**Socioeconomic Status and Cardiovascular Disease Risk Factors among Pregnant Women** **in the Cape Coast Metropolitan Assembly – Central Region, Ghana**

**Abstract**

**Introduction**: Non-communicable diseases (NCDs) contribute 74% of global mortalities, with cardiovascular diseases (CVD) in the lead. Higher rates of CVD have been reported in reproductive women, with the occurrence of CVD in pregnancy posing a problem to both the attending physician and the unborn child.

**Aim:** The study aimed to investigate the association between socioeconomic status (SES) and CVD risk factors among Pregnant Women (PW) in the Cape Coast Metropolis, Ghana.

**Methodology:** A quantitative cross-sectional study was conducted in three health facilities in the Cape Coast Metropolis using systematic random sampling to select 160 PW attending the three antenatal clinics. Participants included those with confirmed pregnancies who were receiving antenatal care and provided informed consent to participate in the study within the randomly selected hospitals with the CCMA. The Mediterranean Diet tool was used to assess participants' dietary patterns, with a score of 9 or above indicating adherence. Data were collected using a structured questionnaire and analysed using IBM SPSS Statistics 27 and R 4.3.1. Socio-demographic details, anthropometrics, maternal characteristics, dietary patterns, and blood pressure were collected and analysed.

**Results and findings:** The findings revealed that 25 (15.6%), 51 (31.9%), 64 (40%) and 20 (12.5%) had no risk factor, one risk factor, two risk factors, and three risk factors, respectively. About 84.4% of the participants had at least one risk factor. Higher SES was associated with increased CVD risk factors. About 56.9% of the participants were either overweight or obese, 7.5% had high blood pressure, 51.9% had a poor dietary pattern, and 37.5% were physically inactive. A**ge** (Estimate = 0.695, p < 0.001) and **marital status** (Estimate = 4.091, p = 0.010) exerted a positive and significant influence on blood pressure. **SES** (Estimate = -0.002, p = 0.957), **employment** (Estimate = 0.737, p = 0.547), and **educational level** (Estimate = 1.198, p = 0.1405) showed no significant effect on BP. A**ge** (Estimate = 0.408, p < 0.001) and **marital status** (Estimate = 4.318, p < 0.001) exhibited a substantial positive influence on body mass index (BMI). In contrast, **SES** (Estimate = 0.037, p = 0.109), **parity** (Estimate = 0.559, p = 0.174), and **job status** (Estimate = -0.619, p = 0.370) demonstrated a lower, non-significant influence on BMI.

**Conclusion:** This study highlights the significant impact of age and marital status on blood pressure and body mass index among PW, while socioeconomic status exhibited no meaningful influence on cardiovascular disease risk factors. Employment status demonstrated a notable negative association with dietary patterns, underscoring the complex interplay between socio-demographic factors and health outcomes in this population.

# **KEY WORDS:** Socioeconomic status, Cardiovascular diseases, Pregnant woman, Risk factors

**Introduction**

## **Background of the Study**

Globally, non-infectious diseases are responsible for about 41 million mortalities annually, which is about 74% of all mortalities. Seventeen million individuals die as a result of NCDs before attaining age 70 each year, and developing countries are responsible for about 86% of these hasty deaths, of which most are from CVD (17.9 million) (Shand et al., 2023). Adjusting for differences in population age patterns, death rates from NCDs are higher in low and middle-income countries (LMICs) than in high-income countries (Coates et al., 2020). About 80% of mortalities related to CVDs are as a result of stroke and heart attack, and for individuals aged 70 and less, 25% of the deaths occur without warning signs (Robinson, 2021). Cardiovascular disease risk factors occur in all individuals; however, due to some unavoidable physiological changes that are bound to occur in some special populations, their cases seem different. Pregnant Women (PW) (Franjic, 2019; Gangakhedkar & Kulkarni, 2021; Vinturache & Khalil, 2021).

Higher rates of CVD have been reported in reproductive women, with the occurrence of CVD in pregnancy posing a problem to both the attending physician and the unborn child. (Ludwig-Walz et al., 2022). The development of CVD in women is further impacted by disparities in traditional cardiovascular risk factors, the presence of female-specific risk factors, and female-predominant high-risk conditions. The early detection and management of these risk factors can decrease morbidity and mortality while improving the overall quality of women’s health (Rajendran et al., 2023).

The Maternal Mortality Ratio (MMR) in Ghana has significantly decreased over the past three decades, dropping from 760 per 100,000 live births in 1990 to 310 in 2017 (T. K. Boafor et al., 2021). Despite a significant drop, Ghana still fears meeting the SDG 3.1 of 70 deaths per 100,000 live births by the year 2030. CVD risk factors occurring during pregnancy are responsible for the countless number of CVDs in PW (Mikkola & Ylikorkala, 2024). These conditions include previous hypertension, hypertension during pregnancy, pre-eclampsia, DM, obesity/overweight, tobacco use, high cholesterol, advanced age, multiple pregnancy, lack of prenatal care, and maternal features such as early menarche and polycystic ovarian syndrome (Mitra & Ghosh, 2019). Hypertensive disorders in PW have significantly increased globally, from 10.9% in 1990 to 18.0% in 2019 (Mathew et al., 2023). However, the incidence rate based on age was reduced, with a projected yearly percentage variation being -0.68. In 2019, the number of pregnancy-related fatalities caused by high BP was around 27,830, which is a 30% decrease compared to 1990 ( Wang et al., 2021). Approximately 10% of pregnancies are affected by hypertension, a significant contributor to both mortality and morbidity (Yan et al., 2021). The global prevalence of HDP rose from 16.3 million to 18.08 million between 1990 and 2019, representing an increase of 10.92% (Wang et al., 2021b). Additionally, the proportion of PW with hypertensive disorders facing challenges also rose significantly from 28.1% in 2012 to 83.7% in 2019. Hypertension-related disorders are the primary reasons for maternal death during pregnancy, making up 14.0% of worldwide maternal fatalities. This is especially true in low and middle-income countries, where it is a significant basis of death among PW (Said, Malqvist, Pembe, Massawe, & Hanson, 2020, Agbeno et al., 2022).

Pregnancy-related hypertensive diseases disproportionately impact Black women, American Indian, and Alaskan Native women (Khedagi & Bello, 2021), mostly. Moreover, Black women have greater rates of severe morbidity and death associated with preeclampsia, whereas Hispanic women tend to have better pregnancy outcomes compared to Black. whereas pregnancy outcomes for Hispanic women seem to be more favourable compared to Black or Caucasian women with equal risk factors (Garovic et al., 2022).

## **Statement of the problem**

Maternal deaths remain a worldwide challenge, with a projected rate of 223 deaths per 100,000 live births, of which 70% the deaths emanate from Sub-Saharan Africa. Cardiovascular diseases (CVDs) significantly contribute to maternal mortality by exacerbating conditions such as preeclampsia, cardiomyopathy, and thromboembolism during pregnancy (Easter, 2024; Keepanasseril et al., 2021; Sahu et al., 2021). About 50.9% of PW exhibit one or more cardiovascular risk factors (Garanet et al., 2023). Gestational hypertension, in particular, is on the rise. In Ghana, hypertension during pregnancy is the leading cause of maternal deaths, accounting for approximately 13.2% of all deaths among women (Hermes et al., 2013; WHO, 2021, 2023).

Despite global efforts to reduce maternal mortality, the Central Region continues to record a higher-than-average maternal mortality ratio (MMR), estimated at 319 deaths per 100,000 live births, compared to the national average of 301 in 2021 (GHANA STATISTICAL SERVICE, 2024). CVD risk factors are a significant contributor to these high mortality rates (Kotit & Yacoub, 2021). The development of risk factors of CVD in pregnancy is influenced by socio-economic disparities, cultural norms, pre-existing maternal conditions, metabolic disorders, limited healthcare access, maternal age, urbanisation, unemployment and other lifestyle factors such as physical inactivity and poor dietary patterns (O’Kelly et al., 2022; Yarney, 2019). However, insufficient research that examined sociodemographic and maternal factors on the risk factors of CVD among PW within the Central Region's unique socio-economic and demographic landscape is a major concern.

Given this gap, it is essential to investigate the factors contributing to the development of physical inactivity, hypertension, overweight/obesity and poor dietary patterns among PW in the Central Region.

## **Purpose of the study**

The study examined the influences of socio-demographic factors on cardiovascular disease (CVD) risk factors among PW in the Cape Coast metropolis.

## **1.4 Significance of the Study**

The outcome of this research will have far-reaching benefits for PW, policymakers, healthcare providers, and health facility administrators. For PW, the study will shed light on the prevalence and factors contributing to the occurrence of CVD risk factors of CVD) during pregnancy. The results will help PW to adopt healthier lifestyles and seek timely medical care, which will ultimately improve maternal and fetal health

For policymakers, the key factors contributing to the risk of CVD are to develop policies and programs to address these challenges of maternal care.

Care providers will utilise the findings from this study to plan prenatal and postnatal care for PW, especially in education. PW will benefit from personalised health education, early risk screenings, and evidence-based strategies to prevent and manage these socio-demographic factors influencing the risk factors of CVD during pregnancy. This will enhance the quality of care given to PW and reduce pregnancy adverse outcomes.

## **1.5. Delimitation**

This research was restricted to PW who are both physically and mentally fit and are not undergoing treatment for any chronic ailments. Individuals having a prior history of recurrent miscarriages and other obstetric complications. PW having twin or triple gestations will be excluded. The individuals who are being surveyed should be receiving antenatal care (ANC) services at the University Hospital, Cape Coast Regional Hospital, and Adisadel Urban Health Centre, all within the Cape Coast Metropolis.

# **2.1 Methodology**

## **Research Design**

The study design for this study is a quantitative cross-sectional descriptive analytic study. It enables the researcher to assess the prevalence of high BMI, PA levels, BP levels, and poor dietary patterns among PW while simultaneously determining the correlation between SES, maternal characteristics, and CVD risk factors.

## **Study Area**

Cape Coast is the Capital town of the Central Region and the former capital of the Gold Coast, now Ghana. It is geographically situated along the Gulf of Guinea to the south and is bordered by Komenda Edina Eguafo Abrem Municipality to the west, Abura Asebu Kwamankese District to the east, and Twifu Heman Lower Denkyira District to the north. Covering an area of around 122 square KM, the Metropolis stretches to Brabadze, which lies approximately 17km from the capital of both the Metropolis and the Central Region.

Cape Coast's population has been steadily growing, reflecting its increasing urbanisation and the migration of people from rural areas in search of employment and better living conditions. The population growth has also led to an increase in demand for housing, education, and healthcare services, placing pressure on existing infrastructure and local government services. According to the most recent census data, the population of Cape Coast is estimated to range between 250,000 and 300,000 people. The population is diverse, with a mix of students, traders, civil servants, and individuals working in sectors such as tourism and fishing.

This growing population underscores the need for sustainable urban planning and improved public services to ensure that development in the city benefits all residents.

For this study, three hospitals within the Cape Coast Metropolitan area were randomly selected: Cape Coast Metropolitan Hospital (CCMH), University of Cape Coast Hospital (UCCH) and Adisadel Urban Health Centre.

Cape coast has a diverse socioeconomic profile which is influenced by its rich history, prestigious educational system, and developing metropolitan economy. It is the formal capital of Gold Coast, the city is now known for its educational establishments, especially the University of Cape Coast (UCC), which makes a substantial contribution to regional growth and employment (Ghana Statistical Service [GSS], 2021).

The main drivers of Cape Coast's economy are tourism, fishing, education, and informal trade. There are now more job options in the public sector, particularly in administration and education, because of the numerous educational systems in the area. A significant portion of the population engages in small-scale farming, fishing, and petty trading (GSS, 2021).

Cape Coast exhibits a **broad income disparity**, with a small upper-middle class composed of professionals and civil servants, while a significant portion of the population falls into the lower-income bracket. According to the Ghana Living Standards Survey (GLSS 7), the **poverty incidence in the Central Region stands at 23.4%**, which is higher than the national average of 23.0% (GSS, 2019). While Cape Coast, being an urban area, likely has a somewhat lower poverty rate than the regional average, **pockets of poverty remain prevalent,** particularly in peri-urban and coastal fishing communities, where access to infrastructure and services is limited.

## **Study Population**

The research was on expectant mothers who received antenatal care services from the three health facilities mentioned above. This included all expectant mothers who carried a live single foetus who attended antenatal clinics at the selected study areas either for the first time or not. All women who met the inclusion criteria were interviewed.

## **Inclusion criteria and exclusion criteria**

The study was conducted among PW attending antenatal care at three selected hospitals. Participants included those with confirmed pregnancies who were receiving antenatal care and provided informed consent to participate in the study within the randomly selected hospitals with the CCMA. Those with a previous history of inevitable abortion, pre-existing medical conditions such as hypertension, diabetes, or heart disease, multiple gestation, were excluded.

## **Sampling Procedure**

About 86% of PW attend antenatal clinics in a year in Ghana (GSS, 2007). The Leslie Kish formula was used to determine the sample size (Baligeh et al., 2023). . At 95% (1.96) confidence and 5% margin of error, a sample size of 150 was reached with 10% added to cater for unreturned questionnaires. Data collection took approximately 3 months, starting from May 2024 and ending in August 2024. Three health institutions were randomly selected from the five major health facilities in the metropolis. The annual attendance from each health facility was used to determine the system of random systematic method to be used in each institution over three months.

## **Data collection instruments**

The study used a structured questionnaire. Socio-demographic, maternal characteristics, and anthropometric data for calculating participants' BMI. Section A included age, education, employment, marital status, and religious affiliation. Section B included gestational age, family history of CVD, oral contraceptive use, breastfeeding, high blood pressure, gestational diabetes, PCOS, and fertility treatments.

Participants' blood pressure was measured twice using an Omron digital machine at 15-minute intervals. They rested for 30 minutes before taking the BP. The ideal BP was recorded using an adult cuff. Mean arterial pressure (MAP) was used for analysis (DeMers & Wachs, 2019).

The study used weight and height to calculate the BMI of PW (PW), using guidelines from the Institute of Medicine (IOM) as a reference point (Rasmussen et al., 2009).. The IOM average standard weight during pregnancy was subtracted from the current weight, taking into account the trimester. The standard weight gain in a normal woman with normal dietary practices is between 0.1kg to 2kg within the first trimester and 0.45 kg weekly after the first trimester. The average weight gain in each trimester was used as a benchmark to determine the actual weight of the PW at the time of data collection.

The International Wealth Index (IWI) (Smits & Steendijk, 2015) was used to measure the socioeconomic status (SES) of participants.

The Mediterranean Diet tool (Trichopoulou et al., 2003) was used to assess participants' dietary patterns, with a score of 9 or above indicating adherence. The data was pretested at Anamabo health centre, and any unclear variables were revised. The tool was culturally appropriate and well-suited to the research objectives, considering culturally specific activities within the Ghanaian context.

## **Sampling technique and sampling size**

A **multistage sampling technique** was employed. Out of five eligible health facilities, **three were randomly selected** to participate. Within each selected facility, **systematic random sampling** was used to recruit **PW who met the inclusion criteria.** A **sample size of 165 participants** was determined using the above formula, ensuring adequate power for statistical analysis and the reliability of the study findings. Of the 165 questionnaires administered, **160 were properly completed and subsequently used for the final analysis.**

Three qualified midwives were recruited and trained as research assistants over three days on proper questionnaire administration, ethical considerations, and confidentiality protocols. Each day after data collection, completed questionnaires were reviewed for completeness and securely stored. Participation was entirely voluntary, and informed consent was obtained from each participant, who was also informed of their right to withdraw from the study at any time without penalty.

## **Data Processing and Data Analysis.**

The data was analysed using IBM SPSS Statistics version 27.0 for descriptive analysis and R 4.4.1 for inferential statistics. Data was meticulously entered into SPSS, and two independent individuals conducted a visual inspection. Means were computed to identify outliers and missing values. Results were displayed in tables and graphs, and associations were determined using the multivariate structural equation model (SEM). Cross-tabulation was used to assess risk factors among participants.

## **Ethical consideration**

Ethical clearance of the research was sought from the Review Committee of the Research Department of the Ghana Health Service after the approval of the topic from the School of Nursing and Midwifery in the University of Cape Coast. Participants who were randomly selected were taken to a noise-free office for privacy and confidentiality, after they had agreed to take part in the study. Their names were not required. After each day's activity, the researcher meets with research assistants to collect all completed questionnaires. They were kept under key and lock

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# **RESULTS**

## **Demographic characteristics of respondents**

Table 1 below shows the distribution of the various demographic characteristics

**Table 1: Demographic characteristics of participants**

|  |  |  |
| --- | --- | --- |
| **Measure** | **Frequency** | **Percent** |
| **Facility** | | |
| CCMH | 45 | 28.1 |
| UCCH | 67 | 41.9 |
| ADISADEL | 48 | 30.0 |
| **Religion** | | |
| Muslim | 20 | 12.5 |
| Christian | 140 | 87.5 |
| **Educational level** | | |
| None | 3 | 1.9 |
| Primary | 9 | 5.6 |
| JHS | 49 | 30.6 |
| SHS | 53 | 33.1 |
| Tertiary | 46 | 28.8 |
| **Marital status** | | |
| Married | 85 | 53.1 |
| Single | 75 | 46.9 |
| **Trimester** |  |  |
| 1st | 21 | 13.1 |
| 2nd | 74 | 46.3 |
| 3rd | 65 | 40.6 |
| **Socioeconomic status** |  |  |
| Lower | 0 | 0 |
| Lower middle | 18 | 11.3 |
| Upper middle | 70 | 43.8 |
| High | 72 | 45.0 |

**Table 2: Age, parity and menarche of participants**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| Deliveries (parity) | 160 | 0.00 | 6.00 | 1.4063 | 1.51012 |
| Age of menarche | 160 | 6.00 | 20.00 | 13.8625 | 1.89832 |
| Age of participants | 160 | 16.00 | 42.00 | 29.0250 | 5.69779 |

University of Cape Coast Hospital, Adisadel Urban Hospital, and CCHM, representing 41.9%, 30.0%, and 28.1% of the sample, respectively. The majority of participants were Christians (87.5%), with the remaining 12.5% being Muslims, 1.9% had no formal education, 5.6% completed primary school, 30.6% completed Junior High School (JHS), 33.1% completed Senior High School (SHS), and 28.8% had completed tertiary education. Marital status was nearly evenly distributed, with 53.1% of participants being married and 46.9% single. About their trimester, 13.1% were in their first trimester, 46.3% in their second trimester, and 40.6% in their third trimester.

The obstetric history revealed a mean parity order of 1.41 deliveries, with some participants reporting as many as six deliveries, while others had none. The age of menarche ranged from 6 to 20 years, with a mean onset age of 13.86 years. Participants’ ages ranged from 16 to 42 years, with an average age of 29.03 years.

## **Past medical and obstetric history of participants**

Figure 1 below presents the past medical and obstetric history of the participants. A small proportion (12.5%) reported a family history of cardiovascular disease (CVD), 18.3% had previously used oral contraceptives, 51.2% had breastfed their children for over a year, 3.8% reported a history of hypertension during pregnancy, and another 3.8% had experienced gestational diabetes. Those who had a history of polycystic ovarian syndrome (PCOS) were 10.6%, while 6.9% had undergone fertility treatments.

**Figure 1: Past medical and obstetric history of participants**

## **Risk Factors of Cardiovascular Diseases**

**Table 3: Mean Arterial Pressure, BMI, and Dietary Pattern of participants**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency** | **Percent** |
| **Mean Arterial Pressure** | | |
| Optimal (MAP <93) | 129 | 80.6 |
| Normal (MAP b/n 93 and 105) | 19 | 11.9 |
| High normal | 8 | 5.0 |
| Grade 1 HPT | 3 | 1.9 |
| Grade 2 HPT | 1 | 0.6 |
| **Body Mass Index** | | |
| Underweight | 4 | 2.5 |
| Normal weight | 65 | 40.6 |
| Overweight | 43 | 26.9 |
| Obesity | 48 | 30.0 |
| **Dietary pattern** |  |  |
| Good | 77 | 48.1 |
| Poor | 83 | 51.9 |
| **Total** | **160** | **100.0** |

The majority of participants (80.6%) had MAP within the optimal range, while 11.9% exhibited normal MAP levels. Only 5.0% classified as having high-normal, 1.9% diagnosed with Grade 1 hypertension, and 0.6% with Grade 2 hypertension. In terms of BMI, 40.6% were normal, 26.9% classified as overweight, and 30.0% categorised as obese. Only 2.5% of participants were underweight. Dietary patterns revealed that 48.1% of participants reported good dietary practices, while the remainder indicated suboptimal dietary habits.

**The Relationship between SES and the CVD risk factors among PWs**

The study explores the association between SES and the risk factors of CVD. The table below presents varying levels of risk across SES categories, shedding light on the potential impact of SES on cardiovascular health during pregnancy.

**Table 4: Socioeconomic status and CVD risk factors**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SES Classification** | **MAP (Mean arterial pressure)** | | **Dietary pattern** | | **Body Mass Index** | |
| **No risk** | **Risk** | **No risk** | **Risk** | **No risk** | **Risk** |
| Lower middle | 17 | 1 | 9 | 9 | 7 | 11 |
| Upper middle | 69 | 1 | 27 | 43 | 35 | 35 |
| High | 70 | 2 | 41 | 31 | 26 | 46 |

***Mean Arterial Pressure***

The results revealed that PW with high **MAP is consistently low** across all SES classifications. In the lower-middle SES group, only 1 out of 18 women (5.6%) was classified to have high MAP and a similar pattern was observed in both the upper-middle and high SES groups, with just 1 (1.4%) and 2 (2.8%) women having high MAP, respectively. These findings indicate that mean arterial pressure, a key indicator of hypertension, is not a significant concern for the PW in this study, regardless of their SES classification. This suggest that the overall blood pressure levels of the PW in the sample are within the normal range, and that hypertension-related cardiovascular risks may not be a major factor for the majority of the participants.

***Dietary Pattern***

A higher proportion of PW in the **upper-middle SES group** were classified as not eating adequately, with 43 out of 70 women (61.4%) showing poor dietary patterns. This group also had the poorest dietary intake as compared to the lower-middle (9 out of 18, or 50%) and high SES (31 out of 72, or 43.1%) groups.

***Body Mass Index***

In the lower-middle SES group, 11 out of 18 women (61.1%) were classified as either overweight or obese. Similarly, in the high SES group, 46 out of 72 women (63.9%) were classified as overweight or obese. The upper-middle SES group had a lower proportion, with 35 out of 70 women (50%) having abnormal weight.

## **Prevalence of Risk Factors among PW**

Table 5 below provides an overview of CVD risk factors among the women in the study. Out of the 160 participants, only a small proportion, specifically 15.6% (25 women), have no identified CVD risk factors. A more substantial portion of the participants, accounting for 31.9% or 51 women, possess one CVD risk factor. The largest segment of the sample, 40% or 64 women, has two CVD risk factors.

Lastly, 12.5% of the participants, equating to 20 women, exhibit three cardiovascular risk factors, placing them in a high-risk category.

A significant majority (84.4%) of the PW have at least one CVD risk factor.

**Table 5: Number of risk factors per participant**

|  |  |  |
| --- | --- | --- |
| **Number of risk factors** | **Frequency** | **Per cent (%)** |
| None | 25 | 15.6 |
| One | 51 | 31.9 |
| Two | 64 | 40.0 |
| Three | 20 | 12.5 |
| Total | 160 | 100.0 |

## **Correlation Matrix**

The correlation study demonstrates the associations between SES and several CVD risk variables among PW, including MAP, BMI, dietary habits, and age.

The correlation between SES and mean arterial pressure (MAP) is positive but modest (r = 0.101). This association implies that socioeconomic gains may be related to increased BP, a recognised risk factor for CVD, but the relationship here is small.

A small positive association was also identified between SES and BMI (r = 0.170), showing that greater SES is associated with slightly higher BMI.

SES is slightly associated with diet quality (r = 0.077). This shows that if SES increases, food quality could also improve marginally. While this link is modest, it does suggest that women of higher SES may have somewhat greater access to healthful meals.

Lastly, age revealed a slight positive connection with SES (r = 0.199), indicating that older PW in this sample tended to have higher SES. While age itself is a non-modifiable characteristic, its link with SES might suggest that older women could be more financially secure or more educated, which can affect health-seeking behaviours and access to resources.

Overall, our data emphasise that among PW, greater SES is marginally linked with specific CVD risk variables such as BMI and blood pressure. Although the relationships are minor, the patterns identified here illustrate the subtle role that SES may have in impacting cardiovascular health risk during pregnancy. Further investigation is necessary to investigate these connections in more detail, especially to elucidate possible mediators and moderators of SES and CVD risk.

**Table 6: Correlation Matrix**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **MAP** | **BMI** | **Diet** | **PA** | **Age** | **SES** |
| MAP | 1.000 | 0.386 | 0.026 | -0.044 | 0.183 | 0.101 |
| BMI | 0.386 | 1.000 | -0.020 | -0.145 | 0.343 | 0.170 |
| DIET | 0.026 | -0.020 | 1.000 | 0.087 | 0.056 | 0.077 |
| Age | 0.183 | 0.343 | 0.056 | -0.005 | 1.000 | 0.199 |
| SES | 0.101 | 0.170 | 0.077 | -0.041 | 0.199 | 1.000 |

## **Structural Equation Model (SEM) Results**

This research examined the correlation between socioeconomic status (SES) and cardiovascular disease (CVD) risk variables, including blood pressure (BP), body mass index (BMI), and dietary habits in PW. Structural equation modelling (SEM) was used to evaluate the direct impacts of socioeconomic status (SES) on each risk factor, while controlling for pertinent confounders such as age, educational attainment, job status, marital status, prenatal visits, parity, cardiovascular disease history, contraceptive usage, and breastfeeding.

Age and marital status were substantially correlated with MAP, although SES and other factors exhibited non-significant associations. Age had a positive and substantial influence on BP (Estimate = 0.695, p < 0.001), suggesting that older PW generally exhibit elevated BP values. Marital status shows a significant positive correlation with BP (Estimate = 4.091, p = 0.010). In contrast, SES (Estimate = -0.002, p = 0.957), employment status (Estimate = 0.737, p = 0.547), educational level (Estimate = 1.198, p = 0.145), and contraceptive use (Estimate = 1.231, p = 0.517), did not reach any statistical significance, indicating that these factors may not be primary determinants of high MAP.

Body Mass Index (BMI), another key CVD risk factor, was substantially linked with age and marital status. Age exhibited a considerable positive influence on BMI (Estimate = 0.408, p < 0.001), showing the pattern of higher BMI with advancing age. Marital status was similarly associated with BMI (Estimate = 4.318, p < 0.001).

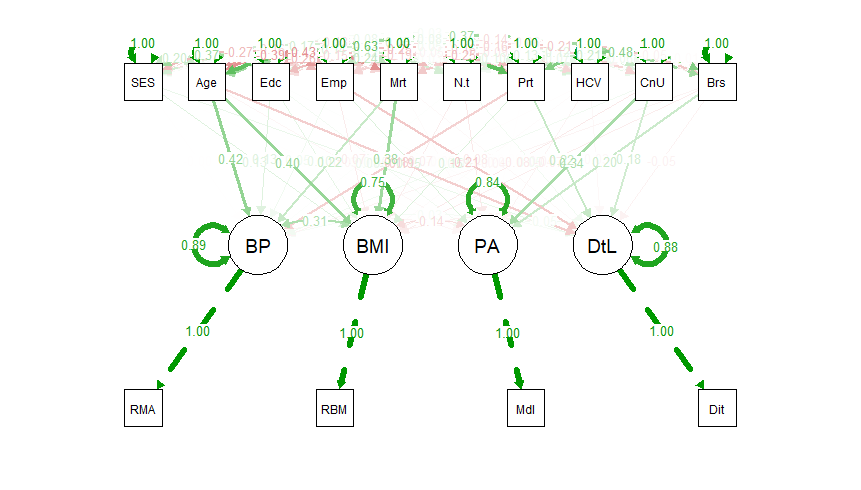
SES (Estimate = 0.037, p = 0.109), job status (Estimate = -0.619, p = 0.370), and parity (Estimate = 0.559, p = 0.174) were not significantly linked with BMI. Dietary habits revealed significant relationships with job status and contraceptive usage, but SES and age did not indicate relevant impacts. Employment status had a significant negative relationship with dietary patterns (Estimate = -0.687, p = 0.018).

Contraceptive usage positively affects food patterns (Estimate = 1.034, p = 0.021), indicating that women with a history of contraceptive use may adopt better dietary practices, presumably connected to health-conscious behaviours. SES showed a minimal, non-significant effect on eating patterns (Estimate = 0.009, p = 0.371). Educational level (Estimate = 0.014, p = 0.944) and age (Estimate = -0.075, p = 0.101) similarly did not exhibit significant impacts on food patterns. The findings underline that age and married status are key drivers of BMI and BP among PW, showing that both demographic and relational variables impact CVD risk factors.

**Table7: Regression Results for Cardiovascular Disease Risk Factors among PW**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Outcome** | **Predictor** | **Estimate** | **Std. Error** | **z-value** | **p-value** |
| **MAP** | SES | -0.002 | 0.041 | -0.054 | 0.957 |
|  | Age | 0.695 | 0.194 | 3.580 | *<*0.001 |
|  | Educational Level | 1.198 | 0.822 | 1.457 | 0.145 |
|  | Employment Status | 0.737 | 1.224 | 0.602 | 0.547 |
|  | Marital Status | 4.091 | 1.596 | 2.563 | 0.010 |
|  | No. of Antenatal Visits | 0.049 | 0.326 | 0.149 | 0.881 |
|  | Parity | -1.093 | 0.730 | -1.498 | 0.134 |
|  | History of CVD | -0.183 | 2.167 | -0.085 | 0.933 |
|  | Contraceptive Use | 1.231 | 1.897 | 0.649 | 0.517 |
|  | Breastfeeding | -0.800 | 1.631 | -0.490 | 0.624 |
| **BMI** | SES | 0.037 | 0.023 | 1.602 | 0.109 |
|  | Age | 0.408 | 0.109 | 3.727 | *<*0.001 |
|  | Educational Level | 0.582 | 0.463 | 1.256 | 0.209 |
|  | Employment Status | -0.619 | 0.690 | -0.897 | 0.370 |
|  | Marital Status | 4.318 | 0.899 | 4.801 | *<*0.001 |
|  | No. of Antenatal Visits | -0.184 | 0.183 | -1.005 | 0.315 |
|  | Parity | 0.559 | 0.411 | 1.359 | 0.174 |
|  | History of CVD | -0.277 | 1.221 | -0.227 | 0.820 |
|  | Contraceptive Use | -1.234 | 1.069 | -1.154 | 0.248 |
|  | Breastfeeding | -0.791 | 0.919 | -0.861 | 0.389 |
| **PA** | SES | -0.002 | 0.046 | -0.037 | 0.971 |
|  | Age | -0.063 | 0.217 | -0.291 | 0.771 |
|  | Educational Level | 0.529 | 0.920 | 0.575 | 0.565 |
|  | Employment Status | 2.315 | 1.370 | 1.690 | 0.091 |
|  | Marital Status | -0.350 | 1.786 | -0.196 | 0.845 |
|  | No. of Antenatal Visits | -0.392 | 0.364 | -1.076 | 0.282 |
|  | Parity | -0.031 | 0.817 | -0.038 | 0.969 |
|  | History of CVD | -1.433 | 2.425 | -0.591 | 0.555 |
|  | Contraceptive Use | 9.333 | 2.123 | 4.395 | *<*0.001 |
|  | Breastfeeding | 4.356 | 1.825 | 2.387 | 0.017 |
| **DIET** | SES | 0.009 | 0.010 | 0.894 | 0.371 |
|  | Age | -0.075 | 0.046 | -1.639 | 0.101 |
|  | Educational Level | 0.014 | 0.195 | 0.070 | 0.944 |
|  | Employment Status | -0.687 | 0.290 | -2.371 | 0.018 |
|  | Marital Status | -0.131 | 0.378 | -0.346 | 0.729 |
|  | No. of Antenatal Visits | 0.053 | 0.077 | 0.690 | 0.490 |
|  | Parity | 0.329 | 0.173 | 1.905 | 0.057 |
|  | History of CVD | -0.197 | 0.513 | -0.384 | 0.701 |
|  | Contraceptive Use | 1.034 | 0.449 | 2.304 | 0.021 |
|  | Breastfeeding | -0.221 | 0.386 | -0.574 | 0.566 |

***Figure 2 SEM path diagram***



**Model Summary and Fit Measures**

The structural equation model (SEM) analysis gave the following model summary and fit measurements, offering insight into the quality of the model fit and the estimating process.

The model uses a maximum likelihood (ML) estimator, optimised using the NLMINB approach. With a total of 160 data points, the model has 50 parameters. The user model test result is 0.000 with 0 degrees of freedom, indicating that the model is completely saturated, fitting the observed data exactly. The baseline model test statistic, by comparison, is 133.712 with 46 degrees of freedom and a very significant p-value (p < 0.001), demonstrating that the baseline model poorly matches the data compared to the user model.

The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) both obtained values of 1.000, denoting optimal model fit, with values close to 1 indicating outstanding fit in both indexes. The root mean square error of approximation (RMSEA) was 0.000, with a 90% confidence range spanning from 0.000 to 0.000, showing no disagreement between the model and observed data in the population. This is further reinforced by the Standardised Root Mean Square Residual (SRMR) of 0.000, showing a great match since SRMR values closer to 0 imply a better fit.

The model’s loglikelihood is -1985.729, with corresponding Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values of 4071.459 and 4225.218, respectively. The sample-size-adjusted BIC (SABIC) is 4066.936. These information requirements aid in analysing model parsimony, with lower values typically suggesting better model fit compared to alternative models.

The findings reveal a great model fit with 0% residual error and strong fit indices, demonstrating that the model accurately describes the data. These results demonstrate the robustness of the model in capturing the association between socioeconomic status and cardiovascular risk variables among PW.

**Table 8: Model Summary and Fit Measures**

|  |  |
| --- | --- |
| **Measure** | **Value** |
| Estimator | ML |
| Optimization Method | NLMINB |
| Number of Model Parameters | 50 |
| Number of Observations | 160 |
| Test Statistic (User Model) | 0.000 |
| Degrees of Freedom (User Model) | 0 |
| Test Statistic (Baseline Model) | 133.712 |
| Degrees of Freedom (Baseline Model) | 46 |
| P-value (Baseline Model) | 0.000 |
| CFI | 1.000 |
| TLI | 1.000 |
| Loglikelihood (User Model) | -1985.729 |
| AIC | 4071.459 |
| BIC | 4225.218 |
| SABIC | 4066.936 |
| RMSEA | 0.000 |
| 90% CI Lower (RMSEA) | 0.000 |
| 90% CI Upper (RMSEA) | 0.000 |
| SRMR | 0.000 |

## 4.10. **Covariances**

The covariance estimates among CVD risk factors and socioeconomic indicators, specifically MAP, BMI, PA, and DIET, offer insights into the interrelationships between these variables.

A substantial positive correlation was discovered between BP and BMI (estimate = 13.684, p < 0.001), with a normalised value of 0.313. This data demonstrates a substantial positive correlation between BP and BMI, indicating that when BMI rises, BP may also increase among the PW in the research. Given that both increased BP and raised BMI are known risk factors for CVD, this association underscores the relevance of BMI in impacting cardiovascular health during pregnancy.

The correlation between MAP and DIET, although positive (estimate = 0.552), was also non-significant (p = 0.704), with a normalised value of 0.030. This shows that food habits, as evaluated in this model, may have minimal direct association with BP levels among the research participants.

The negative correlation between BMI and PA (estimate = -6.784, p = 0.082) approached significance, with a normalised value of -0.139. This implies a possible trend where greater BMI may be marginally related to decreased PA levels, while the finding is not statistically significant. This tendency corresponds with prior studies relating to sedentary activities and increased BMI.

Similarly, the covariances between BMI and DIET (estimate = -0.521, p = 0.525) and between PA and DIET (estimate = 0.951, p = 0.558) were also non-significant, with standardised values of -0.050 and 0.046, respectively. These data imply that dietary habits, as defined here, are not highly linked with either BMI or PA among the PW investigated.

In summary, whereas BMI and BP show a substantial positive link, the associations between other CVD risk variables (PA and DietLatent) and SES-related indicators are modest and largely non-significant. This shows that, within this cohort, BMI may be a more essential factor in impacting cardiovascular health, with less apparent relationships reported for PA and nutrition. Further investigation might clarify these correlations and find other variables on CVD risk.

**Table 9: Covariances**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Covariance** | **Estimate** | **Std. Err** | **z-value** | **P-values** | **Std.lv** | **Std.all** |
| MAP BMI | 13.684 | 3.621 | 3.779 | 0.000 | 0.313 | 0.313 |
| MA PA | -2.916 | 6.865 | -0.425 | 0.671 | -0.034 | -0.034 |
| MAP DIET | 0.552 | 1.451 | 0.380 | 0.704 | 0.030 | 0.030 |
| BMI PA | -6.784 | 3.904 | -1.738 | 0.082 | -0.139 | -0.139 |
| BMI DIET | -0.521 | 0.819 | -0.636 | 0.525 | -0.050 | -0.050 |
| PA DIET | 0.951 | 1.625 | 0.585 | 0.558 | 0.046 | 0.046 |

**Variances**

The variance estimates for the CVD risk factors and SES indicators give insights into the degree of variability for each component among PW in this research.

For the parameters MAP, BMI, PA, and DIET, the variance estimates were 0.000, with matching standard errors and z-values similarly at 0.000, showing that these variables did not contribute further unexplained variability to the model. This conclusion shows these characteristics may either be restricted by the model or have low variance within this particular sample.

In contrast, blood pressure (BP) revealed a significant variance estimate of 77.560 (p < 0.001), with a normalised estimate of 0.888, showing high unexplained variability in BP across the subjects. This heterogeneity underlines the relevance of blood pressure as a significant determinant for cardiovascular health in this group, perhaps impacted by variables not included within the model.

BMI also exhibited substantial variability, with an estimate of 24.631 (p < 0.001) and a standardised value of 0.750. This reveals large variability in BMI levels among PW, supporting BMI as a key CVD risk factor that varies between people, presumably related to socioeconomic or lifestyle disparities.

Lastly, the dietary pattern latent variable (Diet) demonstrated a significant variance of 4.341 (p < 0.001) and a standardised variance of 0.880. This data suggests considerable diversity in food patterns among the women, indicating that poor nutrition is a major component contributing to individual CVD risk profiles.

In summary, BP, BMI, PA, and Diet all revealed considerable and noteworthy variability, underlining their importance as critical determinants related to cardiovascular health among PW. These differences underscore the relevance of addressing these modifiable risk variables in programs aiming at lowering CVD risk within this group.

**Table 10: Variances of the CVDs risk factors of the SEM model**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variance** | **Estimate** | **Std. Err** | **z-value** | **P-values** | **Std.lv** | **Std.all** |
| MAP | 77.560 | 8.672 | 8.944 | 0.000 | 0.888 | 0.888 |
| BMI | 24.631 | 2.754 | 8.944 | 0.000 | 0.750 | 0.750 |
| PA | 97.123 | 10.859 | 8.944 | 0.000 | 0.842 | 0.842 |
| DIET | 4.341 | 0.485 | 8.944 | 0.000 | 0.880 | 0.880 |

# 

# **DISCUSSION**

The study examined the relationship between socioeconomic status (SES) and cardiovascular disease (CVD) risk factors in PW, focusing on blood pressure (BP), body mass index (BMI), and dietary habits. Similar research globally aligns with or contrasts these findings in various ways.

**Socio-Demographic and Maternal Characteristics of PW at Risk of CVD**

The socio-demographic and maternal characteristics of the participants revealed important patterns in the prevalence of CVD risk factors. Among the participants, 51.9% exhibited poor dietary patterns, 57.5% had abnormal body weight (overweight or obese), and 37.5% were physically inactive, indicating significant lifestyle-related risks. In contrast, only 2.5% had high Mean Arterial Pressure (MAP), suggesting that hypertension was not a widespread concern in this cohort. These findings align with studies conducted in different regions. For instance, a study by Syed Nor et al. (2022) in Malaysia found that 38.3% of PW were inactive, while in China, 47.5% of PW reported physical inactivity (Xie et al., 2022).

Regarding BMI, the findings of this study are consistent with other research showing a high prevalence of abnormal BMI among PW. For instance, Chairat et al. (2023) found that more than 50% of PW were classified as overweight. Similarly, Deputy et al. (2015) found that 47.2% of PW had a BMI above normal. A recent systematic review of obesity and overweight among PW revealed a 43.8% pooled prevalence (Kent et al., 2024). The high prevalence of abnormal BMI in this study further emphasises the growing concern over abnormal weight gain during pregnancy, which is a well-known risk factor for CVD and other health complications. However, the prevalence in this study is significantly higher than findings in Croatia, where only 29.2% of PW were classified as overweight or obese (Vince et al., 2021). Cultural perceptions of body size may explain some of these variations, as larger body sizes in some African and African diaspora communities are often associated with wealth, beauty, and dignity (Appiah et al., 2016; Hoenink et al., 2021; Naigaga et al., 2018). These cultural factors may contribute to higher rates of obesity and overweight in these populations, which could explain the differences in BMI prevalence between this study and others conducted in different regions.

In terms of dietary habits, the study found that 51.9% of participants exhibited poor dietary patterns, which is consistent with findings from Garanet et al. (2023) and Franck (2021). Global researchers have shown that unhealthy diets contribute significantly to hypertension and metabolic disorders in PW, directly correlating with future cardiovascular risk. These findings align with the current study’s results, highlighting poor dietary habits as a major risk factor for CVD among PW. The prevalence of poor dietary patterns in this study contrasts with lower percentages observed in some developing countries, where limited access to affordable, nutritious food might contribute to poor dietary habits, further exacerbating cardiovascular risks.

**Socio-Demographic Predictors of PW at Risk of CVD**

The analysis identified several socio-demographic factors, such as age and marital status, as significant predictors of CVD risk among PW. Specifically, older maternal age was significantly correlated with increased BMI (Estimate = 0.408, p < 0.001), which is a well-established risk factor for CVD. Age-related increases in BMI are documented in studies by Gozuyesil et al. (2025), which suggests that older women tend to have higher BMI due to metabolic changes and lifestyle factors that become more pronounced with age. Similarly, marital status was found to influence BMI, with married women being more likely to have higher BMI (Estimate = 4.318, p < 0.001), likely due to lifestyle factors, shared resources, and social support mechanisms. This finding is consistent with research by (Corrêa et al., 2024; Silva et al., 2008), who found that marital status was positively correlated with higher BMI in PW (Lee et al., 2020).

However, SES did not exhibit a significant effect on BMI in this study, which contrasts with findings from studies in high-income countries, such as (Kominiarek et al., 2018), which highlighted that lower SES was linked to elevated BMI due to limited access to nutritious food and healthcare services. The lack of a significant SES impact in this study could be due to factors such as greater access to healthcare resources or more homogenous access to nutrition and exercise in the sample population.

**Influence of Socio-Demographic Factors on Cardiovascular Risk among Diverse Maternal Groups**

The findings from this study revealed that socio-demographic factors, including age, marital status, and employment, influence CVD risk factors such as BMI and dietary habits. For instance, studies in high-income countries often emphasise SES as a key predictor of BMI, with lower SES being linked to higher obesity rates due to limited access to healthcare and nutritious food (Kominiarek et al., 2018). In contrast, the current study found that socio-demographic factors such as age and marital status had more significant effects on CVD risk factors than SES alone. The lack of a strong SES effect may be due to various factors, including access to healthcare resources or community-based health interventions that mitigate the negative impacts of lower SES.

Employment status and contraceptive use were significant predictors of dietary patterns, with employed women reporting more time constraints that negatively impacted their dietary habits, aligning with findings from Bangladesh (Islam et al., 2016). Contraceptive use was positively associated with better dietary patterns, similar to findings from (Barker et al., 2008).

The overall findings suggest that while socio-demographic factors such as age and marital status significantly influence CVD risk factors among PW, the role of SES is complex and may vary based on local context, healthcare infrastructure, and cultural norms. This study underscores the importance of considering both demographic and lifestyle factors when designing interventions to reduce CVD risk during pregnancy, especially in diverse socio-economic contexts.

## **5.1. Summary**

The study aimed to explore the relationship between socioeconomic status (SES) and the presence of cardiovascular risk factors among PW. The results provide valuable insights into the distribution and severity of key cardiovascular risks, including mean arterial pressure (MAP), body mass index (BMI), and dietary patterns. The findings revealed that cardiovascular risk is prevalent across all SES groups, albeit with variations in the number and severity of risk factors.

**Prevalence of Cardiovascular Risk Factors**

The prevalence of cardiovascular risk factors among PW in this study was significant across all SES categories. MAP risk was notably low, with only 2.5% of women exhibiting elevated MAP. This suggests that MAP is not a major concern in this study population. The relatively low MAP risk across SES groups is encouraging, as effective monitoring and control of blood pressure could be contributing factors. However, this finding does not discount the need for continued vigilance regarding hypertension during pregnancy, particularly in women with multiple risk factors.

In contrast, BMI emerged as a key area of concern. A significant proportion of women, 57.5%, were classified as being at risk due to overweight or obesity. This finding is particularly concerning as high BMI is an established risk factor for both cardiovascular diseases and complications during pregnancy, such as gestational diabetes and preeclampsia. The prevalence of overweight and obesity underscores the importance of interventions aimed at promoting a healthy weight and preventing excessive weight gain during pregnancy.

Dietary patterns were also a significant concern, with 51.9% of participants exhibiting poor eating habits. A poor diet, characterised by low fruit and vegetable intake and high consumption of processed foods, is a known contributor to CVD. The high proportion of women with poor dietary patterns suggests that nutritional interventions should be prioritised as part of prenatal care. The role of dietary education in managing and reducing CVD cannot be overstated.

**SES and CVD Risk Factors**

The relationship between SES and CVD risk factors was an important aspect of the analysis. The study revealed that lower-middle SES women were particularly vulnerable to accumulating multiple risk factors, with 50% of participants in this group having two risk factors. This finding suggests that lower SES is associated with a higher likelihood of experiencing multiple cardiovascular risks. The increased risk in this group could be attributed to several factors, including limited access to healthcare, poor diet, and reduced opportunities for physical activity, all of which are commonly observed in lower SES populations.

Interestingly, upper-middle and high SES groups also exhibited notable levels of CVD risk. While lower SES women had a higher proportion of women with two risk factors, upper-middle and high SES women showed a significant incidence of two and three risk factors, especially in the high SES group (44.4%). This means that higher SES does not offer complete protection against CVD risks. Even in these groups, factors such as sedentary lifestyles, stress, and poor dietary habits seem to contribute to the accumulation of CVD. These findings challenge the common assumption that higher SES automatically correlates with better health outcomes and underscore the need for targeted interventions that address lifestyle factors common to all SES groups.

**Socioeconomic status and its impact on individual CVD Risk factors**

The correlation between SES and BP, though modest (r = 0.101), suggests that higher SES might be linked with slightly elevated BP among PW. While the association was small, it is in line with findings from studies that suggest that individuals from higher SES backgrounds often experience increased stress or engage in less healthy lifestyle practices, which may contribute to higher blood pressure (Kraft & Kraft, 2021). However, this result contrasts with some studies, which have shown a more substantial impact of SES on BP, likely due to variations in lifestyle factors, access to healthcare, and diet (Qin et al., 2022). In this cohort, the small effect size may be attributable to other dominant factors such as age or marital status, which may overshadow SES in influencing BP levels.

The finding of a modest positive correlation between SES and BMI (r = 0.170) also mirrors existing literature, which often links higher SES with increased BMI due to better access to food, sedentary lifestyles, or stress-induced eating. However, the correlation was still relatively weak, indicating that while SES plays a role in BMI, other factors such as physical activity and health education might mitigate its effect. This aligns with studies suggesting that higher SES alone does not guarantee a higher BMI but is often compounded by other variables such as dietary habits and exercise patterns.

In terms of dietary habits, the weak positive correlation between SES and diet quality (r = 0.077) suggests that higher SES women may have slightly better dietary patterns. While this finding is consistent with the notion that wealthier individuals typically have access to healthier food, the modest association indicates that SES alone may not significantly influence diet. Research has shown that access to quality food is a key determinant of dietary habits, but factors such as cultural preferences, time constraints, and education may play a more significant role in shaping food choices (Larson et al., 2006). Therefore, while SES is a contributing factor, its impact on diet quality appears limited in this cohort.

**Severity of Risk Factor Accumulation**

While the study found that no participant had all four cardiovascular risk factors, the accumulation of two or three risk factors was prevalent in many participants. This is particularly significant as the presence of multiple risk factors can exacerbate the overall risk of developing CVD during pregnancy and later in life. The upper-middle SES group had the highest proportion of women with three risk factors, suggesting that even women with higher SES are at risk for severe CVD complications.

Lower-middle SES women had the lowest proportion of women with three risk factors, yet still exhibited a high proportion of women with two risk factors. This highlights the compounding effects of multiple CVD risks and the importance of early intervention in these women to prevent the escalation of risk factors.

**Marital Status and Age as Predictors of CVD Risk**

The study revealed that age was a significant predictor of both BP (Estimate = 0.695, p < 0.001) and BMI (Estimate = 0.408, p < 0.001), which is consistent with a wealth of research linking advancing age with higher CVD risk. Older PW in this study exhibited higher BP and BMI levels, reinforcing the idea that age is a critical determinant of CVD risk factors. This finding underscores the importance of age as a non-modifiable risk factor in pregnancy, which warrants increased monitoring and early intervention for older PW.

Similarly, marital status was found to have a significant positive association with both BP (Estimate = 4.091, p = 0.010) and BMI (Estimate = 4.318, p < 0.001), suggesting that married or cohabiting women may experience increased CVD risk compared to their unmarried counterparts. This aligns with studies that indicate marital status can impact health outcomes, possibly due to stress, lifestyle habits, or shared resources within a marriage (Umberson et al., 2010). Married women may face additional stressors or engage in less healthy behaviours, which could contribute to higher BP and BMI. These findings further highlight the need for targeted prenatal care that considers marital status as a risk factor.

**Interaction of SES, Lifestyle Factors, and CVD Risk**

One of the key findings of this study was the lack of a significant association between SES and PA, contrary to what would be expected based on broader literature.

Similarly, dietary habits were found to be significantly influenced by employment status (Estimate = -0.687, p = 0.018) and contraceptive use (Estimate = 1.034, p = 0.021), while SES showed no significant effect. Employed women were found to have poorer dietary patterns, possibly due to time constraints, stress, or limited access to nutritious food due to busy schedules. This finding is consistent with studies that show that employed individuals may struggle to maintain healthy eating habits due to a lack of time or resources. On the other hand, contraceptive use was positively associated with better dietary habits, which could be reflective of health-conscious behaviours among women using contraception. These findings suggest that factors beyond SES, such as employment status and reproductive health choices, may play a more significant role in influencing dietary habits.

The findings of this study demonstrate some alignment with existing research on the relationship between socio-demographic factors and CVD risk, particularly the significant influence of age and marital status. However, the study also presents contrasting findings in terms of the role of SES. While SES is typically viewed as a significant predictor of health outcomes, its impact on CVD risk in this cohort was modest, suggesting that SES may not be as influential as other socio-demographic factors like age or marital status. This could be due to the specific context of the study, where other unmeasured variables (e.g., access to healthcare, local health policies, or community support systems) might have played a more significant role in shaping maternal health.

**Correlation between SES and Risk Factors**

The analysis of correlations between SES and CVD risk factors revealed modest relationships. A slight positive correlation between SES and BMI indicated that higher SES women are more likely to experience higher levels of BMI, potentially due to dietary patterns and lifestyle factors. A slight positive correlation between SES and dietary patterns was observed, although the relationship was not strong. This indicates that women in higher SES groups may, on average, exhibit slightly better dietary habits compared to those in lower SES groups, but the correlation is not robust enough to suggest a definitive trend.

The findings highlight the prevalence of CVD risk factors among PW across all SES groups, with BMI and dietary patterns emerging as key risk factors. While MAP risk was low, multiple risk factors were common, particularly in the lower-middle SES group, where women were more likely to experience two or more risks. However, the upper-middle and high SES groups also exhibited considerable risk, particularly in terms of BMI and physical inactivity. These proposed that CVD risks during pregnancy are prevalent across all SES categories and that interventions should focus on managing modifiable risk factors, such as diet and weight management, in PW. Further research is needed to explore the underlying causes of these associations and to develop tailored strategies to reduce cardiovascular risk in PW from different socioeconomic backgrounds.

## **5.2. Conclusion**

This study underscores the complex interplay between socio-demographic and lifestyle factors in influencing cardiovascular risk among PW. While age and marital status emerged as strong predictors of CVD risk factors, SES had a more modest impact. The findings suggest that future interventions should focus on the socio-demographic factors most strongly associated with CVD risk, such as age and marital status, while also addressing lifestyle factors like diet, which can be influenced by employment and reproductive health choices. Further research is needed to explore the nuanced relationships between SES, lifestyle behaviours, and cardiovascular health, particularly in different cultural and geographical contexts.

## **5.3. Recommendation**

Based on the insights from this study on the impact of socioeconomic status, age, marital status, and other variables on CVD risk factors among PW, here are some targeted recommendations for parents, spouses, healthcare professionals, policymakers, and hospital staff.

Firstly, spouses and family members should **e**ncourage PW to stay active by offering support, whether by taking walks together, helping with household responsibilities, or facilitating time for exercise. Family support is essential for maintaining healthy activity levels, especially in the face of daily stressors.

They should also ensure access to nutritious food choices at home by cooking healthy meals and maintaining a supportive environment for balanced eating habits. Marital support, particularly from spouses, can positively influence dietary habits by fostering a culture of healthy eating in the household.

Management of Stress Levels should be considered among these vulnerable people. Recognise that PW may experience additional stress, particularly if they are balancing work and pregnancy. Providing emotional support and helping to alleviate daily pressures can help reduce stress-related impacts on blood pressure.

Secondly, nurses and prenatal healthcare providers monitor age and marital Status-Related Risks of CVD: Given the positive correlation between age, BP and BMI, healthcare providers should monitor these variables closely. Nurses should assess older PW more frequently for hypertension and weight gain, providing tailored advice on managing these risk factors.

Since contraceptive use was associated with better dietary practices, nurses could promote contraceptive counselling as part of general health education, as it may correlate with health-conscious behaviour.

Implement Dietary Education for Working PW. Since employment was associated with less healthy dietary habits, policymakers should advocate for nutritional support programs tailored to employed PW, including resources for quick, healthy meal planning. Flexible work policies could be encouraged to provide breaks for meal preparation and promote work-life balance.

Administrators should develop initiatives that offer widespread prenatal education focusing on lifestyle factors, such as dietary practices and physical activity. Educational campaigns should specifically target lower SES groups to mitigate health disparities, emphasising affordable ways to stay active and eat healthily.

Hospital Workers and Maternal Health Clinics should integrate routine screening for high blood pressure and high BMI, especially among older and married PW, as these groups may be at higher risk of CVD. Maternal health clinics can establish protocols for closer monitoring of these populations.

Offer on-site or referral-based nutritional counselling for PW, especially those who are employed, to guide them in making healthy dietary choices. This service should emphasise easy-to-prepare, nutritious meals that align with busy schedules.

Promote frequent prenatal visits to monitor physical activity, dietary habits, and overall health, especially among high-risk groups. Regular check-ins with healthcare professionals can provide opportunities to reinforce healthy lifestyle behaviours.

Stakeholders should take it as a responsibility to educate the community on the impact of age on pregnancy health, emphasising the need for proactive health management for older PW. Awareness campaigns could focus on the importance of regular blood pressure checks, healthy weight maintenance, and proper nutrition during pregnancy. Stakeholders should implement programs and initiatives that reach PW of all socioeconomic backgrounds, emphasising that health behaviours like poor diet are crucial for maternal and foetal health. Educational materials should be widely accessible and cover cost-effective ways to adopt healthy lifestyles.

These recommendations are intended to address the different CVD risk factors identified in the study, emphasising lifestyle interventions, comprehensive support, and education across various demographics to promote the health of PW and reduce risk factors for adverse pregnancy outcomes.

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