hypertension and being diagnosed with gestational hypertension (p value = 0.015).

4.2.3. Association between dietary habits and participants blood pressure status.

Several significant relationships were found between participants reported dietary patterns and their blood pressure readings at various stages of pregnancy. Interestingly, in the 6^{th} month of gestation, diet was significantly associated with blood pressure states with (p value = 0.001). moreover, in the 8^{th} and 9^{th} month of gestation, diet was significantly associated with blood pressure status with (p value = 0.003 and = 0.001) respectively.

Table 3 Chi-Square tests of the association between the diagnosis of gestational Hypertension and the other important variables.

The association between the diagnosis of gestational Hypertension and the:		Value	df	Asymp. Sig.(2-sided)
Multivitamin use	Pearson Chi-Square	.196	1	.658
Frequency of Multivitamin Use	Pearson Chi-Square	10.862	3	.012

Table 4 Chi-Square tests of the association between the frequency of multivitamin use and the blood pressure readings at various stages of pregnancy.

frequency of multivitamin use with the:		Value	df	Asymp. Sig.(2-sided)
7th month blood pressure reading	Pearson Chi-Square	15.010	6	.020
9th month blood pressure reading	Pearson Chi-Square	13.680	4	.008

Table 5 chi-square tests of the association between gestational hypertension and having family history of hypertension.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.878[a]	1	.015
Continuity Correction[b]	4.787	1	.029
Likelihood Ratio	6.416	1	.011
Fisher's Exact Test			
Linear-by-Linear Association	5.834	1	.016
N of Valid Cases	135		

Table 6 Chi-Square test Results for the Association Between dietary habits during pregnancy and blood pressure status.

The association between the dietary habits and the:		Value	df	Asymp. Sig.(2-sided)
6th month blood pressure reading	Pearson Chi-Square	14.000	2	.001
8th month blood pressure reading	Pearson Chi-Square	13.666	3	.003
9th month blood pressure reading	Pearson Chi-Square	18.411	4	.001

Additionally, regarding the association between blood pressure status in the ninth month of pregnancy and the dietary avoidance or restrictions during pregnancy, (As shown in table 7) the Chi-square analysis results indicate a highly significant association with p value (= 0.000).

Table 7 chi-square test analysis results for the association between blood pressure status in the ninth month of pregnancy and the dietary avoidance or restrictions during pregnancy

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.102[a]	8	.000
Likelihood Ratio	10.257	8	.247
Linear-by-Linear Association	.204	1	.652
N of Valid Cases	57		

4.2.4. Association between blood pressure status and hemoglobin levels during pregnancy.

The Pearson chi-square test confirmed a statistically significant association between hemoglobin levels and blood pressure readings in the eighth month with p value = 0.018 (as shown in table 8).

Table 8 chi-square test analysis results for the association between eighth month blood pressure status and hemoglobin levels during pregnancy.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.023[a]	9	.018
Likelihood Ratio	13.163	9	.155
Linear-by-Linear Association	1.935	1	.164
N of Valid Cases	39		

4.2.5. Association between blood pressure monitoring in the sixth month and number of pregnancies

When examining the association between the number of pregnancies and blood pressure status during the sixth month of pregnancy. The results show that among women with three pregnancies as shown in table 9, all six participants (100%) recorded normal blood pressure. While for those with four pregnancies, four participants 66.7% had normal blood pressure, and two participants 33.3% experienced gestational hypertension. Lastly, in women with five or more pregnancies, only one participant 50% experienced gestational hypertension, and one participant 50% had severe hypertension, with no cases of normal blood pressure recorded in

this group. As it shown in table 10 the Chi-square test results show a statistically significant association between the number of pregnancies and blood pressure categories in the sixth month with p value = 0.032, indicating that blood pressure levels during the sixth month of pregnancy varied significantly depending on pregnancy count.

Table 9 crosstab of blood pressure status in the sixth month and number of pregnancies.

Blood Pressure Monitoring 6th_month		Number of Pregnancies			Total
		3	4	5_or_more	
Normal Bp 120- 80mmHg	Count	6	4	0	10
	% within Blood Pressure Monitoring 6th month	60.0%	40.0%	0.0%	100.0%
	% within Number of Pregnancies	100.0 %	66.7%	0.0%	71.4%
Gestational hypertension 140_90mmHg	Count	0	2	1	3
	% within Blood Pressure Monitoring 6th month	0.0%	66.7%	33.3%	100.0%
	% within Number of Pregnancies	0.0%	33.3%	50.0%	21.4%
Sever hypertension more than 140_90mmHg	Count	0	0	1	1

	% within Blood Pressure Monitoring 6th month	0.0%	0.0%	100.0%	100.0%
	% within Number of Pregnancies	0.0%	0.0%	50.0%	7.1%
Total	Count	6	6	2	14
	% within Blood Pressure Monitoring 6th month	42.9%	42.9%	14.3%	100.0%
	% within Number of Pregnancies	100.0 %	100.0 %	100.0%	100.0%

4.2.6. The association between blood pressure status in both the sixth and ninth month of pregnancy with previous pregnancy complications

The assessment of how a history of complications in previous pregnancies correlates with blood pressure outcomes in the sixth month of the current pregnancy clear in table 11. in which all women with normal blood pressure had no history of complications. Conversely, two out of three women who had gestational hypertension had faced complications in previous pregnancies. additionally, a solitary case of sever hypertension was identified, and it was among those without prior complications. However, the distribution of blood pressure categories in the ninth month across groups with different histories of pregnancy complications clear in table 12. reveled that only a one case exhibited pre-hypertension, primarily among

those with prior complications. The Chi-square test showed a statistically significant relationship between previous complications and both the sixth- and ninth-month blood pressure status with p value = (0.014), and p value (0.000) respectively (as shown in table 13).

Table 10 chi-square test analysis results for the association between blood pressure status in the sixth month of pregnancy and number of pregnancies

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.578[a]	4	.032
Likelihood Ratio	10.839	4	.028
Linear-by-Linear Association	7.143	1	.008
N of Valid Cases	14		

Table 11 crosstab of blood pressure status in the sixth month and complications in previous pregnancies

Blood Pressure Monitoring 6th month		Complications in Previous Pregnancies		Total
		Yes	No	
Normal Bp 120- 80mmHg	Count	0	10	10
	% within Blood Pressure Monitoring 6th month	0.0%	100.0%	100.0%
	% within Complications in Previous Pregnancies	0.0%	83.3%	71.4%
Gestational hypertension 140_90mmHg	Count	2	1	3
	% within Blood Pressure Monitoring 6th month	66.7%	33.3%	100.0%
	% within Complications in Previous Pregnancies	100.0%	8.3%	21.4%
Sever hypertension more than 140_90mmHg	Count	0	1	1
	% within Blood Pressure Monitoring 6th month	0.0%	100.0%	100.0%
	% within Complications in Previous Pregnancies	0.0%	8.3%	7.1%
Total	Count	2	12	14
	% within Blood Pressure Monitoring 6th month	14.3%	85.7%	100.0%
	% within Complications in Previous Pregnancies	100.0%	100.0%	100.0%

Table 12 crosstab of blood pressure status in the ninth month and complications in previous pregnancies

Blood Pressure Monitoring 9th month		Complications in Previous Pregnancies			Total
		Yes	No	Not applicable -first pregnancy	
Normal Bp 120- 80mmHg	Count	2	39	14	55
	% within Blood Pressure Monitoring 9th month	3.6%	70.9%	25.5%	100.0 %
	% within Complications in Previous Pregnancies	66.7%	100.0%	93.3%	96.5%
Pre hypertension 130_80mmHg	Count	1	0	0	1
	% within Blood Pressure Monitoring 9th month	100.0%	0.0%	0.0%	100.0 %
	% within Complications in Previous Pregnancies	33.3%	0.0%	0.0%	1.8%
Gestational hypertension 140_90mmHg	Count	0	0	1	1
	% within Blood Pressure Monitoring 9th month	0.0%	0.0%	100.0%	100.0 %
	% within Complications in Previous Pregnancies	0.0%	0.0%	6.7%	1.8%
Total	Count	3	39	15	57
	% within Blood Pressure Monitoring 9th month	5.3%	68.4%	26.3%	100.0 %
	% within Complications in Previous Pregnancies	100.0%	100.0%	100.0%	100.0 %

Table 13 chi-square test analysis results for the association between blood pressure status in both the sixth and ninth month of pregnancy with complications in previous pregnancies.

The complications in previous pregnancies and the:		Value	df	Asymp. Sig.(2-sided)
6th month blood pressure status	Pearson Chi-Square	8.556[a]	2	.014
9th month blood pressure status	Pearson Chi-Square	21.142	4	.000

4.3.Logistic regression analysis

To further investigate the factor associated with gestational hypertension, a binary logistic regression analysis was conducted. The overall model was statistically significant with p value = (0.012) as shown in table 14, indicating that the included variables meaningfully contributed to the prediction of hypertensive outcomes.

Table 14 Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	27.229	13	.012
	Block	27.229	13	.012
	Model	27.229	13	.012

The frequency of multivitamin use appeared as a significant predictor in table 15. Women who took multivitamins multiple times a day (coded as c2) had significantly increased odds of developing gestational hypertension (p = 0.023 Exp (B) = 18.007), compared to those who took them once daily. Similarly, irregular multivitamin intake (c1) also showed significant association (p value = 0.044 Exp (B) = 4.412). In contrast, a longer duration of multivitamin use (coded as b2, more than 6 months) was associated with a reduced risk of gestational

hypertension (p value = 0.013 Exp (B) = 0.214), suggesting a protective effect. Importantly, a positive family history of hypertension was also found to be significantly associated with lower odds of gestational hypertension in this cohort (p value = 0.037 Exp (B) = 0.260), indicating a possible complex or unexpected relationship warranting further investigation. Other variables including dietary patterns, physical activity, and food or drink avoidance habits during pregnancy didn't show any statistically significant associations with gestational hypertension.

Table 15 Variables in equation (investigation of the factor associated with gestational hypertension)

	B	S.E.	Wald	df	Sig.	Exp(B)
1. Family History of Hypertension (1)	-1.348	.645	4.371	1	.037	.260
2. Use of Multivitamins (a1)	-20.854	40192.977	.000	1	1.000	.000
3. Duration of Multivitamin Use			6.236	2	.044	
4. Duration of Multivitamin Use (b1)	19.855	23718.666	.000	1	.999	419655790.284
5. Duration of Multivitamin Use (b2)	-1.544	.618	6.236	1	.013	.214
6. Frequency of Multivitamin Use			6.391	2	.041	
7. Frequency of Multivitamin Use (c1)	1.484	.735	4.075	1	.044	4.412
8. Frequency of Multivitamin Use (c2)	2.891	1.269	5.188	1	.023	18.007

9. Physically Active (d1)	.056	.684	.007	1	.935	1.058
10. Diet during pregnancy			3.380	2	.184	
11. Diet during pregnancy (e1)	-.508	1.192	.182	1	.670	.601
12. Diet during pregnancy (e2)	-1.542	.840	3.367	1	.066	.214
13. Foods or drinks avoided during pregnancy			.000	4	1.000	
14. Foods or drinks avoided during pregnancy (f1)	19.403	14576.408	.000	1	.999	267056626.946
15. Foods or drinks avoided during pregnancy (f2)	16.615	40192.969	.000	1	1.000	16437369.257
16. Foods or drinks avoided during pregnancy (f3)	17.179	40192.970	.000	1	1.000	28899573.034
17. Foods or drinks avoided during pregnancy (f4)	19.994	19471.893	.000	1	.999	482335895.827
Constant	22.495	40192.977	.000	1	1.000	5880915197.318

Note: The categorical variables in the model were coded as follows: *Use of Multivitamins:* (1 = Yes, 0 = No) - *Duration of Multivitamin Use:* b1 = 3–6 months, b2 = More than 6 months (reference category: Less than 3 months) - *Frequency of Multivitamin Use:* c1 = Do not take regularly, c2 = Multiple times a day (reference category: Once daily) - *Physically Active:* (1 = Yes, 0 = No) - *Diet during Pregnancy:* e1 = Balanced diet, e2 = High carbohydrate diet (reference category: Healthy diet) - *Foods or Drinks Avoided during Pregnancy:* f1 = Avoids milk and dairy products, f2 = Avoids meat, f3 = Avoids calcium-rich foods f4 = Avoids leafy green vegetables.

Chapter - 5

Chapter 5

5. Discussion

5.1.Prevalence of gestational hypertension.

This cross-sectional study revealed that among the 135 participants who were surveyed, 22 women were diagnosed with gestational hypertension during their current pregnancy, representing a prevalence rate of 16.3% within the study sample.

This rate is higher than the global average, with percentage between 5% to 10% according to international estimates. Particularly, studies from high-income countries like the United States, and European nations often report gestational hypertension rates closer to 6–8%, this could be explained by variation in healthcare access, nutritional status, and genetic predisposition in some low- and middle-income settings. [26]

However, A supporting study conducted in 2023 included a sample of 807 primigravidae and revealed a prevalence of hypertensive disorders of pregnancy (HDP) at 18.6% (150 women). Among these, the vast majority (79.3%, n=119) were diagnosed with gestational hypertension, while 19.3% (n=29) had preeclampsia and 1.3% (n=2) experienced eclampsia. The mean age of participants in that study was 26.34 ± 3.84 years. [27] These findings match with the current study's indication of relatively high gestational hypertension rates and further highlight the demand for improved maternal health interventions across various levels of care.

The relatively increased gestational hypertension rate observed in this study could be attributed to several local factors, including poor dietary diversity due to the nature of Libyan food that include high carbohydrate intake, and limited awareness about hypertension in pregnancy. Additionally, the high proportion of women with a family history of hypertension (nearly 60%) may have contributed to this increased prevalence. Therefore, the comparable prevalence

between the studies supports the need for preventive strategies and confirms the importance of addressing modifiable risk factors among Libyan pregnant women

5.2.Multivitamin use and gestational hypertension risk

The current study noted no significant association between multivitamin use and gestational hypertension. This Agrees with findings by Fogacci et al. (2020), who assessed data from over 300,000 women and showed no benefit of folic acid-containing multivitamins against hypertensive disorders in pregnancy. Their conclusion emphasized that stronger evidence persists for nutrients such as calcium and vitamin D, while multivitamins showed inconsistent or weak associations. [(14)] in the same way, Shim et al. (2016), a meta-analysis involving over 200,000 participants, found no statistically significant association between multivitamin use (including folic acid) and a reduced risk of gestational hypertension or preeclampsia. [(17)]

On the other hand, a narrative review published by Brown B, (2020), oxford university, summarize that calcium supplementation strongly recommended to the pregnant to reduce the blood pressure, also the magnesium playing a role in hypertension during pregnancy, additionally mentioned that omega 3s role in regulating the blood pressure. [(10)] However, conflicting evidence exists. Chen et al. (2019) observed that iron-containing multiple micronutrient supplements were associated with a lower risk of pregnancy-induced hypertension in young women (aged 20–24). [(15)] The variation may be attributed to multiple interrelated factors, including differences in age distribution among study populations, as younger females (such as those aged 20 to 24 in the Chinese study) may respond differently to supplementation compared to older age groups. moreover, genetic predispositions, baseline nutritional status, dietary habits, and access to routine antenatal care in China may differ significantly from those in the Libyan population, thereby influencing how multivitamin use impacts blood pressure regulation during pregnancy.

5.2.1. Frequency of multivitamin use and gestational hypertension risk

Interestingly, the current study identified a significant association between frequent multivitamin use (specifically when taken multiple times per day) and an increased risk of developing gestational hypertension (OR = 18.007, p = 0.023). This finding suggests that excessive intake of multivitamins may interrupt the sensitive equilibrium of micronutrients in the body, potentially causing physiological imbalances that affect blood pressure regulation. While multivitamin supplements are commonly recommended for their health benefits, these results point to the possibility that over supplementation could be ineffective or harmful.

This observation separates from the majority of previous research, which frequently concentrates on whether or not multivitamins are used, rather than how frequently they are consumed. The frequency and dosing patterns of supplement intake have received limited attention in the literature. However, the current study findings match with the study by Li et al. (2020), which reported that women consuming high doses of folic acid (≥800 μg/day) from preconception through mid-pregnancy were at higher risk of gestational hypertension. [18] This recommends a potential unexpected effect of excessive vitamin intake where more is not always superior, and may, in fact, cause additional risks during pregnancy.

Moreover, a randomized control trail study by Subramanian A, (2021) in Bangladesh with the aim of examination the dose dependent vitamin D supplementation impact on pregnancy blood pressure from mid-to-late gestation. A total of 1298 healthy woman enrolled at 17 -24 weeks gestation. The pregnant were randomized to in receive one of four doses: placebo, 4,200IU/ weeks 16,800 IU/week or 28,00 IU/week. The findings showed that vitamin D supplementation did not significantly affect systolic blood pressure of diastolic blood pressure at 24 or 30 weeks of gestation. however, by 36 weeks the highest dose (28,000 IU/ week) was associated with slightly higher BP compared to the placebo group. however, the study concluded that vitamin

D supplementation starting in mid-pregnancy did not reduce maternal blood pressure and only marginally increased it at the highest dose in late pregnancy. [23]

These findings spotlight the importance of raise critical issues about the widespread availability of over-the-counter multivitamins and the potential risks of self-medication without professional medical guidance. Many women may without realizing exceed safe limits, especially when combining prenatal vitamins with other fortified products. Therefore, these findings emphasize the need for increased public health education, more regulation of dietary supplements, and enhanced prenatal counseling to ensure that multivitamin use enhances, rather than risks, maternal health.

5.2.2. Duration of multivitamin use and gestational hypertension risk.

However, the current study revealed that a longer duration of multivitamin use, especially exceeding six months, was associated with significantly decreased odds of progressing gestational hypertension (OR = 0.214, p = 0.013). This finding supports the concept that the consistency in taking prenatal multivitamin throughout pregnancy play an important role in supporting maternal vascular health and avoiding hypertensive complications. This observation is consistent with the findings of Maria P.G. (2018), whose study illustrated that longer durations of folic acid-containing supplement use were significantly associated with a decreased risk of both gestational hypertension and preeclampsia. [19]

The protective effect of prolonged, appropriately supplementation can be explained by several biological mechanisms. initially, consistent multivitamin intake may boost endothelial function by supporting nitric oxide production, an essential molecule responsible for vasodilation and maintenance of normal blood pressure. [28] Secondly, a prolonged multivitamin use duration can prevent or correct micronutrient deficiencies, such as magnesium and calcium deficiencies, which have been involved in the development of hypertension during pregnancy. Adequate

levels of these minerals are fundamental for smooth muscle relaxation, vascular compliance, and regulation of blood pressure. [29][30] moreover, continuous consumption of antioxidants such as vitamin C, vitamin E, and folic acid can help alleviate oxidative stress, which is a esteemed contributor to the pathogenesis of gestational hypertension. Oxidative stress leads to endothelial dysfunction, increased vascular resistance, and systemic inflammation, all of which can result in elevated blood pressure. By maintaining an antioxidant-rich environment through prolonged multivitamin use, it is possible to support healthier placental function and maternal cardiovascular adaptation. [28] It is also worth to recognize that prolonged use of multivitamins may influence placental development and angiogenesis during the early stages of pregnancy. Adequate supply of micronutrients during the critical period of placental formation can prevent abnormal placental vascularization, which has been associated with hypertensive disorders later in pregnancy. [31]

Collectively, these mechanisms validate the concept that prenatal multivitamin supplementation, when started early and continued throughout pregnancy, may not only play a role in preventing nutrient deficiencies but also provide systemic benefits that participate in reducing the risk of gestational hypertension.

5.2.3. Calcium Supplementation and gestational hypertension

Calcium has demonstrated more consistent advantages in literature when it comes to the prevention of gestational hypertension. The World Health Organization recommends calcium supplementation (1.5–2 grams/day) particularly for women with low dietary calcium intake, a recommendation supported by reviews and multiple clinical trials. [24] The study by Gomez et al. (2024) highlights that even low-dose calcium supplementation regimen (500 mg/day) could help lower the risk of gestational hypertension and preeclampsia, particularly in populations with insufficient calcium intake. [24] even though the current study did not isolate calcium use

as an independent variable, a number of participants mentioned using multivitamin combinations that included calcium within their regimen. However, the study did not find a clear association between these combinations and a reduced risk of gestational hypertension. this may cause by a variety of reasons, including that the study did not measure the actual calcium intake or calcium rich food among participants. additionally, calcium absorption can be influenced by factors such as vitamin D status, dietary habits, and gastrointestinal health all of which were not accounted for in this study.

5.3. Dietary habits and lifestyle during pregnancy

This study also assessed the possible association between dietary habits, physical activity, and blood pressure changes during pregnancy. A high percentage of participants (87.4%) revealed that they consumed a high-carbohydrate diet, while only a small percentage (7.4%) on a balanced diet. This dietary habit was found to be significantly associated with elevated blood pressure readings in the 6th, 8th, and 9th months of pregnancy, with p values of 0.001, 0.003, and 0.001 respectively. These findings are in agreement with the evidence showed in the systematic review by Raghavan et al. (2019), which assessed the association between dietary patterns before and during pregnancy and the risk of hypertensive disorders of pregnancy (HDP), including gestational hypertension and preeclampsia. [32] however, Raghavan et al. concluded that dietary patterns rich in vegetables, fruits, whole grains, nuts, legumes, fish, and vegetable oils and lower in meat and refined grains are associated with a lowered risk of hypertensive disorders of pregnancy, including preeclampsia and gestational hypertension. in contrast, Western-style diets, often high in processed carbohydrates, meats, and saturated fats, were associated with an increased risk of HDP across several cohorts, including those from Norway, Australia, and the Netherlands. The dietary habits reported by participants in the current study are similar to the unhealthy patterns described in the review by Raghavan et al. (2019). Many women in the current study sample consumed amounts of white bread, rice,

pasta, and sweets. This type of diet can increase the risk of gestational hypertension, as it may lead to oxidative stress, inflammation, and problems in blood vessel function, all of which are related to high blood pressure during pregnancy. The similarity between the current study results and those in the review indicates that existing nutrition strategies from other environments might be effective in Libya if appropriately adapted to fit the local situation.

Raghavan et al. also mentioned that most of the studies in their review were done in high-income countries, mainly among healthy white women. They pointed out that there is not enough research from low- and middle-income countries or non-Western populations. the current study helps fill this gap by revealing how diet may impact blood pressure during pregnancy in Benghazi. These results support global recommendations that encourage healthy eating during pregnancy and highlight the importance of providing simple, culturally appropriate nutrition advice as part of routine care for pregnant women in Libya.

Another interesting finding from this study was the valid association between dietary avoidance behaviors and blood pressure status in the ninth month of pregnancy with p value = (0.000). Pregnant women who avoided certain food groups such as dairy products, meat, or green leafy vegetables showed variations in blood pressure status. While causation cannot be established in a cross-sectional design, these findings highlight that inadequate nutritional diversity may influence the development of gestational hypertension.

Regarding the physical activity, 72.6% of participants reported good physical activity during pregnancy. However, no statistically significant association was found with gestational hypertension. This contrasts with literature suggesting that Women who were randomized in early pregnancy to aerobic exercise (30–60 min 2–7 times a week) had a significantly lower incidence of HDP, specifically, a lower incidence of gestational hypertension. [33] A possible reason for this discrepancy is that the physical activity data were self-reported, which may have

contributed to overestimation due to recall bias or the desire to provide socially acceptable answers. or the consideration of household chores and work as forms of physical activity. furthermore, it is likely that the types of activities done were minimal, inconsistent, or not maintained throughout the pregnancy, and therefore may not have been enough to positively affect cardiovascular or vascular health.

5.4.Family history of hypertension and gestational hypertension.

An important finding in the current study was the significant association between family history of hypertension and the development of gestational hypertension with p value (= 0.015). this is in agreement with global research that identifies genetic predisposition as a major risk factor for hypertensive disorders in pregnancy. Studies such as Lewandowska M. (2021) have shown that chronic hypertension in the family members of pregnant women affected the risk of gestational hypertension and preeclampsia in a different way. [34] Interestingly, the logistic regression in the current study revealed that having a family history of hypertension was associated with reduced odds of developing gestational hypertension (OR = 0.260, and p value = 0.037). This finding appears conflicting to what is commonly reported in literature. A possible explanation for this could be insufficient of the sample size or reflect confounding variables that were not fully controlled in the model. more extensive investigations and Further studies with larger samples are needed to clarify this unexpected association.

5.5.Previous Pregnancy History and Gestational Hypertension

The current study also investigated number of previous pregnancies as a risk factor, in which a statistically significant association was observed between number of pregnancies and blood pressure status in the sixth month of pregnancy with p value (= 0.032). moreover, women with multiple previous births, especially those with five or more pregnancies, showed higher prevalence of gestational hypertension and severe hypertension. These results are in agreement

with findings from Luo, J.(2020) who reported that multiparity is associated with greater risk of gestational hypertension and other pregnancy complication. [35] additionally, the occurrence of complications during previous pregnancies, was significantly associated with current blood pressure status in both the sixth and ninth months (p value = 0.014 and p value = 0.000) respectively. This strengthens the concept that previous pregnancy history is a major predictor of current pregnancy consequences and should be carefully reviewed during antenatal visits.

5.6. Hemoglobin and gestational hypertension.

low hemoglobin (anemia) is a common health issue during pregnancy and plays an important role in maternal blood pressure regulation. In the current study, most participants (75.6%) had normal hemoglobin levels. however, a statistically significant relation was detected between hemoglobin levels and blood pressure during the eighth month of pregnancy with p value (= 0.018). This agrees with observations from existing literature, such as the study by Asres et al. (2021), which observed that elevated hemoglobin levels were associated with a higher risk of gestational hypertension. One possible explanation is hemoconcentration where the blood becomes more concentrated due to a reduced plasma volume leading to increased blood viscosity and resistance in the vessels. This condition may contribute to higher blood pressure. additionally, an increase in free hemoglobin contents results in vasoconstriction, which leads to the development of PIH. [20] Interestingly, while moderate anemia might help reduce blood pressure by lowering blood viscosity, severe anemia remains a serious health risk and is linked to poor maternal and fetal outcomes. In the current study, the association was significantly noticeable in the eighth month, indicating that changes in hemoglobin levels during third trimester may have a stronger impact on blood pressure. This highlights the potential benefit of regular hemoglobin monitoring in the third trimester as a tool to identify women at risk of developing gestational hypertension.

5.7.Verification of hypothesis

The current study results accept the null hypothesis (H_0), which states that there is no significant effect of taking multivitamin supplements on the risk of developing hypertension in pregnant women. On the other hand, rejects the alternative hypothesis (H_1) which states that multivitamin supplements significantly affect the risk of developing hypertension in pregnant women. although, no association was found between the gestational hypertension and multivitamin intake, a strongly significant association was observed particularly among pregnant who used the multivitamins for more than six months duration, and significant lower odds of gestational hypertension.

5.8.Strength and limitations of the study

This study has several notable strengths. firstly, it considers a critical gap by providing crucial data on Libyan pregnant women, a group previously underrepresented in research on multivitamin use and gestational hypertension. Secondly, the use of both bivariate and multivariate (chi-square, logistic regression) analyses strengthens the reliability of the findings. Additionally, the high response rate (97.8%) lowers the risk of non-response bias.

The study also has limitations. firstly, because of its cross-sectional design allowing only for the identification of associations and limits the ability to infer causality. In addition to using self-reported data may lead to recall and social desirability biases. Also, the uncontrolled confounders such as body mass index (BMI), pre-pregnancy weight, sodium intake, and stress levels were not included in the analysis, although they are known to affect blood pressure regulation. furthermore, it was challenging to isolate the effect of specific nutrients because different multivitamin brands and combinations were used by participants. lastly, although timing was documented (e.g., first vs. second trimester initiation), the exact gestational week and compliance levels were not verified, which may have influenced the results.

5.9.Recommendation for future research

To better understand the association between multivitamin use and gestational hypertension, future studies should investigate for a longer duration to explore the cause and effect. Laboratory test to measure vitamins and minerals level would help confirm the self-reported data. the effects of varying dosages of nutrients such as calcium, vitamin D, and folic acid on blood pressure should also be investigated. Additionally, more advanced study design such as case control, cohort or randomized control trail are recommended to better understand the link between the multivitamin use and gestational hypertension. Finally, including women from various regions, especially rural areas, will make the results more representative and uncover regional differences.

Chapter – 6

Chapter 6

6. Conclusion

To conclude, the current study provides important data from the Libyan pregnant women regarding the use of multivitamin and the risk of gestational hypertension, however the findings suggests that although general multivitamin use is not directly related to increased risk of gestational hypertension, the duration and frequency of prenatal multivitamin intake do have a significant impact on outcome. Additionally other factors such as family history and previous pregnancy history and hemoglobin level were found to influence the development of pregnancy induced hypertension. These findings highlight the need for a more comprehensive approach to antenatal care.

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Appendices

Appendix-I

Questionnaire:

Research Project Title: The Impact of Multivitamins on Hypertension Risk in Pregnant Women

asraa_78pg@limu.edu.ly Switch account

Not shared

* Indicates required question

Hospital or Clinic Name

- ◯ Benghazi medical center
- ◯ Ibn sina clinic
- ◯ Benghazi specialized hospital
- ◯ Beirut hospital
- ◯ other

Patient Demographic Information:

Patient Demographic Information:

1. Age Group: *

- ◯ 18-25
- ◯ 26-30
- ◯ 31-35
- ◯ 36-40
- ◯ Above 40

2. Education Level:

- ◯ Uneducated
- ◯ Less than High School
- ◯ High School
- ◯ Diploma
- ◯ Bachelor's Degree
- ◯ Postgraduate Degree
- ◯ Not Mentioned

3. Employment Status:

- ◯ Employed
- ◯ Unemployed

Pregnancy History:

4.Current Pregnancy month

- ◯ Just delivered
- ◯ 1st
- ◯ 2nd
- ◯ 3rd
- ◯ 4th
- ◯ 5th
- ◯ 6th
- ◯ 7th
- ◯ 8th
- ◯ 9th

5. Number of Pregnancies:

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 or more

6. Complications in Previous Pregnancies:

- ◯ Yes
- ◯ No

7. Family History of Hypertension:

- ◯ Yes
- ◯ No
- ◯ Not Mentioned

Multivitamin Use:

8. Use of Multivitamins:

- ◯ Yes
- ◯ No

9. Frequency of Multivitamin Use:

- ◯ Once Daily
- ◯ Multiple Times a Day
- ◯ Do not Take Regularly
- ◯ Not used

10. Nutrients in Prenatal Multivitamin:

- ☐ Pregnacare Original
- ☐ Pregnacare Plus Omega-3
- ☐ Folic Acid
- ☐ Iron
- ☐ Calcium
- ☐ Vitamin D
- ☐ Vitamin B12

11. Duration of Multivitamin Use:

- ◯ Less than 3 Months
- ◯ 3-6 Months
- ◯ More than 6 Months
- ◯ Not used

12. Timing of Multivitamin Initiation:

- ◯ Before Conception
- ◯ In the First Trimester
- ◯ In the Second Trimester
- ◯ In the Third Trimester
- ◯ Not used

Lifestyle and Diet:

13. Physically Active:

- ◯ Yes
- ◯ No

15. Consumption of Caffeinated Beverages:

- ◯ Yes, Daily
- ◯ Yes, a Few Times Per Week
- ◯ No
- ◯ Not Mentioned

16. Diet during pregnancy?

- ◯ Healthy diet (rich in fruits, vegetables, whole grains, and lean proteins)
- ◯ Not healthy diet (high in processed foods, sugars, and unhealthy fats)
- ◯ Balanced diet (a mix of healthy and occasional indulgent foods)
- ◯ High- carbohydrate diet (rich in food like pasta, rice, breed, starchy food)
- ◯ Not mentioned

17. Foods or drinks avoided during pregnancy

- ◯ Avoids milk and dairy products
- ◯ Avoids meat
- ◯ Avoids fish
- ◯ Avoids calcium-rich drinks (e.g., milk or fortified juices)
- ◯ Avoids leafy green vegetables
- ◯ Avoids nuts and seeds
- ◯ Not mentioned

Health and Hypertension:

18. Diagnosis of Hypertension:

- ◯ Yes
- ◯ No

19. Timing of Hypertension Diagnosis:

- ◯ Essential hypertension
- ◯ Before Pregnancy

- ◯ During Current Pregnancy
- ◯ After Previous Pregnancy
- ◯ Not HTN

20. Medication for Hypertension:

- ◯ Yes
- ◯ No
- ◯ Not HTN

21. Blood Pressure Monitoring:

	Normal Bp 120/80mmHg	Pre-hypertension 130/80mmHg	Gestational hypertension 140/90mmHg	Sever hypertension >140/90mmHg
1st month	◯	◯	◯	◯
2nd month	◯	◯	◯	◯
3rd month	◯	◯	◯	◯
4th month	◯	◯	◯	◯
5th month	◯	◯	◯	◯
6th month	◯	◯	◯	◯
7th month	◯	◯	◯	◯
8th month	◯	◯	◯	◯
9th month	◯	◯	◯	◯

22. Laboratory Test Results:

	Normal	Mild Deficiency	Moderate Deficiency	Sever Deficiency	High
Hemoglobin (Hb) / Hematocrit (Hct)	◯	◯	◯	◯	◯
Serum Ferritin	◯	◯	◯	◯	◯
Calcium Levels	◯	◯	◯	◯	◯
Magnesium Levels	◯	◯	◯	◯	◯
Potassium Levels	◯	◯	◯	◯	◯
Vitamin D Levels	◯	◯	◯	◯	◯
Serum Folate Levels	◯	◯	◯	◯	◯
Vitamin B12 Levels	◯	◯	◯	◯	◯
Albumin/Protein Levels	◯	◯	◯	◯	◯
Creatinine (Kidney Function Test)	◯	◯	◯	◯	◯

Submit

Clear form

Appendix-II

Ethical Approval Certificate

الجامعة الليبية الدولية
Libyan International University

Certificate Reference N0: MCP-2024-00255 **Date :** 2024/10/15

ETHICAL CLEARANCE CERTIFICATE

Project Title:	The Impact of Multivitamins on Hypertension Risk in Pregnant Women
Project No.:	MHS-14-D-00298
Name of the Principal Investigator (PI):	Hanin Hussin

On behalf of the Libyan International Medical University's Research Ethics Committee and in compliance with the Helsinki Declaration, I hereby give ethical approval for the above-mentioned research project proposal and its methodology. The research project has been reviewed and approved by an independent ethical review committee, and will be conducted in accordance with relevant national and international laws, regulations, and ethical guidelines. The Research Ethics Committee must be, immediately, informed of:

- Any material alteration in the conditions or the commitments mentioned in the submitted proposal document.
- Any ethics violations that may affect the ethical conduct of the appointed research.

The Research Ethics Committee may request procedures for obtaining informed consent before participating and access to any information or data at any time during the course or after completion of the project.

The Research Ethics Committee may withdraw or amend this Ethical Clearance Certificate if:

- Any unethical principle or practice is suspected or any participant confidentiality is revealed.
- Any relevant information has been withheld or misrepresented.
- Any regulatory changes of whatever nature are required.
- The conditions contained in the certificate have not been adhered to.

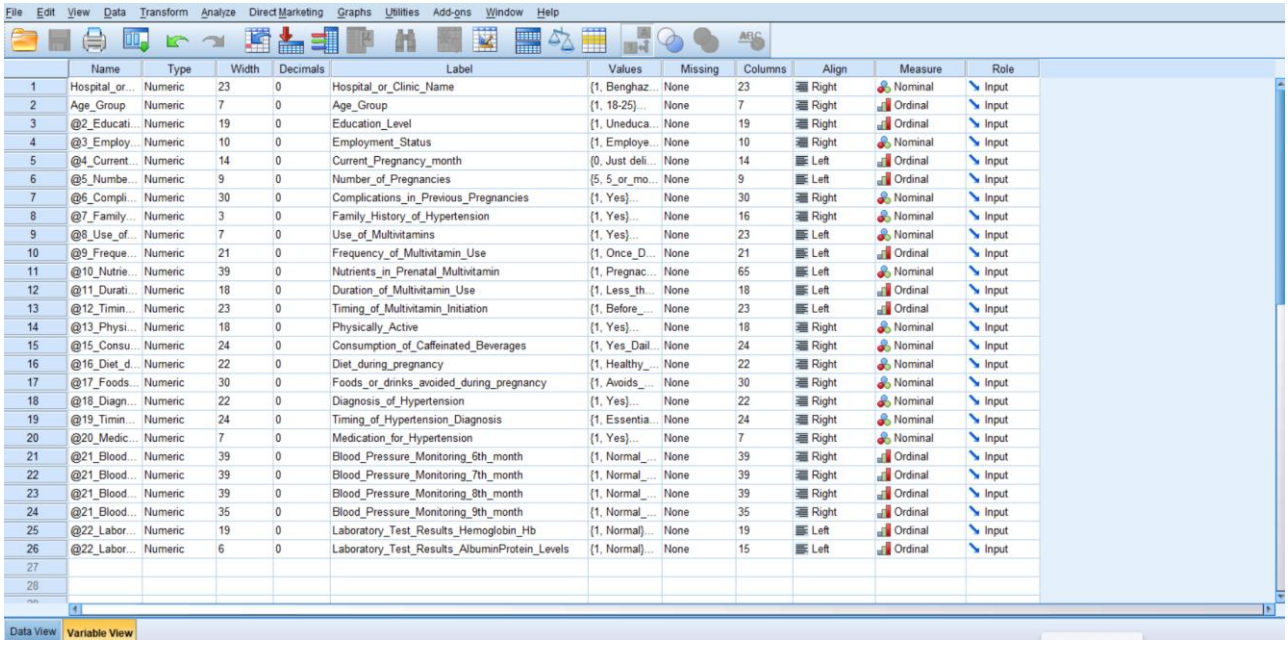
In respect to ethical compliance, the principal investigator must provide a periodical report of the project. The report should include information about any adverse events or unanticipated problems that arose during the course of the research project, as well as any deviations from the approved protocol.

Prof. Ali Saeid Albarghathi
Chairman of the Research Ethics Committee at
The Libyan International University

Email: ethics@limu.edu.ly

Appendix-III

Statistical Analysis Data



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Hospital_or...	Numeric	23	0	Hospital_or_Clinic_Name	{1, Benghaz...	None	23	Right	Nominal	Input
2	Age_Group	Numeric	7	0	Age_Group	{1, 18-25}...	None	7	Right	Ordinal	Input
3	@2_Educati...	Numeric	19	0	Education_Level	{1, Uneduca...	None	19	Right	Ordinal	Input
4	@3_Employ...	Numeric	10	0	Employment_Status	{1, Employe...	None	10	Right	Nominal	Input
5	@4_Current...	Numeric	14	0	Current_Pregnancy_month	{0, Just deli...	None	14	Left	Ordinal	Input
6	@5_Numbe...	Numeric	9	0	Number_of_Pregnancies	{5, 5_or_mo...	None	9	Left	Ordinal	Input
7	@6_Compli...	Numeric	30	0	Complications_in_Previous_Pregnancies	{1, Yes}...	None	30	Right	Nominal	Input
8	@7_Family...	Numeric	3	0	Family_History_of_Hypertension	{1, Yes}...	None	16	Right	Nominal	Input
9	@8_Use_of...	Numeric	7	0	Use_of_Multivitamins	{1, Yes}...	None	23	Left	Nominal	Input
10	@9_Freque...	Numeric	21	0	Frequency_of_Multivitamin_Use	{1, Once_D...	None	21	Left	Ordinal	Input
11	@10_Nutrie...	Numeric	39	0	Nutrients_in_Prenatal_Multivitamin	{1, Pregnac...	None	65	Left	Nominal	Input
12	@11_Durati...	Numeric	18	0	Duration_of_Multivitamin_Use	{1, Less_th...	None	18	Left	Ordinal	Input
13	@12_Timin...	Numeric	23	0	Timing_of_Multivitamin_Initiation	{1, Before_...	None	23	Left	Ordinal	Input
14	@13_Physi...	Numeric	18	0	Physically_Active	{1, Yes}...	None	18	Right	Nominal	Input
15	@15_Consu...	Numeric	24	0	Consumption_of_Caffeinated_Beverages	{1, Yes_Dail...	None	24	Right	Nominal	Input
16	@16_Diet_d...	Numeric	22	0	Diet_during_pregnancy	{1, Healthy_...	None	22	Right	Nominal	Input
17	@17_Foods...	Numeric	30	0	Foods_or_drinks_avoided_during_pregnancy	{1, Avoids_...	None	30	Right	Nominal	Input
18	@18_Diagn...	Numeric	22	0	Diagnosis_of_Hypertension	{1, Yes}...	None	22	Right	Nominal	Input
19	@19_Timin...	Numeric	24	0	Timing_of_Hypertension_Diagnosis	{1, Essentia...	None	24	Right	Nominal	Input
20	@20_Medic...	Numeric	7	0	Medication_for_Hypertension	{1, Yes}...	None	7	Right	Nominal	Input
21	@21_Blood...	Numeric	39	0	Blood_Pressure_Monitoring_6th_month	{1, Normal_...	None	39	Right	Ordinal	Input
22	@21_Blood...	Numeric	39	0	Blood_Pressure_Monitoring_7th_month	{1, Normal_...	None	39	Right	Ordinal	Input
23	@21_Blood...	Numeric	39	0	Blood_Pressure_Monitoring_8th_month	{1, Normal_...	None	39	Right	Ordinal	Input
24	@21_Blood...	Numeric	35	0	Blood_Pressure_Monitoring_9th_month	{1, Normal_...	None	35	Right	Ordinal	Input
25	@22_Labor...	Numeric	19	0	Laboratory_Test_Results_Hemoglobin_Hb	{1, Normal}...	None	19	Left	Ordinal	Input
26	@22_Labor...	Numeric	6	0	Laboratory_Test_Results_AlbuminProtein_Levels	{1, Normal}...	None	15	Left	Ordinal	Input
27											
28											

Data View | Variable View

Hospital or Clinic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hospital A	76	56.3	56.3	56.3
	Hospital B	2	1.5	1.5	57.8
	Hospital C	50	37.0	37.0	94.8
	Others	7	5.2	5.2	100.0
	Total	135	100.0	100.0	

Education Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Uneducated	4	3.0	3.0	3.0
	High school	12	8.9	8.9	11.9

	Diploma	32	23.7	23.7	35.6
	Bachelor's Degree	79	58.5	58.5	94.1
	Postgraduate Degree	8	5.9	5.9	100.0
	Total	135	100.0	100.0	

Employment Status

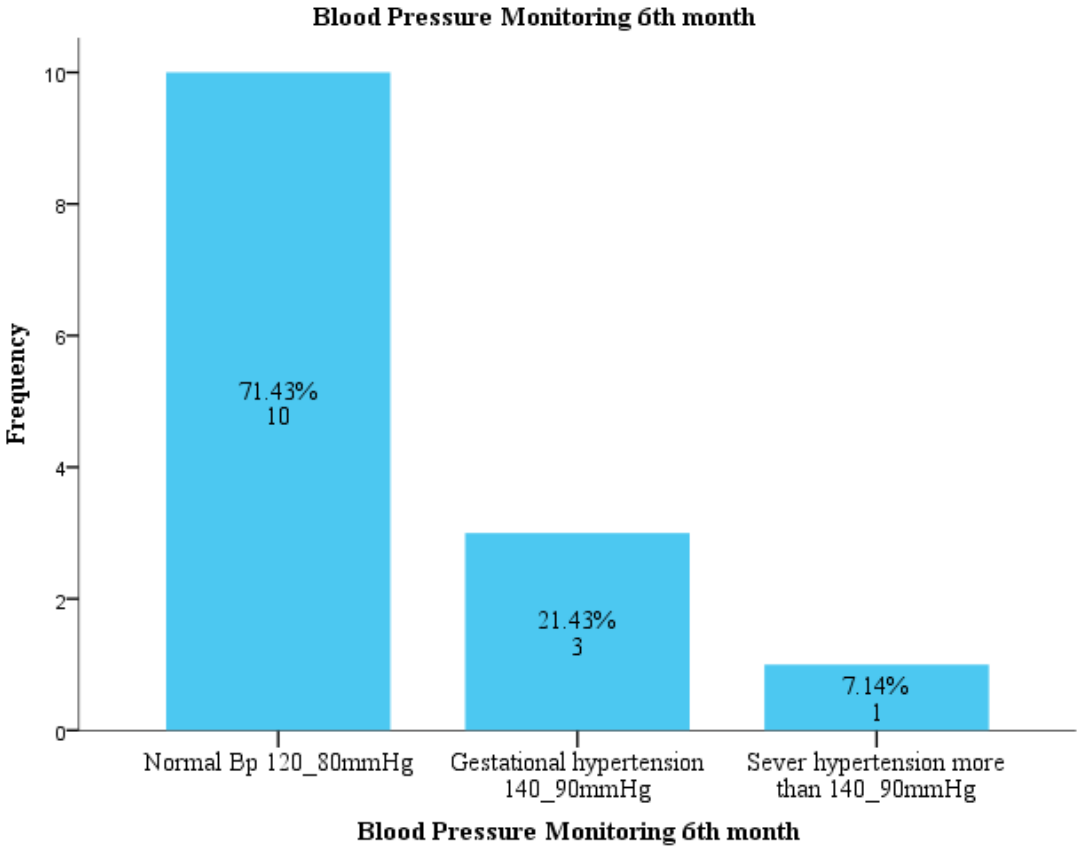
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed	60	44.4	44.4	44.4
	Unemployed	75	55.6	55.6	100.0
	Total	135	100.0	100.0	

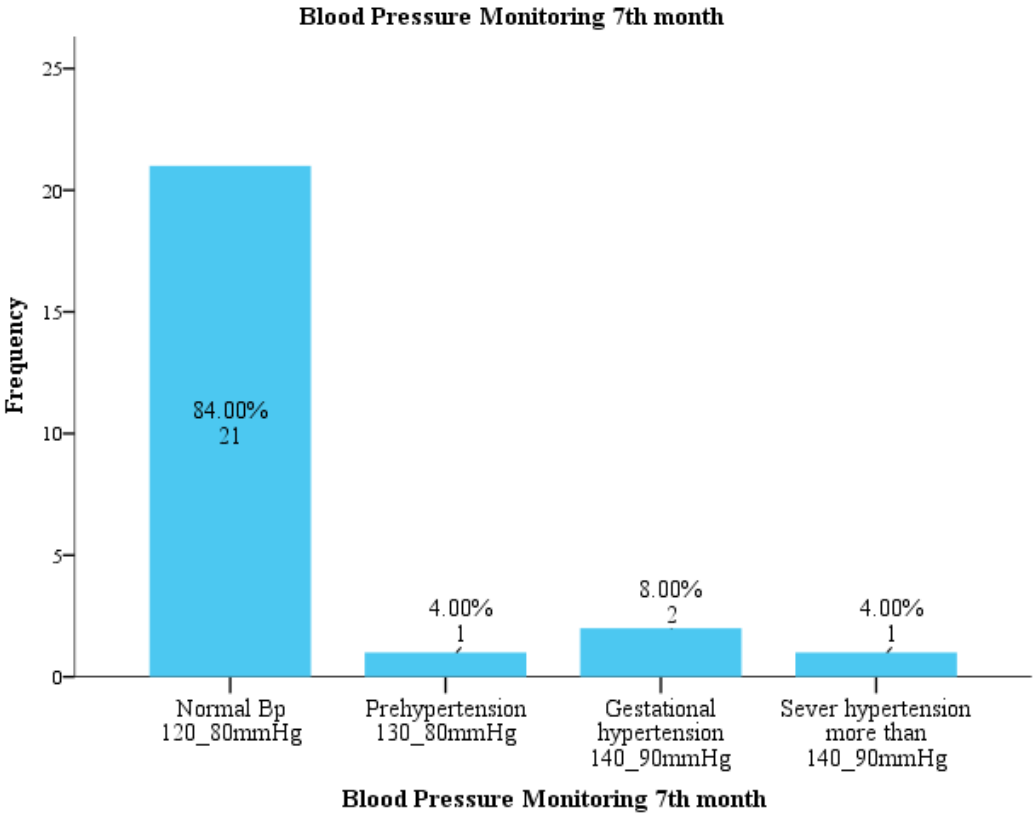
Timing of Multivitamin Initiation

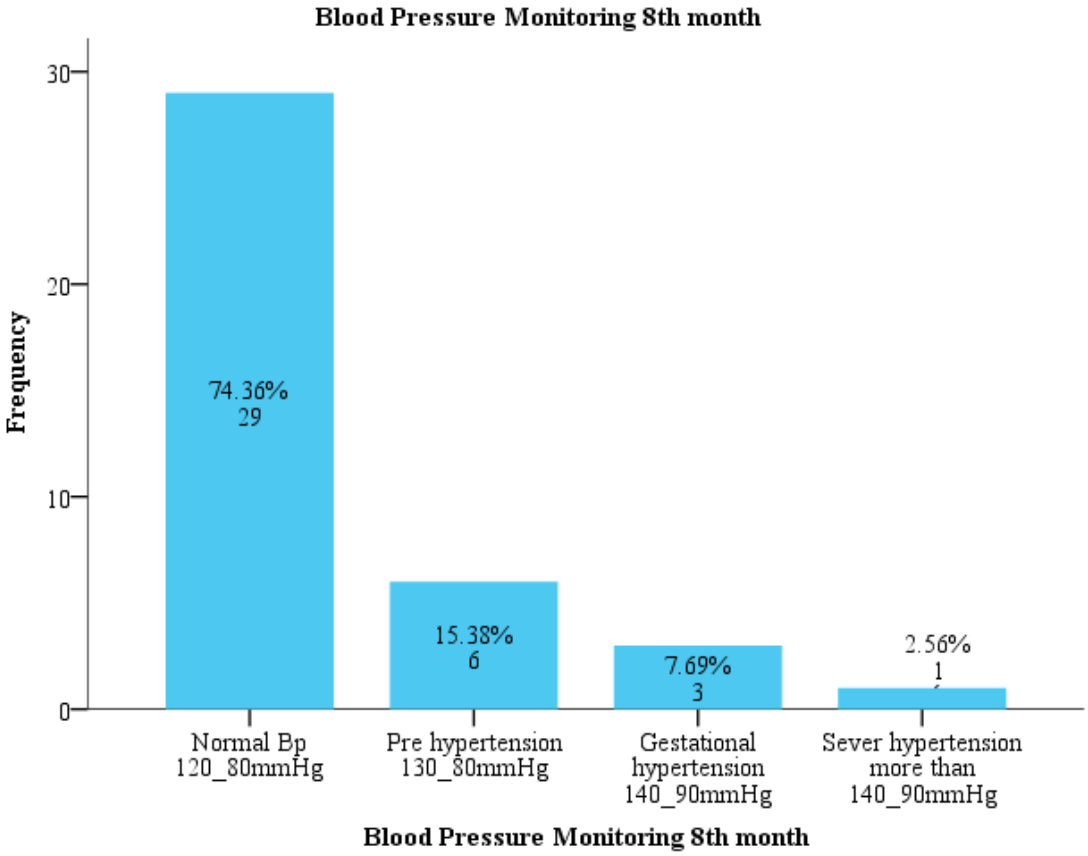
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Before Conception	13	9.6	9.6	9.6
	In the First Trimester	100	74.1	74.1	83.7
	In the Second Trimester	21	15.6	15.6	99.3
	Not used	1	.7	.7	100.0
	Total	135	100.0	100.0	

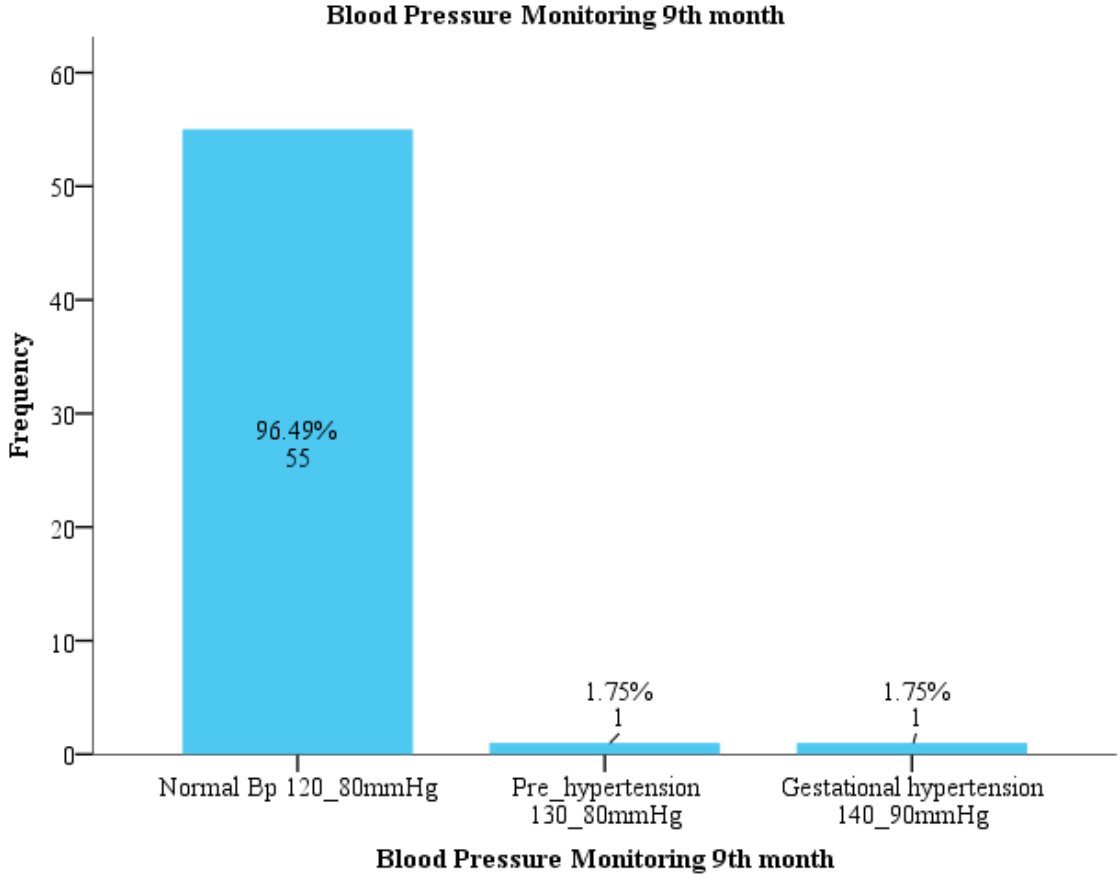
Consumption of Caffeinated Beverages

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes Daily	43	31.9	31.9	31.9
	Yes a Few Times Per Week	44	32.6	32.6	64.4
	No	48	35.6	35.6	100.0
	Total	135	100.0	100.0	


Blood Pressure Monitoring 6th month
Frequency
10
8
6
4
2
0
71.43%
10
21.43%
3
7.14%
1
Normal Bp 120_80mmHg
Gestational hypertension 140_90mmHg
Sever hypertension more than 140_90mmHg
Blood Pressure Monitoring 6th month


Blood Pressure Monitoring 7th month
Frequency
25
20
15
10
5
0
84.00%
21
4.00%
1
8.00%
2
4.00%
1
Normal Bp 120_80mmHg
Prehypertension 130_80mmHg
Gestational hypertension 140_90mmHg
Sever hypertension more than 140_90mmHg
Blood Pressure Monitoring 7th month


Blood Pressure Monitoring 8th month
Frequency
30
20
10
0
74.36%
29
15.38%
6
7.69%
3
2.56%
1
Normal Bp
120_80mmHg
Pre hypertension
130_80mmHg
Gestational
hypertension
140_90mmHg
Sever hypertension
more than
140_90mmHg
Blood Pressure Monitoring 8th month


Blood Pressure Monitoring 9th month
Frequency
60
50
40
30
20
10
0
96.49%
55
1.75%
1
1.75%
1
Normal Bp 120_80mmHg
Pre_hypertension
130_80mmHg
Gestational hypertension
140_90mmHg
Blood Pressure Monitoring 9th month

Frequency of Multivitamin Use with Diagnosis of gestational Hypertension Crosstab

			Diagnosis of Hypertension		Total
			Yes	No	
Frequency of Multivitamin Use	Once Daily	Count	15	85	100
		% within Frequency of Multivitamin Use	15.0%	85.0%	100.0%
		% within Diagnosis of Hypertension	68.2%	75.2%	74.1%
	Multiple Times a Day	Count	1	20	21
		% within Frequency of Multivitamin Use	4.8%	95.2%	100.0%
		% within Diagnosis of Hypertension	4.5%	17.7%	15.6%
	Do not Take Regularly	Count	6	7	13
		% within Frequency of Multivitamin Use	46.2%	53.8%	100.0%
		% within Diagnosis of Hypertension	27.3%	6.2%	9.6%
	Not used	Count	0	1	1
		% within Frequency of Multivitamin Use	0.0%	100.0%	100.0%
		% within Diagnosis of Hypertension	0.0%	0.9%	0.7%
Total		Count	22	113	135
		% within Frequency of Multivitamin Use	16.3%	83.7%	100.0%
		% within Diagnosis of Hypertension	100.0%	100.0%	100.0%

Diagnosis of gestational Hypertension with Family History of Hypertension Crosstab

			Family History of Hypertension		Total
			Yes	No	
Diagnosis of Hypertension	Yes	Count	18	4	22
		% within Diagnosis of_ Hypertension	81.8%	18.2%	100.0%
		% within Family History of Hypertension	22.8%	7.1%	16.3%
	No	Count	61	52	113
		% within Diagnosis of_ Hypertension	54.0%	46.0%	100.0%
		% within Family History of Hypertension	77.2%	92.9%	83.7%
Total		Count	79	56	135
		% within Diagnosis of_ Hypertension	58.5%	41.5%	100.0%
		% within Family History of Hypertension	100.0%	100.0%	100.0%

Blood Pressure Monitoring 9th month with Diet during pregnancy Crosstab

Blood Pressure Monitoring 9th month		Diet during pregnancy			Total
		Healthy diet	Balanced diet	High carbohydrate diet	
Normal Bp 120_80mmHg	Count	2	3	50	55
	% within Blood Pressure Monitoring 9th month	3.6%	5.5%	90.9%	100.0%
	% within Diet during pregnancy	66.7%	100.0%	98.0%	96.5%
Pre hypertension 130_80mmHg	Count	1	0	0	1

	% within Blood Pressure Monitoring 9th month	100.0%	0.0%	0.0%	100.0%
	% within Diet during pregnancy	33.3%	0.0%	0.0%	1.8%
	Count	0	0	1	1
	% within Blood Pressure Monitoring 9th month	0.0%	0.0%	100.0%	100.0%
Gestational hypertension 140 90mmHg	% within Diet during pregnancy	0.0%	0.0%	2.0%	1.8%
	Count	3	3	51	57
	% within Blood Pressure Monitoring 9th month	5.3%	5.3%	89.5%	100.0%
Total	% within Diet during pregnancy	100.0%	100.0%	100.0%	100.0%

Blood Pressure Monitoring 9th month with Complications in Previous Pregnancies Crosstab

Blood Pressure Monitoring 9th month		Complications in Previous Pregnancies			Total
		Yes	No	Not applicable first pregnancy	
Normal Bp 120_80mmHg	Count	2	39	14	55
	% within Blood Pressure Monitoring 9th month	3.6%	70.9%	25.5%	100.0%

	% within Complications in Previous Pregnancies	66.7%	100.0%	93.3%	96.5%
Pre hypertension 130_80mmHg	Count	1	0	0	1
	% within Blood Pressure Monitoring 9th month	100.0%	0.0%	0.0%	100.0%
	% within Complications in Previous Pregnancies	33.3%	0.0%	0.0%	1.8%
Gestational hypertension 140_90mmHg	Count	0	0	1	1
	% within Blood Pressure Monitoring 9th month	0.0%	0.0%	100.0%	100.0%
	% within Complications in Previous Pregnancies	0.0%	0.0%	6.7%	1.8%
Total	Count	3	39	15	57
	% within Blood Pressure Monitoring 9th month	5.3%	68.4%	26.3%	100.0%
	% within Complications in Previous Pregnancies	100.0%	100.0%	100.0%	100.0%

Blood Pressure Monitoring 8th month with Laboratory Test Results Hemoglobin Hb Crosstab

Blood Pressure Monitoring 8th month		Laboratory Test Results Hemoglobin Hb				Total
		Normal	Mild Deficiency	Moderate Deficiency	Sever Deficiency	
Normal Bp 120_80mmHg	Count	22	2	5	0	29
	% within Blood Pressure Monitoring 8th month	75.9%	6.9%	17.2%	0.0%	100.0%
	% within Laboratory Test Results Hemoglobin Hb	73.3%	100.0%	83.3%	0.0%	74.4%
Pre hypertension 130_80mmHg	Count	6	0	0	0	6
	% within Blood Pressure Monitoring 8th month	100.0%	0.0%	0.0%	0.0%	100.0%
	% within Laboratory Test Results Hemoglobin Hb	20.0%	0.0%	0.0%	0.0%	15.4%
Gestational hypertension 140_90mmHg	Count	2	0	0	1	3
	% within Blood Pressure Monitoring 8th month	66.7%	0.0%	0.0%	33.3%	100.0%
	% within Laboratory Test Results Hemoglobin Hb	6.7%	0.0%	0.0%	100.0%	7.7%
Sever hypertension more than 140_90mmHg	Count	0	0	1	0	1
	% within Blood Pressure Monitoring 8th month	0.0%	0.0%	100.0%	0.0%	100.0%

	% within Laboratory Test Results Hemoglobin Hb	0.0%	0.0%	16.7%	0.0%	2.6%
Total	Count	30	2	6	1	39
	% within Blood Pressure Monitoring 8th month	76.9%	5.1%	15.4%	2.6%	100.0%
	% within Laboratory Test Results Hemoglobin Hb	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix-IV

Arabic Abstract

الخلفية: عالميًا، تُعد اضطرابات ارتفاع ضغط الدم أثناء الحمل (HDP) أحد الأسباب الرئيسية لاعتلال ووفيات الأم والجنين أثناء الحمل. يُعد ارتفاع ضغط الدم الحملي (GH) فئة منHDP ، ويُعتبر الأكثر انتشارًا، حيث يؤثر على 5-8٪ من النساء في صحة ممتازة. ومع ذلك، لم يتم التحقيق بشكل شامل في تأثير الفيتامينات المتعددة على خطر ارتفاع ضغط الدم لدى النساء الحوامل في ليبيا. **الأهداف:** تهدف هذه الدراسة إلى استكشاف كيفية تأثير استخدام الفيتامينات المتعددة على خطر ارتفاع ضغط الدم الحملي بين النساء الحوامل في بنغازي ليبيا. **الطريقة:** أجريت دراسة مقطعية بين النساء الحوامل اللائي يتلقين رعاية ما قبل الولادة في مستشفيات وعيادات بنغازي من نهاية نوفمبر 2024 إلى أبريل 2025. بلغ إجمالي حجم العينة 135، وتم جمع البيانات من خلال إجراء مقابلات وجهاً لوجه باستخدام استبيان. تم إدخال البيانات وتحليلها باستخدام برنامج SPSS الإصدار 21. تم اعتبار المتغيرات ذات القيمة الاحتمالية الأقل من 0.05 ذات دلالة إحصائية. **النتائج:** تم جمع إجمالي 138 امرأة حامل يحضرن رعاية ما قبل الولادة في مستشفيات وعيادات بنغازي للمشاركة، وأفادت مشاركة واحدة فقط (0.7٪) بعدم استخدام أي مكملات. وتم تشخيص 22 من أصل 135 امرأة (16.3٪) بارتفاع ضغط الدم الحملي أثناء حملهن الحالي. ومع ذلك، لم يتم العثور على علاقة ذات دلالة إحصائية بين تناول الفيتامينات المتعددة وارتفاع ضغط الدم (القيمة الاحتمالية = 0.658). في المقابل، عند تحليل وتيرة تناول الفيتامينات المتعددة، تم العثور على ارتباط ذي دلالة إحصائية (القيمة الاحتمالية = 0.012)، بالإضافة إلى ذلك، ارتبطت مدة أطول من استخدام الفيتامينات المتعددة (أكثر من 6 أشهر) بانخفاض خطر الإصابة بارتفاع ضغط الدم الحملي) القيمة الاحتمالية = 0.013(Exp (B) = 0.214 ، مما يشير إلى وجود تأثير وقائي. **الخلاصة:** تشير النتائج إلى أنه على الرغم من أن الاستخدام العام للفيتامينات المتعددة لا يرتبط ارتباطًا مباشرًا بزيادة خطر الإصابة بارتفاع ضغط الدم الحملي، إلا أن مدة وتكرار تناول الفيتامينات المتعددة قبل الولادة يؤثران بشكل كبير على النتائج. كما وُجد أن عوامل أخرى، مثل التاريخ العائلي وتاريخ الحمل السابق ومستوى الهيموغلوبين، تؤثر على تطور ارتفاع ضغط الدم الحملي. تُبرز هذه النتائج الحاجة إلى نهج أكثر شمولاً لرعاية ما قبل الولادة.