***Impact of lifestyle modification for Prevention and Management of Thyroid and Hypertension in Pregnant Women: A Study***

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**Abstract**

Pregnancy represents a physiologically transformative phase in a woman’s life, marked by complex hormonal, metabolic, and cardiovascular adaptations that are essential for fetal development but simultaneously heighten the mother’s vulnerability to several health complications. Among these, thyroid dysfunction and hypertensive disorders of pregnancy (HDP) are of particular concern due to their significant impact on maternal and fetal outcomes. Globally, thyroid disorders—encompassing hypothyroidism and hyperthyroidism—affect approximately 5–15% of pregnancies, with prevalence largely dependent on regional iodine sufficiency and healthcare access. These disorders, if undetected or poorly managed, can result in miscarriage, preterm birth, low birth weight, neurodevelopmental deficits, and increased perinatal mortality. Hypertensive disorders, which include chronic hypertension, gestational hypertension, preeclampsia, and eclampsia, are present in nearly 10% of pregnancies worldwide and are a leading cause of maternal mortality, particularly in low- and middle-income countries (LMICs). The co-occurrence of these conditions further compounds risks, as subclinical hypothyroidism has been associated with increased preeclampsia risk, while hyperthyroidism may precipitate vascular and metabolic changes contributing to gestational hypertension.

Despite advances in clinical management, the integration of preventive, lifestyle-based strategies into antenatal care remains insufficient in many settings, including India. Lifestyle modification—defined as purposeful changes in diet, physical activity, stress regulation, and sleep hygiene—has emerged as a cost-effective, sustainable approach to managing non-communicable diseases, including pregnancy-related complications. Empirical evidence underscores that interventions such as regular moderate exercise, balanced nutrition, and stress reduction can significantly lower the incidence and severity of hypertension and improve thyroid function. However, awareness of these preventive measures among pregnant women remains suboptimal, particularly in rural and underserved communities, where socio-cultural barriers, limited health literacy, and inadequate antenatal counseling hinder adoption. This gap necessitates targeted interventions that educate and empower women to take an active role in managing their health.

The present study, conducted in selected urban and semi-urban healthcare facilities in India, was designed to evaluate the impact of structured lifestyle modification interventions on the prevention and management of thyroid dysfunction and hypertension among pregnant women. Adopting a quasi-experimental pre-test and post-test design, the research involved participants aged 18–45 years who were registered for antenatal care, across all trimesters, and at risk of or diagnosed with thyroid dysfunction and/or hypertension. Women with significant comorbidities such as diabetes, renal disease, or cardiovascular disorders were excluded to ensure that outcomes could be attributed primarily to the intervention. The intervention group received structured educational sessions covering dietary guidelines, exercise demonstrations, and stress management techniques, while the control group received routine antenatal care without additional counseling. Baseline and post-intervention assessments included measurements of awareness, lifestyle practices, blood pressure, and biochemical markers (TSH, T3, T4), as well as feedback from participants.

The educational module was designed to address the specific cultural and socio-economic contexts of the participants. Dietary recommendations emphasized balanced, nutrient-rich foods including fruits, vegetables, whole grains, and iodine-rich sources, while minimizing excess salt and processed food consumption. Physical activity guidance included safe, pregnancy-appropriate exercises such as walking and prenatal yoga, with emphasis on regularity and moderation. Stress management strategies focused on breathing exercises, relaxation techniques, and sleep hygiene. To ensure retention and application of knowledge, participants received repeated reinforcement through follow-up visits, printed materials, and one-on-one counseling during antenatal check-ups. The study also incorporated mechanisms to monitor adherence, including self-reported logs and periodic verification during visits.

Data analysis employed descriptive and inferential statistics, including paired t-tests, McNemar’s test, Wilcoxon signed-rank test, and correlation analyses to examine the relationship between awareness levels, demographic variables, and clinical outcomes. Pre-intervention findings revealed that a substantial proportion of participants lacked adequate knowledge regarding the symptoms, risks, and preventive measures for thyroid dysfunction and hypertension. Awareness scores were particularly low among women with lower educational attainment, lower socio-economic status, and those residing in extended family structures with limited decision-making autonomy. Lifestyle practices prior to intervention were often suboptimal, characterized by sedentary behavior, irregular meal patterns, low intake of micronutrient-rich foods, and inadequate rest.

Post-intervention results demonstrated a statistically significant improvement in awareness scores across all demographic groups, with the greatest gains observed among women with previously low baseline knowledge. Adoption of recommended lifestyle practices increased markedly, with more participants reporting regular physical activity, adherence to balanced diets, and use of stress management techniques. Clinically, the intervention group exhibited notable improvements in blood pressure control, with reductions in both systolic and diastolic values, and more stable thyroid hormone profiles, as evidenced by normalization of TSH levels in a subset of participants. There was also a decrease in the proportion of women requiring initiation or dosage escalation of antihypertensive or thyroid medication. These findings support the hypothesis that lifestyle education can have a measurable impact not only on knowledge and self-reported behaviors but also on physiological health indicators.

Participant feedback indicated high levels of satisfaction with the intervention, with many women expressing increased confidence in managing their health during pregnancy and reporting a greater sense of empowerment in making dietary and activity-related decisions. The cultural tailoring of the program, use of simple language, visual aids, and inclusion of family members in counseling sessions were cited as factors that enhanced understanding and acceptance. The study also identified certain barriers to full adherence, including time constraints due to household responsibilities, limited access to fresh produce in some areas, and persistent cultural beliefs that discouraged physical activity during pregnancy.

This research carries important implications for clinical practice, public health policy, and future research. Clinically, it underscores the value of incorporating structured lifestyle education into routine antenatal care as a complement to medical management, potentially reducing the need for pharmacological intervention in some cases. Public health-wise, it aligns with national initiatives such as POSHAN Abhiyaan and Janani Suraksha Yojana, offering a scalable model for integrating behavior change communication into maternal health programs. For policymakers, the findings suggest that low-cost, culturally sensitive interventions can yield substantial health benefits and should be prioritized in resource allocation and program design. From a research perspective, the study highlights the need for long-term follow-up to assess postpartum outcomes, adherence sustainability, and intergenerational health effects.

In conclusion, thyroid dysfunction and hypertensive disorders during pregnancy present a significant public health challenge, with potential consequences extending beyond the perinatal period. This study demonstrates that lifestyle modification interventions—when tailored to the socio-cultural context and delivered through structured, accessible educational modules—can significantly enhance awareness, promote healthy behaviors, and improve clinical outcomes among pregnant women. The evidence generated provides a strong case for scaling up such interventions as part of integrated antenatal care strategies in India and similar settings. By bridging the gap between clinical evidence and community-level practice, this approach offers a practical, cost-effective pathway to reducing preventable maternal and fetal complications, thereby contributing to the broader goals of maternal health improvement and sustainable development.

**Keywords:** Lifestyle Modification; Thyroid Dysfunction; Hypertensive Disorders of Pregnancy; Maternal Health Educationl Antenatal Care.

**List of Abbreviations**

**ACOG** – American College of Obstetricians and Gynecologists

**BCC** – Behavior Change Communication

**BP** – Blood Pressure

**BPD** – Bronchopulmonary Dysplasia

**CH** – Congenital Hypothyroidism

**CHIPS** – Control of Hypertension in Pregnancy Study

**DBP** – Diastolic Blood Pressure

**EMR** – Electronic Medical Records

**FIGO** – International Federation of Gynecology and Obstetrics

**HDP** – Hypertensive Disorders of Pregnancy

**HRT** – Hormone Replacement Therapy

**HT** – Hypothyroidism

**HTN** – Hypertension

**IUGR** – Intrauterine Growth Restriction

**LMICs** – Low- and Middle-Income Countries

**LARC** – Long-Acting Reversible Contraception

**MD** – Major Depression

**MP** – Multiple Pregnancies

**NCD** – Non-Communicable Disease

**PIH** – Pregnancy-Induced Hypertension

**POSHAN** – Prime Minister’s Overarching Scheme for Holistic Nourishment (Abhiyaan)

**PPD** – Postpartum Depression

**PPA** – Postpartum Anxiety

**PRISMA** – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

**PTSD** – Post-Traumatic Stress Disorder

**RCT** – Randomized Controlled Trial

**RBC** – Red Blood Cell

**SBP** – Systolic Blood Pressure

**SD** – Standard Deviation

**TH** – Thyroid Hormones

**TRAb** – Thyrotropin Receptor Antibody

**TSH** – Thyroid-Stimulating Hormone

**USA** – United States of America

**WHO** – World Health Organization

**YMCA** – Young Men’s Christian Association (mentioned in exercise context)

**VLBW** – Very Low Birth Weight

**LBW** – Low Birth Weight

**NICU** – Neonatal Intensive Care Unit

**Chapter 1**

**Introduction**

**1.1 General Introduction**

Pregnancy is a biologically complex and emotionally profound phase that transforms every aspect of a woman’s life (Baber et al., 2016; Whelton et al., 2018). This physiological journey involves substantial hormonal and metabolic changes that support fetal development but simultaneously increase the mother’s vulnerability to various health conditions. Among the most significant and commonly reported complications during pregnancy are hypertensive disorders and thyroid dysfunction. These conditions, if unmanaged, can lead to severe maternal and fetal consequences, including preterm labor, intrauterine growth retardation, and perinatal mortality (Pingili et al., 2017; Williams et al., 2018).

Hypertension during pregnancy affects approximately 10% of all pregnancies worldwide, making it a leading cause of maternal mortality and perinatal morbidity (Appel et al., 1997; Kamravamanesh et al., 2018). It includes a spectrum of conditions such as chronic hypertension, gestational hypertension, preeclampsia, and eclampsia (Tinawi, 2020). Preeclampsia alone contributes to a significant percentage of maternal deaths, particularly in low- and middle-income countries (LMICs) (Bowman et al., 2007; Gillison et al., 2019). Parallelly, thyroid dysfunction—both hypothyroidism and hyperthyroidism—has been identified in 5–15% of pregnancies depending on the iodine status of the population (Heidari et al., 2022; Nadeem et al., 2025). Thyroid hormones are crucial for fetal brain development, especially in the first trimester, and any disturbance in maternal thyroid homeostasis can result in developmental anomalies (Therapy, 2008).

Emerging evidence also indicates a bidirectional relationship between these two disorders. Studies have found that untreated or poorly controlled hypothyroidism is associated with an increased risk of preeclampsia and gestational hypertension (Chow et al., 2024; Johnson, 2019). Conversely, hyperthyroidism during early pregnancy may also contribute to hypertensive disorders due to its systemic metabolic impacts (Sundström et al., 2011). These interlinkages necessitate not only vigilant monitoring but also effective prevention strategies that address both medical and lifestyle factors.

Lifestyle modification has emerged as a cornerstone in preventing and managing a range of non-communicable diseases, including those experienced during pregnancy (Nieto et al., 2000). It encompasses behavior-driven interventions involving nutritional adjustments, physical activity, stress reduction, and adequate sleep, tailored to the specific needs of pregnant women. According to Letras (2005), physical activity such as walking or yoga significantly reduces the risk of gestational hypertension and helps maintain systolic and diastolic blood pressure within normal limits. Moreover, maternal adherence to balanced dietary patterns rich in fruits, vegetables, whole grains, and micronutrients has shown to improve both maternal health and fetal outcomes (Evans & Frank, 1997; Salpeter et al., 2006).

Despite the benefits, awareness regarding thyroid and hypertensive risks during pregnancy, and the role lifestyle changes can play in preventing them, remains suboptimal in many populations. For instance, Alamneh et al. (2020) observed that a large number of pregnant women lacked critical knowledge about pregnancy-induced hypertension and its associated risks. Similarly, Karalexi et al. (2022) reported inconsistencies in thyroid testing protocols and follow-up care among women without pre-existing thyroid disease. These gaps in awareness highlight the need for structured educational interventions as part of antenatal care services.

India, with its high maternal morbidity burden and regional disparities in healthcare access, faces unique challenges. Cultural beliefs, lack of antenatal counseling, and socio-economic limitations often prevent women from adopting recommended lifestyle practices (Davis, Lazdam, et al., 2012). In such contexts, the promotion of health literacy through counseling, community outreach, and personalized support becomes imperative. Studies by Spruill (2010) confirm that structured counseling significantly enhances pregnant women’s readiness to prevent hypertensive complications. Similarly, ACOG (2019) stressed the importance of nutritional education for thyroid function regulation via the diet-gut-thyroid axis.

The current study seeks to bridge this gap by evaluating the impact of lifestyle modification on awareness and prevention of thyroid and hypertension-related complications in pregnant women. It further examines how demographic variables influence the knowledge level and health practices of pregnant women in the Indian context. Through educational modules, lifestyle counseling, and pre-post assessment, the study aims to develop an evidence-based framework for behavior-driven maternal care.

Additionally, this research aligns with the growing focus on patient-centered and preventive models of antenatal care. Global organizations such as the World Health Organization (WHO) and FIGO advocate for integrated antenatal approaches that combine clinical care with behavioral interventions. According to Abbasalizadeh et al. (2020), maternal preparation should begin even before conception, as early nutritional and behavioral habits influence maternal outcomes and fetal programming. Incorporating lifestyle-based modules into routine antenatal visits not only empowers women but also eases the burden on overburdened clinical systems.

In conclusion, the convergence of thyroid dysfunction and hypertension during pregnancy poses a compounded health risk for women and their offspring. Lifestyle modification emerges as a cost-effective and sustainable solution to this dual burden. However, its effectiveness is contingent upon awareness, accessibility, and cultural adaptation. This study is therefore positioned to contribute significant empirical evidence and practical recommendations to improve maternal health outcomes through informed lifestyle choices and structured behavioral interventions.

**1.2 Background of the Study**

Pregnancy is a critical phase in a woman’s life that involves complex physiological, hormonal, and metabolic changes. These adaptations, though essential for fetal growth and development, also render the mother vulnerable to several health complications, among which hypertension and thyroid dysfunction are particularly significant. These conditions are major contributors to maternal morbidity and mortality globally and are associated with a host of adverse outcomes including preterm birth, intrauterine growth restriction, low birth weight, and perinatal mortality (Chiavaroli et al., 2019; Courtney et al., 2020).

Hypertensive disorders of pregnancy (HDP), including gestational hypertension, preeclampsia, and eclampsia, affect nearly 10% of pregnancies worldwide (Diez-Canseco et al., 2015; Fagard et al., 2008). HDP is one of the leading causes of maternal mortality and is linked to increased risk of long-term cardiovascular diseases in women (Young, 2019). Preeclampsia, a multisystemic disorder, is often sudden in onset and may progress to life-threatening complications for both mother and child. In India, HDP is reported as a major contributor to maternal complications, especially in rural and low-income settings (Forman et al., 2009)).

In parallel, thyroid dysfunction—particularly hypothyroidism and hyperthyroidism—poses another serious risk during pregnancy. The prevalence of thyroid disorders in pregnancy ranges from 5% to 15%, depending on geographical, nutritional, and ethnic factors (Sadakane et al., 2008). These disorders, if unrecognized or poorly managed, can negatively influence maternal metabolic balance and fetal neurodevelopment (Allen et al., 2014). Maternal hypothyroidism has been associated with miscarriage, preterm birth, and impaired cognitive development in the offspring (Sari, 2024). Conversely, uncontrolled hyperthyroidism may increase the risk of gestational hypertension and intrauterine growth restriction (De La Torre et al., 2019).

Studies have increasingly emphasized the interrelationship between thyroid function and blood pressure regulation. Subclinical hypothyroidism has been associated with an increased risk of preeclampsia and gestational hypertension (Fisher et al., 2018), while early pregnancy hyperthyroidism has been linked to vascular complications including elevated blood pressure (House & Ramirez, 2008). These interdependencies underscore the need for holistic and proactive strategies to manage maternal health during pregnancy.

One such strategy is lifestyle modification, which encompasses changes in dietary habits, physical activity, stress management, and sleep hygiene. Lifestyle medicine has become a cornerstone in the prevention and control of chronic diseases, including gestational complications (Weiner & Wingo, 2023). According to Lemaitre et al. (2006), lifestyle interventions improve vascular health, insulin sensitivity, and hormonal balance—factors that are highly relevant to both hypertension and thyroid health.

The significance of lifestyle-based approaches during pregnancy has been validated by numerous studies. Gallagher et al. (1999) demonstrated that regular physical activity during pregnancy, such as walking or yoga, significantly reduces the risk of gestational hypertension. Likewise, Sabbatini & Kararigas (2020) highlighted the importance of moderate aerobic exercise in lowering the risk of gestational diabetes and improving postpartum health. Nutritional interventions, including reduced salt intake and increased consumption of iodine-rich and micronutrient-dense foods, have also been found to improve thyroid function and reduce hypertension-related symptoms (Hypertension, 2020; Song et al., 2018).

Despite this growing body of evidence, awareness and adoption of lifestyle modifications among pregnant women remain low, particularly in low-resource settings. Hung et al. (2015) found that a significant proportion of pregnant women in North India were unaware of the symptoms and consequences of pregnancy-induced hypertension. Similarly, Boardman et al. (2015) reported inadequate follow-up and treatment adherence for thyroid dysfunction during and after pregnancy due to limited health education and poor antenatal counseling.

India presents unique challenges due to its vast socio-economic disparities, cultural beliefs, and unequal access to quality antenatal care. Many pregnant women—especially in rural areas—lack exposure to accurate information regarding preventive health practices. Factors such as illiteracy, financial constraints, lack of women’s agency, and cultural taboos surrounding pregnancy-related decisions further inhibit healthy behavioral choices (Gartlehner et al., 2017; Wenger et al., 2018). Moreover, frontline healthcare providers often focus primarily on medical management, with limited emphasis on behavior change counseling.

This research is driven by the gap between clinical evidence and community-level awareness, particularly concerning the dual burden of thyroid dysfunction and hypertension during pregnancy. Although medical therapy remains essential for managing severe conditions, lifestyle interventions provide a low-cost, scalable, and sustainable approach to improving maternal and fetal health. For example, the implementation of behavior change strategies involving dietary counseling, structured exercise, and stress management has been associated with reduced medication dependence and better pregnancy outcomes (Pimenta, 2012; Srivaratharajah & Abramson, 2019).

Furthermore, national health initiatives like POSHAN Abhiyaan, Janani Suraksha Yojana, and the School Health and Wellness Programme recognize the need for promoting maternal nutrition and health education. However, the practical integration of lifestyle counseling into routine antenatal care remains underdeveloped in many settings. This study seeks to contribute empirical data on how targeted lifestyle modification interventions can improve not only knowledge and awareness but also clinical indicators such as blood pressure and thyroid hormone levels in pregnant women.

By employing a pre-post interventional design, this study explores how behavior change communication and structured lifestyle interventions influence health behavior and physiological outcomes. The methodology includes measurement of anthropometric data, blood pressure, and biochemical markers like TSH, T3, and T4 levels, along with assessment of awareness levels using structured questionnaires. These outcomes will inform strategies for enhancing antenatal education and reducing the burden of preventable pregnancy complications.

In summary, the prevalence and interlinkage of thyroid dysfunction and hypertension during pregnancy necessitate a multi-pronged and proactive healthcare approach. Lifestyle modification, as a complementary strategy to medical care, offers significant potential for improving awareness, empowering women, and achieving better pregnancy outcomes. However, its impact remains under-researched in the Indian context. This study seeks to bridge that gap by evaluating the real-world implications of lifestyle change on both knowledge enhancement and biomedical improvement among pregnant women.

**1.3 Operational Definitions**

To ensure clarity and consistency throughout the research, the following terms are defined operationally in the context of the present study:

**1. Lifestyle Modification**

In this study, *lifestyle modification* refers to purposeful changes undertaken by pregnant women in their daily routines, including dietary practices, physical activity, stress management, hydration, and sleep habits. These modifications are introduced through structured educational interventions and measured based on self-reported adherence and changes in health behavior, as captured in the pre- and post-intervention questionnaires (Nobakht et al., 2025; Ostchega et al., 2020).

**2. Pregnant Women**

*Pregnant women* are defined as females between the ages of 18 and 45 years who are in any trimester of pregnancy and have been registered for antenatal care at designated healthcare facilities. Eligibility is confirmed through medical documentation, and the sample includes both primigravida and multigravida participants (Stuart et al., 2018; Weng et al., 2024).

**3. Thyroid Dysfunction**

*Thyroid dysfunction* in this study refers to abnormal levels of thyroid hormones (TSH, T3, T4) as confirmed through laboratory reports. It includes both hypothyroidism and hyperthyroidism, regardless of clinical presentation, and is assessed based on diagnostic thresholds outlined in current obstetric and endocrinological guidelines (Broder et al., 2015; Lindsey, 2014).

**4. Hypertension**

*Hypertension* is operationally defined as systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg on two or more separate occasions during pregnancy, as per WHO and ACOG criteria. It includes gestational hypertension and preeclampsia and is confirmed through blood pressure monitoring at antenatal visits (Cifkova et al., 2019; Martinez-Martin et al., 2023).

**5. Awareness**

*Awareness* refers to the degree of knowledge and understanding that pregnant women possess regarding thyroid and hypertension-related risks, symptoms, causes, prevention strategies, and the role of lifestyle modification. It is measured using structured questionnaires developed and validated for this study (Heidari et al., 2025; Prescott et al., 1998).

**6. Intervention**

*Intervention* denotes the structured lifestyle modification program provided to the experimental group, which includes educational sessions, demonstrations, and follow-ups related to diet, exercise, and stress management. The duration and frequency of the intervention are standardized across participants, and effectiveness is evaluated through post-intervention assessments (Irwinda et al., 2021).

**7. Physical Activity**

*Physical activity* refers to any bodily movement initiated by skeletal muscles that require energy expenditure, including walking, yoga, or supervised exercise sessions recommended for pregnant women. Frequency (e.g., 3–5 times per week) and duration (e.g., 20–30 minutes per session) are assessed via self-report and monitoring logs (Abbasi et al., 2021).

**8. Dietary Behavior**

*Dietary behavior* is defined as participants’ intake patterns of food and nutrients, especially regarding salt consumption, fluid intake, and nutrient-dense foods (fruits, vegetables, iodine sources). Changes in dietary behavior are tracked pre- and post-intervention using a checklist developed from national dietary guidelines (Chan et al., 2025; Rehman et al., 2017).

**1.4 Statement of the Problem**

Thyroid dysfunction and hypertensive disorders are among the most prevalent medical conditions complicating pregnancy, posing serious risks to both maternal and fetal health. In India, where maternal morbidity and mortality remain significant public health concerns, these conditions are often diagnosed late or inadequately managed due to insufficient awareness, limited antenatal screening, and lack of preventive education (Achamrah & Ditisheim, 2018; Yano & Kario, 2012). Despite the growing body of clinical evidence highlighting the benefits of lifestyle interventions—such as dietary regulation, physical activity, and stress management—these non-pharmacological strategies remain underutilized in antenatal care protocols.

Several studies have shown that subclinical hypothyroidism and gestational hypertension can be effectively prevented or managed through timely lifestyle adjustments, yet the majority of pregnant women do not receive structured guidance or counseling on these aspects (Mansour & Ajeel, 2009; Pedrosa et al., 2014). Furthermore, the correlation between awareness levels and actual adoption of healthy behaviors during pregnancy remains poorly understood, especially in resource-limited settings.

Current antenatal services in many parts of India continue to emphasize pharmacological management while overlooking behavior-based interventions. There is a lack of empirical data that assesses how educational strategies and lifestyle counseling can influence both awareness and health outcomes related to thyroid and hypertensive complications during pregnancy. As a result, many women remain unaware of the risks and the role they can play in managing these conditions through daily lifestyle practices.

This gap in maternal health services necessitates a focused study that evaluates the impact of structured lifestyle modification programs on the awareness and management of thyroid and hypertension among pregnant women. It is essential to determine whether such interventions can lead to measurable improvements in health knowledge and physiological parameters such as blood pressure and thyroid hormone levels.

Therefore, this study aims to investigate:

* To what extent does lifestyle modification influence the awareness and preventive behaviors among pregnant women?
* Can educational interventions serve as an effective, scalable strategy to reduce the burden of thyroid and hypertensive complications during pregnancy?

Addressing these questions is critical not only for improving individual pregnancy outcomes but also for informing public health strategies that integrate lifestyle education into routine maternal care.

**1.5 Rationale of the Study**

The increasing prevalence of thyroid dysfunction and hypertensive disorders during pregnancy presents a pressing challenge to maternal healthcare systems, particularly in low- and middle-income countries like India. These conditions are linked to a host of adverse pregnancy outcomes including miscarriage, preterm birth, intrauterine growth restriction, and maternal mortality (Ahmed et al., 2014; Ritchey et al., 2018). Despite their significance, awareness and preventive strategies at the community level remain limited. This underscores the need for innovative, low-cost, and sustainable solutions that go beyond pharmacological intervention and prioritize patient education and behavioral change.

Lifestyle modification, encompassing changes in diet, physical activity, and stress management, has been recognized as an effective strategy for preventing and managing a wide range of non-communicable diseases, including those encountered during pregnancy (Alese et al., 2021; Davis, Newton, et al., 2012). However, these interventions are not yet fully integrated into the antenatal care framework in many regions of India. Moreover, there is limited empirical research that evaluates the real-world impact of lifestyle education on both knowledge enhancement and clinical outcomes among pregnant women.

Existing antenatal programs tend to focus on clinical screening and medical treatment, often neglecting the critical role of preventive health behavior. Many pregnant women are unaware of how their daily habits—including dietary choices, sedentary lifestyle, and poor stress regulation—can contribute to the development or worsening of thyroid and hypertensive conditions. This gap between available evidence and actual practice calls for a context-specific investigation that can inform policy and practice.

This study is therefore driven by several compelling factors:

* **Scientific Necessity**: There is a lack of research that examines the intersection of lifestyle modification, awareness, and clinical outcomes in pregnant women at risk of thyroid and hypertensive disorders (Hannemann & Wallaschofski, 2012; Ives et al., 2020).
* **Public Health Relevance**: The findings have the potential to inform maternal health policies and contribute to national initiatives such as *POSHAN Abhiyaan*, *Janani Suraksha Yojana*, and the *School Health and Wellness Programme* by integrating lifestyle counseling into routine antenatal care.
* **Clinical Importance**: By evaluating physiological markers such as blood pressure and thyroid hormone levels (TSH, T3, T4), this study will offer evidence on the measurable health benefits of lifestyle interventions, potentially reducing the need for pharmacological treatment in certain cases (Hansen et al., 2007; Rajati et al., 2019)
* **Empowerment and Education**: The study emphasizes women’s health literacy and aims to empower pregnant women with knowledge that enables them to take an active role in managing their health (Aggarwal et al., 2021; Milani et al., 2022).

Given these factors, the study will fill a critical knowledge gap and offer practical, actionable insights for integrating behavioral health into antenatal care. It not only aims to generate academic evidence but also to create scalable models of maternal health promotion that are cost-effective, culturally sensitive, and medically validated.

**1.6 Objectives of the Study**

The objectives of the study are given as follows;

1. To study the correlation between the level of knowledge and awareness regarding the prevention and management of thyroid and hypertension of selected demographic variables.

2. To educate and make aware the pregnant women regarding the prevention of thyroid and hypertension by adopting certain lifestyle modification.

3. To study and evaluate the effectiveness of lifestyle modification to prevent and manage thyroid and hypertension.

**1.7 Hypotheses of the Study**

The hypotheses of the study are given as follows;

* **Hypothesis 1(H1):** There is no significant correlation between the level of knowledge and awareness regarding the prevention and management of thyroid and hypertension and selected demographic variables.
* **Hypothesis 2 (H2):** There is no significant impact of educating and making pregnant women aware of lifestyle modifications on the prevention of thyroid and hypertension.
* **Hypothesis 3 (H3):** There will be a significant association between the level of knowledge regarding the prevention of thyroid and hypertension and selected demographic variables.

**1.8 Significance of the Study**

This study is significant for several reasons, spanning clinical, educational, public health, and policy dimensions. Thyroid dysfunction and hypertensive disorders during pregnancy are among the leading causes of maternal and fetal complications globally. In India, these conditions are exacerbated by low health literacy, socio-economic disparities, and limited access to structured antenatal education. Despite being largely preventable or manageable through early intervention and behavioral change, the adoption of lifestyle modifications among pregnant women remains minimal due to insufficient awareness and inadequate counseling.

This research addresses a critical gap by systematically evaluating the impact of lifestyle modification programs on awareness, knowledge, and health outcomes related to thyroid and hypertension among pregnant women. Through this, the study contributes meaningfully to several domains:

**1. Clinical Relevance**

The study provides empirical evidence on the efficacy of lifestyle interventions—dietary adjustments, physical activity, and stress management—in managing blood pressure and regulating thyroid function during pregnancy. This is crucial for reducing reliance on pharmacological treatment and preventing complications such as preeclampsia, preterm birth, and intrauterine growth restriction.

**2. Health Education and Literacy**

The study focuses on enhancing maternal awareness through structured education and behavioral interventions. It helps to fill the knowledge gap by empowering pregnant women with the necessary information to make informed decisions, thus promoting self-efficacy in managing their health conditions.

**3. Public Health and Community Impact**

By identifying demographic correlations and barriers to lifestyle change, the findings can inform community-level interventions and targeted awareness campaigns. This is particularly valuable in underserved rural and semi-urban populations where antenatal education is minimal.

**4. Contribution to National Health Programs**

The study aligns with national goals under *POSHAN Abhiyaan*, *Janani Suraksha Yojana*, and the *School Health and Wellness Programme*, supporting their emphasis on maternal nutrition, behavior change communication (BCC), and health system strengthening.

**5. Policy and Practice Implications**

The insights generated from this research can guide policy-makers and healthcare providers in integrating lifestyle education modules into routine antenatal care. It advocates for a shift from a purely clinical approach to a more comprehensive, preventive, and women-centered model of maternal healthcare.

In summary, the study holds the potential to create scalable, cost-effective, and culturally appropriate frameworks for improving maternal health outcomes in India and similar contexts. It bridges the gap between medical management and preventive lifestyle practices, offering a sustainable model of maternal care that can significantly reduce pregnancy-related complications.

**1.9 Scope and Delimitations**

**Scope of the Study**

This study is designed to evaluate the effectiveness of lifestyle modification interventions—primarily involving diet, physical activity, and stress management—in the prevention and management of thyroid dysfunction and hypertensive disorders among pregnant women. The scope includes:

* **Population**: Pregnant women between the ages of 18–45 years, attending antenatal clinics, irrespective of their trimester, and who are at risk of or diagnosed with thyroid dysfunction and/or hypertension.
* **Geographical Area**: The study is conducted in selected healthcare facilities (urban and semi-urban) within India, with a focus on primary and secondary care settings.
* **Intervention**: Structured lifestyle education sessions covering nutrition, exercise, and stress-reduction techniques, delivered during antenatal visits.
* **Assessment**: The study measures pre- and post-intervention awareness, lifestyle practices, and clinical outcomes (such as blood pressure and thyroid hormone levels) using standardized tools and biochemical reports.
* **Design**: A quasi-experimental pre-test and post-test design with control and intervention groups to assess the impact of lifestyle education.

This research intends to generate evidence-based recommendations for improving maternal awareness and health outcomes through non-pharmacological interventions. The study’s findings may be useful for integrating behavior change strategies into national maternal health policies and antenatal care programs.

**Delimitations of the Study**

Delimitations define the boundaries set by the researcher to narrow the scope of the study. These include:

1. **Sample Limitation**: The study includes only registered pregnant women from selected healthcare institutions who consent to participate. It excludes women with co-morbid chronic illnesses such as diabetes, renal disease, or cardiovascular disorders that may confound the results.
2. **Time Frame**: The intervention and data collection are limited to the duration of pregnancy, specifically between the second trimester and delivery. Long-term postpartum follow-up is not included in this study.
3. **Intervention Focus**: The lifestyle modification program is limited to educational components. It does not include pharmacological treatments or clinical procedures beyond standard care.
4. **Self-reported Measures**: Awareness and lifestyle practices are assessed through structured questionnaires and self-reports, which may introduce subjectivity and recall bias.
5. **Generalizability**: The findings may not be generalizable to all pregnant populations, particularly those in remote rural areas or tertiary care hospitals with differing health service provisions and demographic profiles.

By clearly defining these parameters, the study maintains focus, feasibility, and relevance while acknowledging the limitations that may affect the interpretation and applicability of its findings.

**1.10 Organization of the Thesis**

This thesis is structured into five well-defined chapters to present a comprehensive understanding of the research problem, methodology, findings, and implications:

**Chapter 1: Introduction**

This chapter outlines the foundation of the study. It includes the general introduction, background of the study, operational definitions, statement of the problem, rationale, objectives, hypotheses, research questions, significance, scope and delimitations, and the organizational framework of the thesis.

**Chapter 2: Review of Literature**

This chapter presents an extensive review of theoretical and empirical literature related to thyroid dysfunction and hypertension in pregnancy. It includes studies on awareness levels, lifestyle interventions, and maternal health outcomes. The chapter identifies research gaps and conceptualizes the study’s framework.

**Chapter 3: Research Methodology**

This chapter details the research design, setting, sampling methods, tools used for data collection, validity and reliability procedures, ethical considerations, and statistical techniques applied for data analysis. It explains how the intervention was implemented and how its effectiveness was measured.

**Chapter 4: Results and Discussion**

This chapter presents the results of data analysis with relevant tables and figures. It includes demographic findings, awareness levels, clinical outcomes, and the impact of lifestyle modification. The discussion section interprets the findings in light of existing literature and research questions.

**Chapter 5: Summary, Conclusion, and Recommendations**

This final chapter summarizes the entire study, highlights key findings, draws conclusions, and suggests practical recommendations for health educators, policymakers, and healthcare providers. It also outlines directions for future research.

**Chapter 2**

**Literature Review**

**2.1 Introduction**

Maternal health during pregnancy is a critical determinant of both immediate and long-term outcomes for mothers and their offspring. Pregnancy introduces profound physiological and hormonal transformations that, while essential for fetal development, also elevate a woman's vulnerability to various health complications (Goldstein et al., 2014; Mori et al., 2015). Among the most prevalent and clinically significant of these complications are thyroid dysfunction and hypertensive disorders, both of which contribute substantially to maternal and neonatal morbidity and mortality globally (Caminha et al., 2017; Hutabarat et al., 2017; Stuenkel et al., 2015). The World Health Organization underscores maternal health as a key indicator of a nation’s healthcare efficiency and socio-economic development, as it reflects the accessibility and quality of health services available to women during this crucial phase of life (Akasaka et al., 2019; Chobanian et al., 2003; Janoray et al., 2016).

Thyroid dysfunction, encompassing conditions such as hypothyroidism and hyperthyroidism, affects 5–15% of pregnancies worldwide, with incidence rates varying according to regional iodine sufficiency (Connelly et al., 2022; Valero et al., 2021). These disorders can disrupt metabolic homeostasis, interfere with fetal neurodevelopment, and lead to complications such as miscarriage, preterm birth, and low birth weight (Gharge et al., 2024; Kaushik & Singh, 2025). Parallelly, hypertensive disorders of pregnancy (HDP), including gestational hypertension and preeclampsia, affect approximately 10% of pregnancies and are among the leading causes of maternal mortality and morbidity (Hasson & Villaume, 2024; Majali et al., 2025). The presence of either condition not only increases the risk of adverse perinatal outcomes but also predisposes women to chronic health issues such as cardiovascular disease later in life (Gangwisch et al., 2013; Yong et al., 2017). The compounded presence of thyroid dysfunction and hypertension during pregnancy poses even greater risks, necessitating integrated preventive and management approaches.

Amidst growing evidence, lifestyle modification has emerged as a powerful, non-pharmacological strategy in the prevention and management of both thyroid-related and hypertensive complications during pregnancy. Lifestyle modification refers to intentional changes in daily behavior patterns, including improvements in dietary habits, physical activity, stress management, sleep quality, and health literacy (Black & Garbutt, 2002; Kalinowski et al., 2021; Seraj et al., 2019). Research has consistently highlighted that adopting a balanced, nutrient-rich diet, engaging in moderate physical exercise such as walking or prenatal yoga, and employing stress-reducing techniques can help regulate thyroid hormone levels and maintain optimal blood pressure. Such interventions not only contribute to better pregnancy outcomes but also empower women through improved health awareness and self-efficacy (Desousa et al., 2016; Lee et al., 2021; Magee et al., 2022).

Given the interrelationship between thyroid and hypertensive disorders, and the pivotal role lifestyle factors play in influencing maternal health trajectories, it becomes imperative to explore how lifestyle interventions can be systematically integrated into antenatal care (Hofmeyr et al., 2015; Kucharska et al., 2018). This literature review, therefore, aims to examine existing empirical evidence on thyroid dysfunction and hypertension during pregnancy, assess the awareness levels among pregnant women, and evaluate the role and effectiveness of lifestyle modifications as a preventive and management tool. This exploration sets the foundation for understanding the relevance of the present study and the development of targeted educational and behavioral interventions to improve maternal health outcomes.

**2.2 Studies related to Knowledge regarding Hypertension**

Studies related to knowledge regarding hypertension are presented as follows;

1. According to the comprehensive review by Roberts et al. (2019), “Depression, Anxiety, and Post-Traumatic Stress Disorder Following a Hypertensive Disorder of Pregnancy: A Narrative Literature Review” examines the link between hypertensive disorders of pregnancy (HDP) and mental health conditions such as postpartum anxiety (PPA), postpartum depression (PPD), and post-traumatic stress disorder (PTSD). The authors analyze 17 studies, indicating that maternal morbidity and the severity of these conditions increase following severe HDP presentations. While the findings are not definitive, the potential association supports the need for further evaluation of mental health disorders in postpartum women, particularly those with HDP. The review emphasizes the importance of future research to advance clinical strategies and improve the management of such patients.
2. According to the comprehensive review by Soomro et al. (2024), “Pregnant Women Struggling with High Blood Pressure and Stress in Pregnancy and Role of Nitric Oxide Supplement L-Arginine for Prolonged Period” highlights the positive effects of the supplement L-arginine, which the body utilizes to produce nitric oxide that improves blood vessel function in high-risk pregnancies by reducing diastolic blood pressure. The supplementation also extends the gestation period by one week and three days, although it shows no significant effect on systolic blood pressure. The findings support the assertion that L-arginine has favourable effects in preventing preeclampsia and managing hypertension, particularly in pregnant women.
3. In their analysis, Schutte et al. (2021) discuss the increasing hypertension loads in LMICs where, despite the growing figure, the awareness and control of hypertension are critically low. The traditional risks include the consumption of undesirable diets, lack of physical activity, and obesity; whereas novel risks such as pollution and urbanization require more study. Global approaches discussed in the article include the HEARTS technical package and access to healthcare. Potential approaches include the salt-atherosclerosis campaign, expanding telehealth capability, and the use of low-cost compound regimens. There is an evident urgent political and scientific need to address hypertension in LMICs to bring about feasible measures for intervention, thus reducing hypertension disparities.
4. According to the comprehensive review by Tinawi (2020), “Hypertension in Pregnancy” provides a brief but comprehensive understanding of hypertension during pregnancy, emphasizing the importance of prompt diagnosis and management. This article outlines the classificational system of hypertension, discusses treatment approaches for the condition, and highlights key parameters for preeclampsia management based on up-to-date guidelines. The review also underscores that untreated hypertension poses severe risks to both expectant mothers and their babies. As a working document, the article aims to offer a snapshot to assist clinicians in managing hypertensive complications during pregnancy.
5. A study conducted by Kintiraki et al. (2015) delves into “Pregnancy-induced Hypertension,” a condition that affects 6-10% of pregnant women. The disease is stratified according to blood pressure classes, with elevated risks to women until delivery, including the development of preeclampsia, placental problems, and adverse effects on the fetus. The study discusses treatment approaches, key points regarding the initiation of hypertension medication, and suggests methyldopa as the first-line drug. The authors also address the importance of blood pressure checks and advocate for nonpharmacological treatment for mild hypertension.
6. Pinheiro et al. (2016) highlight in their research that “Hypertensive Disorders During Pregnancy and Health Outcomes in the Offspring” can have medium and long-term effects on the health of offspring. The study, which reviewed 45 articles, established that maternal hypertension during pregnancy affects the offspring's cardiovascular, immune, and neurological development. Gestational hypertension is linked to elevated offspring blood pressure, while preeclampsia is associated with lower cognitive functioning. The review emphasizes the need for standardized guidelines to improve the consistency of future studies and to explore other metabolic impacts of hypertension disorders in pregnancy.
7. The findings presented by Folk (2018) in “Hypertensive Disorders of Pregnancy: Overview and Current Recommendations” reveal a high level of both maternal and fetal morbidity and mortality related to hypertensive disorders of pregnancy and the limitations in accurately predicting preeclampsia due to the absence of specific biomarkers. The article focuses on the identification of hypertensive disorders, diagnostic procedures, therapy, and management plans, as well as providing advice on the future consequences of these conditions during the pregnancy period.
8. Research led by Wu, Green, and Myers (2023) in “Hypertensive Disorders of Pregnancy” investigates hypertensive disorders of pregnancy (HDPs), including chronic hypertension, gestational hypertension, and pre-eclampsia. The study focuses on new directions in early pregnancy risk assessment, such as placental growth factor and the use of aspirin in preventing risks. It also examines changes in guidelines regarding blood pressure goals, the timing of birth, and postnatal period management. Highlighting the strong connection between HDPs and future cardiovascular disease, the research emphasizes the importance of postnatal compliance and calls for future prospective research on primary prevention for the long-term cardiovascular health of high-risk women.
9. Sakurai, Shishido, and Horiuchi (2022) present an in-depth review of “Experiences of Women with Hypertensive Disorders of Pregnancy: A Scoping Review.” In this scoping review, the authors outline how women perceive hypertensive disorders of pregnancy (HDP) as life-threatening, how they cope with the condition, their concerns for the baby, and their need for social support. The review highlights the long-term physical and psychological consequences of HDP and stresses the critical role of healthcare providers. According to the authors, future health risks for female patients diagnosed with HDP should be addressed through lifetime surveillance systems.
10. In examining the “Impact of Educational Interventions on Knowledge About Hypertensive Disorders of Pregnancy Among Pregnant Women: A Systematic Review”, Gholami et al. (2022) identify the results of a systematic review that analysed six papers with a total of 819 pregnant women. The interventions included pamphlets, smartphone applications, videos, and engaging presentations. The knowledge findings show a significant enhancement in participants’ understanding of HDP and the reduction of risks related to HDP complications. Consequently, the study re-emphasizes the need for individually appropriate educational interventions to reduce the risks of maternal and fetal complications among women experiencing HDP.
11. Palve (2019) offers valuable insights into gestational hypertension with “Gestational Hypertension: Overview and Current Recommendations.” This paper explores the role of hypertension in pregnancy as a significant cause of maternal and perinatal morbidities and mortality. It explains various hypertensive disorders, including preeclampsia and eclampsia, and reiterates the importance of proper diagnosis and intervention to prevent complications for both the mother and child. Preeclampsia is found in 8–10% of pregnancies in India, particularly in primigravidae women between 20 weeks of gestation. The research addresses risk factors, medications and vitamins, non-medicinal therapies for pregnancy-induced hypertension, the role of antenatal care, and self-care management in ensuring safe childbirth.
12. The research work by Pimenta (2012) sheds light on “Hypertension in Women” with a focus on the effects of combined oral contraceptives. This type of contraception can cause hypertension and increase cardiovascular risk among some users, although in most cases, blood pressure returns to normal within three months after cessation of use. The article also highlights unanswered questions concerning the impact of menopause and hormone replacement therapy (HRT) on blood pressure, and notes that new types of progestin are preferred for hypertensive females. While cancer is becoming more prevalent, cardiovascular diseases are now the leading cause of death among women. The study emphasizes that antihypertensive therapy remains the same for both men and women.
13. Moussa, Arian, and Sibai (2014) systematically review the “Management of Hypertensive Disorders in Pregnancy”, highlighting these disorders as the most frequent medical complication of pregnancy, affecting 5-10% of pregnant women and significantly contributing to maternal mortality in the USA. With a 25% increase in the incidence of preeclampsia over two decades, the review discusses new task force recommendations, newly defined disorders, and updated approaches to managing them. It also reviews progress in understanding the pathophysiology of these conditions and the development of medical treatments that are less toxic and teratogenic to the fetus. The review emphasizes fetal programming and adult disease prevention as essential milestones for future generation management.
14. Through their investigation, Chapman et al. (2023) emphasize “Arterial Hypertension in Women: State of the Art and Knowledge Gaps” as a global risk factor for cardiovascular disease and mortality in women. The article highlights gaps in understanding the pathophysiology by sex, and the non-adherence to more comprehensive female risk factors in clinical recommendations, particularly for female patients. The review explores obstetric and social determinants of hypertension, such as gynecological conditions, adverse pregnancy outcomes, menopause, and gender inaccessibility to medical care. Focusing specifically on initial management in postmenopausal women with type 2 diabetes, it suggests that diagnostic and therapeutic cut-offs will likely need to be lower in women to prevent subsequent cardiovascular events.
15. An evaluation by Abrams (2015) discusses “Hypertension in Pregnancy: A Review of Current Guidelines,” exploring hypertensive conditions with a focus on preeclampsia-eclampsia, chronic hypertension, and postpartum hypertension. Choi and co-authors conducted a literature review to highlight preeclampsia, noting that ACOG's seventh edition of “Hypertension in Pregnancy” recently reported a 25% increase in eclampsia cases over the last fifteen years. The guidelines aim to assist treatment managers in incorporating them into their practice, inform healthcare providers about the risks, and promote awareness among patients and families. The article also examines risk factors, diagnostic criteria, and management of these disorders in accordance with the current ACOG guidelines.
16. Insights provided by Razak et al. (2018) indicate “Pregnancy-Induced Hypertension and Neonatal Outcomes: A Systematic Review and Meta-Analysis” explores the effect of pregnancy-induced hypertension (PIH) on preterm neonates. The study, which included patients from 2000 to 2016, compares PIH to neonatal mortality, severe retinopathy of prematurity, and severe brain injury. It reports an an increased risk of bronchopulmonary dysplasia (BPD), <29-week infants in PIH, and higher risk of mortality and invasive ventilation in severe PIH cases. The study demonstrates that the effects of PIH on newborns are varied, underscoring the need for further investigation into the processes and outcomes associated with the phenomenon.
17. An in-depth assessment by Wertaschnigg et al. (2019) uncovers “Treatment of Severe Hypertension During Pregnancy: We Still Do Not Know What the Best Option Is,” emphasizing the importance of antihypertensive therapy to prevent maternal death from intracranial hemorrhage and stroke. However, the precise target levels for maternal and fetal outcomes remain unknown. In many cases, the choice of antihypertensive medications is a concern for clinicians due to the lack of standardized, large-scale, randomized clinical trials. Consequently, knowledge regarding optimal outcomes for offspring in concurrent and subsequent therapy is limited, underscoring the need for sufficient trials to assess the effectiveness of treatments and their effects on offspring.
18. **Exploring current trends, Phipps et al. (2016) evaluate “Preeclampsia: Updates in Pathogenesis, Definitions, and Guidelines,” a condition with dangerous consequences for both mother and baby. The article discusses how advanced age at childbirth, overweight, and diseases affecting blood vessels characterize developed countries, while low birth-preparedness raises the incidence in developing countries. This review covers new insights into pathogenesis, such as angiogenesis, oxidative stress, and auto-antibodies, and updates the global classification and therapeutic goals. Preeclampsia is now recognized as a chronic systemic disease that carries lifelong cardiovascular risks for affected women, with a focus on prevention, treatment, and long-term follow-up care.**

**2.3 Studies related to Healthy Lifestyle to Prevent Hypertension**

**Studies related to healthy lifestyle to prevent hypertension are presented as follows;**

1. In their comprehensive analysis, Barakat et al. (2024) uncover “Influence of Physical Activity during Pregnancy on Maternal Hypertensive Disorders: A Systematic Review and Meta-Analysis of Randomized Controlled Trials,” exploring how physical activity impacts hypertensive disorders during pregnancy. The findings of the systematic review and meta-analysis of RCTs from 2010 to 2023 indicated that physical activity effectively reduced both the risk of gestational hypertension and improved systolic and diastolic blood pressure. However, no relationship was detected between physical activity and the development of preeclampsia. This study highlights the potential benefits of physical activity for maternal health during pregnancy.
2. A critical perspective is offered by Danielli et al. (2022) on “Effects of Supervised Exercise on the Development of Hypertensive Disorders of Pregnancy,” investigating the potential of supervised exercise to reduce the incidence of hypertensive disorders of pregnancy (HDP). The meta-analysis of 16 randomized controlled trials (RCTs) showed that supervised exercise was effective in decreasing the HDP risk in the intervention group (3%) compared to the control group (5%). The authors highlighted that both aerobic and anaerobic exercise, with or without yoga, provide added benefits to pregnancy and emphasized the importance of encouraging women to engage in structured exercises to reduce the risks of HDP.
3. The investigation carried out by Dipietro et al. (2019) highlights “Benefits of Physical Activity during Pregnancy and Postpartum,” providing a summary of evidence on the impact of physical activity on maternal health. This review clearly demonstrates that moderate-intensity aerobic exercise significantly lowers the probability of weight gain, gestational diabetes, and postpartum depression. However, its effects on preeclampsia, gestational hypertension, or anxiety are not clearly established. The review strengthens the call for exercise during pregnancy and the postpartum period, acknowledging the large public health gains as society faces the growing concern that childbearing-age women are increasingly sedentary and overweight.
4. Focusing on “Maternal dietary patterns and risk of adverse pregnancy (hypertensive disorders of pregnancy and gestational diabetes mellitus) and birth (preterm birth and low birth weight) outcomes: a systematic review and meta-analysis,” Kibret et al. (2019) bring attention to the relationship between dietary behaviors, nutrient intake, and outcomes such as hypertensive disorders of pregnancy, gestational diabetes mellitus, preterm birth, and low birth weight. The authors scrutinized 21 papers from around the world and demonstrated that compliance with a healthy diet, including fruits, vegetables, legumes, whole grains, and fish, is linked to lower odds of adverse outcomes. While this research is crucial for identifying dietary patterns in low-income settings, there are significant challenges due to resource limitations for managing maternal nutrition.
5. The research findings of Lima (2023) contribute to “Major Clinical Approaches to Proper Nutrition and Lifestyle Change During Pregnancy: A Systematic Review” by highlighting the significance of appropriate nutrition and physical transformations during pregnancy. The study emphasizes how preparations initiated at least three months before conception can enhance gametes and gene regulation, ultimately improving the health of both mother and child. In response to dietary challenges posed by the rise of ultra-processed foods, the review advocates for supplementation during pregnancy to meet increased nutrient demands. Overall, this systematic review stresses the importance of guiding women of childbearing age towards adopting healthier diets and lifestyles for improved pregnancy outcomes and the well-being of unborn children.
6. An exploration conducted by Valenzuela et al. (2021) emphasizes “Lifestyle Interventions for the Prevention and Treatment of Hypertension,” addressing preventable and treatable hypertension, defined as high blood pressure affecting over one-third of the world’s adult population. The authors highlight lifestyle factors such as daily exercise, proper diet, weight control, reduced stress, and proper sleep, which enhance blood vessel health, lower inflammation, and address underlying causes like obesity and poor insulin sensitivity. Additionally, the study examines mechanisms including improved myokine release and decreased sympathetic tone hyperactivity. The article underscores the importance of integrating lifestyle changes with medications to manage and prevent hypertension while enhancing overall health.
7. Highlighting critical issues, Battarbee et al. (2020) examine "Chronic Hypertension in Pregnancy," discussing pre-eclampsia, preterm delivery, and both maternal and fetal mortality. The study raises concerns in the diagnosis and management of patients with the disease due to a scarcity of data and explores the imperative need for more studies to determine appropriate blood pressure to enhance patient outcomes. While noting that pregnancy timing matters, the article uses the case for LARCs to counter risks. It also includes specific recommendations for averting maternal harm and promoting equity for racially and ethnically diverse pregnant individuals, as well as a broad synthesis of the most recent guidance documents and key factors to consider when managing chronic hypertension during pregnancy.
8. In pursuit of understanding “The Effect of Counselling on the Mother’s Level of Knowledge and Readiness in Preventing Hypertension Complications in Pregnancy: Scoping Review,” Agustini and Emilia (2023) study the effectiveness of counseling in improving pregnant women’s knowledge and readiness to prevent hypertensive complications. Specifically, using the PRISMA-ScR Checklist, the authors reviewed 500 articles from databases such as Google Scholar and Science Direct, ultimately selecting nine studies with various research designs. Four themes emerged from the analysis: hypertension in pregnancy, readiness for preventive intervention, counseling techniques, and maternal perception. The conclusions highlight the importance of counseling as a crucial factor in enhancing maternal health and reducing the risk of hypertension-related complications.
9. Through detailed analysis, Thangada et al. (2018) uncover significant findings on “The Emerging Role of Mobile-Health Applications in the Management of Hypertension.” The study discusses the possibilities of m-health in hypertension, including medication administration alerts, compatibility with EMR systems, BP trend feedback, and point-of-care sensors. Applications of m-health have shown benefits in increasing medication compliance and enhancing communication between patients and doctors. However, areas of concern include the accuracy of smartphone sensors in recording patient BP. The authors emphasize the importance of these technologies being securely validated to support individuals with hypertension in reducing blood pressure through self-monitoring and feedback facilities.
10. According to the comprehensive review by Koroma et al. (2024) on “Prevalence of Hypertension, Awareness, Treatment, and Blood Pressure Control in Sierra Leone: A Systematic Review and Meta-Analysis,” the burden of hypertension (HTN) in Sierra Leone is substantial. Through 15 cross-sectional studies involving 14,707 participants, the review calculated an aggregate uncontrolled HTN prevalence estimate of 27.64% among the investigated population, with a slightly higher prevalence among urban dwellers (29.76%) compared to rural areas (15.77%). The prevalence, treatment, and control rates as percentages were 37.21%, 12.87%, and 29.73%, respectively. Significant differences in gender and location also influenced the data. These findings underscore the compelling need for practices, interventions, and policies to prevent, manage, and reduce hypertension in Sierra Leone.
11. In their analysis, Wenger et al. (2018) examine “Hypertension Across a Woman’s Life Cycle” as a major contributing factor to cardiovascular death in women in the United States of America. This paper discusses the effects of high blood pressure across different phases of childhood and adult development: adolescents, pregnant and lactating women, post-menopausal women, and elderly men and women, highlighting relative risk factors and strategies for its primary prevention and control. The review considers emerging biomarkers, including race/ethnicity and hormonal therapies, alongside knowledge gaps such as blood pressure goals in elderly women and the cardiovascular effects of hypertensive pregnancy complications. Hypertension control remains a critical measure to enhance cardiovascular health.
12. A study conducted by Psara et al. (2020) delves into “Critical Review of Nutrition, Blood Pressure, and Risk of Hypertension Through the Lifecycle: Do B Vitamins Play a Role?” by summarizing the various factors contributing to hypertension development. This paper revisits and evaluates prior potential risk factors such as obesity, physical inactivity, and social usage, along with previous dietary strategies like the DASH diet. New findings highlight that RBC B vitamins, particularly riboflavin, may reduce SBP in individuals with genetic susceptibility. The present review provides a critical evaluation of the effects of nutrition on hypertension risk and identifies knowledge gaps that warrant further investigation.
13. Magee and von Dadelszen (2021) highlight in their research that “Management of Hypertension in Pregnancy” analyzes state-of-the-art guidelines for hypertension in pregnancy, focusing on targeted blood pressure levels and antihypertensive treatment. The study emphasizes results from the CHIPS trial, indicating that a BP target of 135/85 mmHg does not harm the fetus while reducing rates of severe hypertension and maternal complications. Commonly prescribed antihypertensive medications such as methyldopa, labetalol, and nifedipine are discussed alongside recommendations for managing severe hypertension. The authors stress the importance of shared decision-making processes and propose further research to refine BP targets and assess medication efficacy based on maternal and physiological characteristics.
14. The findings presented by Mate et al. (2021) reveal that “Lifestyle, Maternal Nutrition and Healthy Pregnancy” emphasizes the importance of healthy behaviors and nutrition during preconception, pregnancy, and postpartum to achieve positive outcomes and avoid gestational diseases. The article underscores the role of proper proportions of vegetables, polyunsaturated fats, fiber, and micronutrient levels, especially in overweight or diabetic women. It highlights the benefits of 30 minutes of daily exercise in reducing preeclampsia, gestational diabetes, and postnatal weight gain. Additionally, the review explores the roles of microbiome modulation, behavioral interventions, and other factors in promoting good maternal and fetal health.
15. Nayluzzuharo et al. (2024) present an in-depth review of “Interventions to Prevent Hypertension in Pregnant Women: A Systematic Review,” analyzing various aspects of preeclampsia, a dangerous pregnancy complication affecting 5-8% of pregnancies globally. Using the PRISMA method, the review examines six published studies from 2019 to 2024 across Asia, America, and Europe. The study includes approaches such as m-Health applications, brochures, movies, nutrition, and the assessment of low-dose aspirin and probiotics. The authors highlight the importance of education, lifestyle changes, and pharmacological intervention as practical recommendations to prevent hypertension in pregnancy and increase the chances of safe motherhood.
16. A detailed study by Ożarowski et al. (2018) discusses the “Pharmacological Effect of Quercetin in Hypertension and Its Potential Application in Pregnancy-Induced Hypertension,” highlighting the benefits of using quercetin to control hypertension during pregnancy. With traditional treatments like methyldopa associated with side effects, the search for natural remedies led to the discovery of quercetin, a flavonoid isolated from plant sources. Quercetin has antihypertensive, antioxidant, and anti-inflammatory properties, improving endothelial function and fetal development without the risk of teratogenicity. The review elaborates on the safety and effectiveness of quercetin, focusing on its potential as a preventive and curative intervention for pregnancy-induced hypertension (PIH), particularly in high-risk pregnant women.

**2.4 Studies related to Knowledge regarding Thyroid in pregnancy**

Studies related to knowledge regarding thyroid in pregnancy are presented as follows;

1. Joshi et al. (2024) offer valuable insights into “From Conception to Delivery: A Comprehensive Review of Thyroid Disorders and Their Far-Reaching Impact on Feto-Maternal Health,” emphasizing the severe ramifications of thyroid disorders on both the pregnant woman and her fetus. The article highlights the importance of timely screening and targeted interventions, as well as a personalized care approach supported by emerging technologies like telehealth. It also stresses the necessity of follow-up care for postpartum conditions such as thyroiditis. The authors advocate for the education of healthcare providers, public awareness, and standardized screening policies, underscoring the need for collaborative approaches to improve outcomes and ensure safe mother-infant wellness.
2. The research work by Petca et al. (2023) sheds light on “Management of Hyperthyroidism during Pregnancy: A Systematic Literature Review,” providing an overview of hyperthyroidism management in pregnancy with a particular focus on Graves' disease and hCG-mediated thyroiditis. The review emphasizes the importance of a collaborative management approach, as antithyroid medications are the primary treatment for subclinical hyperthyroidism. The article also notes that radioactive iodine therapy is prohibited, and thyroidectomy is restricted to certain cases. Additionally, it highlights the critical need for all pregnant or childbearing women to undergo screening for thyroid dysfunction, irrespective of pre-specified protocols and algorithms.
3. Shulhai et al. (2024) systematically reviews “The Role of Nutrition on Thyroid Function,” focusing on the interdependent nature of nutrition, the gut, and thyroid functioning via the diet-gut-thyroid axis. The article examines the influence of micronutrients including iodine, selenium, iron, vitamin A, and B12 on thyroid hormone synthesis and regulation, as well as their impact on gut bacteria. It highlights how malnutrition can lead to thyroid disorders, autoimmune thyroid diseases, and thyroid cancer. The review underscores the importance of a balanced diet with essential micronutrients for thyroid health and suggests several areas that warrant future investigation.
4. An evaluation by Szpunar and Parry (2018) discusses “A Systematic Review of Cortisol, Thyroid-Stimulating Hormone, and Prolactin in Peripartum Women with Major Depression,” highlighting that morning cortisol levels were significantly decreased in pregnant and postpartum women diagnosed with major depression (MD). Conversely, alterations in TSH or prolactin were not associated with MD during this period. The paper concludes by stressing the importance of future research to identify clear hormonal correlates of peripartum mood disorders.
5. Insights provided by Carvalho et al. (2022) indicate “Gaps in the Knowledge of Thyroid Hormones and Placental Biology,” analyzing the function of thyroid hormones (TH) in fetal development and their regulation during pregnancy. The authors highlight evidence that changes in maternal TH affect the fetus, yet the mechanisms by which the placenta modulates maternal TH concentrations remain unclear. The review also points out insufficient knowledge regarding the developmental expression patterns of TH transporters, receptors, and metabolic enzymes in the placenta. It calls for further exploration into the genomic and nongenomic impacts of TH on the placenta during maternal thyroid disease, which may improve pregnancy outcomes and the treatment of thyroid disorders.
6. The study by Zgliczynska et al. (2023) critically analyzes “Maternal Thyroid Function in Multiple Pregnancies: A Systematic Review,” focusing on the changes in thyroid hormones during pregnancy and how elements of multiple pregnancies (MP), such as high concentrations of HCG, affect thyroid hormones. The review of 12 articles published between 1997 and 2022 reveals that women with MP exhibit abnormal thyroid-stimulating hormone and free thyroid hormone levels, particularly in the first trimester. The authors call for the establishment of new reference ranges for thyroid function in MP to improve the recognition and management of thyroid abnormalities, urging further studies on this topic.
7. An in-depth assessment by Springer et al. (2017) uncovers “Thyroid in Pregnancy: From Physiology to Screening,” focusing on the crucial role of thyroid hormones in fetal growth and morphogenesis, including brain and skeletal development. The study emphasizes the significance of thyroxine during the first trimester and the potential consequences of maternal hypothyroidism, which may lead to irreversible developmental changes in the fetal brain. The article also discusses the epidemiology and impact of thyroid diseases, hypothyroidism, and thyroid autoimmunity. The authors explore laboratory methods, TSH reference intervals by trimester, and the debate between case finding and universal screening, advocating for universal screening to enhance maternal and fetal outcomes.
8. A critical perspective is offered by Delitala et al. (2019) on “Thyroid Function and Thyroid Disorders During Pregnancy: A Review and Care Pathway,” discussing the impact of thyroid dysfunction on both pregnancy and fetal health. The authors stress the importance of maintaining a maternal euthyroid state to avoid adverse outcomes such as poor fetal neurological development, preterm labor, and congenital abnormalities. The review covers diagnostic cut-off points for TSH, the differential treatment of primary and subclinical hypothyroidism, and gestational transient hyperthyroidism. The paper emphasizes the necessity of close monitoring of both the woman and fetus, particularly regarding thyroxine replacement and the use of antithyroid drugs.
9. The investigation carried out by De Leo and Pearce (2018) highlights “Autoimmune Thyroid Disease During Pregnancy,” focusing on the effects of thyroid autoimmunity on pregnancy. Anti-thyroid antibodies are found in approximately 2-18% of pregnant women, and they are associated with outcomes such as miscarriage, preterm birth, and postpartum thyroiditis. The review examines the potential effectiveness of levothyroxine in enhancing fertility and pregnancy outcomes for euthyroid women with thyroid antibodies. It also stresses the importance of future research in understanding the etiology and treatment of the condition. To optimize pregnancy health, the authors underscore the necessity of screening for fetal and neonatal hyperthyroidism in TRAb-positive pregnancies.
10. Focusing on “Thyroid Disorders in Subfertility and Early Pregnancy,” Anandappa et al. (2020) bring attention to the effect of thyroid autoimmunity, as measured by raised anti-thyroid antibodies, on miscarriage. The article also explores modifications in thyroid function during pregnancy, approaches to thyroxine administration, and thyroid profile measurement. While much of the guidance is based on consensus statements, clinical trials have provided further insights into hypothyroidism and the use of thyroid hormones in subclinical hypothyroidism and autoimmune thyroid disorders.
11. The research findings of Sari (2024) contribute to understanding “The Effect of Thyroid Dysfunction on Pregnancy Outcome: Systematic Review and Meta-Analysis”. The study highlights the secondary consequences of thyroid dysfunction observed at 13 weeks of pregnancy, such as preterm birth, pre-eclampsia, placental abruption, fetal distress, and postpartum hemorrhage. The findings are statistically significant and emphasize the importance of enhancing maternal thyroid status control during pregnancy to improve perinatal outcomes.
12. An exploration conducted by McNeil and Stanford (2015) emphasizes the importance of “Reporting Thyroid Function Tests in Pregnancy,” particularly in detecting manifest hypothyroidism and evaluating the treatment of subclinical hypothyroidism. The authors discuss the role of TSH in relation to gestational age, ethnic background, iodine status, and assessment methodologies. They also critique current clinical guidelines, arguing that individual values for thyrotropin in early pregnancy should range between 3.0 and 4.0 mIU/L, rather than the commonly used 2.5 mIU/L, which underestimates the necessary thresholds for optimal care.
13. In their thorough exploration, Sheehan et al. (2015) identify the relationship between “Maternal Thyroid Disease and Preterm Birth: Systematic Review and Meta-Analysis” of 15 studies involving 2,538,949 participants. The authors found that hypothyroidism and hyperthyroidism are associated with a statistically significant risk of preterm birth, with odds ratios of 1.19 and 1.24, respectively. However, subclinical hypothyroidism and isolated hypothyroxinemia showed no significant correlation. These findings emphasize the need for controlling manifest thyroid diseases during pregnancy to reduce adverse outcomes such as preterm birth.
14. Highlighting critical issues, Yalamanchi and Cooper (2015) examine “Thyroid Disorders in Pregnancy” with a focus on the diagnosis and management of thyroid disease in pregnant women. The authors emphasize the management of overt hypothyroidism and hyperthyroidism while addressing the current controversies surrounding subclinical hypothyroidism, thyroid antibody-positive euthyroidism, and the screening of thyroid disorders in pregnant women. The review draws attention to the differences in guidelines among professional associations and underscores the importance of proper thyroid disease control for the well-being of both mother and child.
15. In pursuit of understanding “Thyroid Disease in Pregnancy: A Review of Diagnosis, Complications, and Management,” Moore (2016) studies thyroid dysfunction, one of the second most common endocrine disorders during pregnancy. The review highlights the impact of overt thyroid disease, including hyperthyroidism and hypothyroidism, on pregnancy outcomes, and addresses concerns regarding the effects of subclinical hypothyroidism on fetal cognitive function. The paper conducts a comprehensive literature review, analyzing recent guidelines for the safe diagnosis and management of thyroid diseases during pregnancy and the postpartum period to ensure the well-being of both mother and child.
16. Through detailed analysis, Pamma et al. (2024) uncover significant findings on “Regulation of Thyroid Hormone: An Important Aspect During Pregnancy.” The review emphasizes that even minimal thyroid dysfunction can result in neurodevelopmental disorders in the fetus. It discusses the challenges in diagnosing thyroid dysfunction, as these conditions are often asymptomatic, and stresses the importance of periodizing thyroid function studies according to pregnancy trimesters. The paper also addresses the management of thyroid hormones and iodine intake, highlighting their crucial role in achieving better pregnancy outcomes.
17. According to the comprehensive review by Léger et al. (2022), “Fetal and Neonatal Thyroid Dysfunction” summarizes a limited number of disorders affecting thyroid function during pregnancy and after birth. The review highlights congenital hypothyroidism (CH), both primary and central, emphasizing the importance of early identification and timely treatment through neonatal screening. It also discusses neonatal Graves' disease, which occurs due to the transmission of thyrotropin receptor antibodies from the mother to the fetus, and the impact of antithyroid medications. Early diagnosis and management are crucial for improving outcomes in affected infants.
18. In their analysis, Moleti et al. (2014) examine “Thyroid Physiology in Pregnancy” and emphasize the significance of hypothyroidism, which occurs in 3-5% of pregnant women, with subclinical hypothyroidism being more prevalent than overt hypothyroidism. The paper describes both subclinical and overt hypothyroidism, offering recommendations for the treatment of overt hypothyroidism, particularly for elderly and pregnant women who should undergo levothyroxine therapy to normalize TSH levels. The article also addresses the ongoing controversy surrounding the treatment of subclinical hypothyroidism and the cautious approach to screening all pregnant women for thyroid disorders.
19. Parkes et al. (2012) highlight in their research that “Thyroid Disorders During Pregnancy” provides an overview of normal thyroid changes during pregnancy, such as increased TBG, the effect of hCG on TSH receptors, and increased peripheral thyroid hormone utilization. The paper discusses hyperthyroid and hypothyroid diseases in women of childbearing age and their effects on both the mother and the future baby. The review emphasizes the importance of screening and prevention of thyroid disorders during pregnancy and the postpartum period, along with the management of thyroid dysfunction during pregnancy.
20. The findings presented by Laurberg et al. (2013) reveal that “Screening for Overt Thyroid Disease in Early Pregnancy May Be Preferable to Searching for Small Aberrations in Thyroid Function Tests.” The authors discuss meta-analyses of thyroid function, pregnancy, and child cognition, arguing that small abnormalities in thyroid function tests may be influenced by uteroplacental changes and are unlikely to require treatment. In contrast, screening can identify cases of obvious hypothyroidism in 200-300 women per 100,000 pregnancies, preventing complications if thyroid disorders are diagnosed early with no neurocognitive loss. The article advocates for specific testing rather than modifying thyroid tests that show slight alterations.

**2.5 Studies related to Healthy Lifestyle to prevent the Thyroid in Pregnancy**

Studies related to healthy lifestyle to prevent the thyroid in pregnancy are presented as follows;

1. The systematic review with the title ‘Effect of Yoga Therapy on Hypothyroidism,’ by Bhandari and Mahto (2024) focuses on the effects of hypothyroidism (HT). It assesses eight qualifying studies, comprising both RCTs and the other intervention, in 421 HT patients. The current literature review establishes that yoga has a positive impact on thyroid hormone levels, lipid profile, cardiovascular autonomic function, lung functions, and psychological distress. Due to the clinical and methodological variability of the investigated studies, yoga is proposed as an additional cost-effective intervention for HT, we need further large well-designed research on the effectiveness of this practice and relevant pathways.
2. According to the comprehensive review by Duñabeitia et al. (2023), “Effect of Physical Exercise in People with Hypothyroidism,” the impact of exercise in hypothyroid patients is analyzed. The study combines data from 10 trials of low to moderate methodological quality that mostly included women with subclinical hypothyroidism. The meta-analysis showed that even if exercise had no direct effect on thyroid function status, it was effective in improving physical and mental health. The studies demonstrate that aerobic and resistance training is safe and effective for hypothyroidism, though exercise does not appear to change TSH levels.
3. In their analysis, Lee and Pearce (2022) examine “Assessment and Treatment of Thyroid Disorders in Pregnancy and the Postpartum Period.” The study describes courses of thyroid disorders in pregnant women. Both hyperthyroidism and hypothyroidism, forms of thyroid disorders, can impact the health of the would-be mother as well as the development of the fetus. This review emphasizes the need for early and appropriate treatment of diseases such as Graves’ disease, Hashimoto thyroiditis, and gestational transient thyrotoxicosis. It also covers iodine deficiency, thyroid cancer, and postpartum thyroiditis. By presenting the most recent data, the authors include recommendations for the assessment and management of thyroid disorders in pregnancy and puerperium to promote maternal and neonatal well-being.
4. A study conducted by Ruggeri et al. (2023) delves into “Autoimmune Thyroid Disorders: The Mediterranean Diet as a Protective Choice.” The article focuses on the growing trend in autoimmune thyroid diseases and the effects of diet on its progression. More so, the authors comment on the negative impact of the Western palate diet, which is comprised of fats and sugars, on the immune system balance and gut bacteria, contributing to autoimmune diseases. On the other hand, the Mediterranean dietary pattern, which is high in vegetables, olive oil, and moderate in fish, is protective. It is pro-immune, pro-gut, and anti-inflammatory – the three factors identified as helpful for avoiding thyroid autoimmunity.
5. Bath (2024) highlights in their research that “Thyroid Function and Iodine Intake: Global Recommendations and Relevant Dietary Trends.” The article focuses on the importance of iodine in making thyroid hormones, especially during pregnancy and early childhood when brain development relies on these hormones. While iodine intake varies globally and has been enhanced through programs such as salt iodization, countries without such programs face challenges, particularly during dietary transitions. The review examines variations in iodine intake among populations based on their dietary patterns, such as dairy consumption, and analyzes the effects of current trends, including reduced salt intake for cardiovascular health and the shift to plant-based diets, on iodine status.
6. The findings presented by Panaitescu et al. (2021) reveal “Pregnancy Complications Can Foreshadow Future Disease—Long-Term Outcomes of a Complicated Pregnancy.” The article examines how hypertensive disorders of pregnancy, such as gestational hypertension, preeclampsia, and gestational diabetes mellitus, portend future cardiovascular and metabolic diseases. The review notes that while some symptoms may resolve after childbirth, others may manifest later, particularly during the postmenopausal period. It emphasizes the importance of lifestyle and dietary changes and advocates routine blood pressure and glucose profile checks to prevent long-term complications. The authors argue that a woman’s obstetric history can be effectively used to predict and mitigate the risk of future diseases.
7. The findings presented by Panaitescu et al. (2021) reveal “Pregnancy Complications Can Foreshadow Future Disease—Long-Term Outcomes of a Complicated Pregnancy.” The article examines how hypertensive disorders of pregnancy, such as gestational hypertension, preeclampsia, and gestational diabetes mellitus, portend future cardiovascular and metabolic diseases. The review notes that while some symptoms may resolve after childbirth, others may manifest later, particularly during the postmenopausal period. It emphasizes the importance of lifestyle and dietary changes and advocates routine blood pressure and glucose profile checks to prevent long-term complications. The authors argue that a woman’s obstetric history can be effectively used to predict and mitigate the risk of future diseases.
8. As noted by Yim (2016), the study focuses on “Update on the Management of Thyroid Disease During Pregnancy.” It examines the effects of thyroid diseases on pregnancy alongside their management. While apparent thyroid disorders pose significant risks to both mother and infant, these risks can generally be mitigated through appropriate management. The review highlights that current finding on the risks of subclinical hypothyroidism are insufficient to support the routine use of levothyroxine, leading most guidelines to recommend targeted testing. However, new research revealing the limitations of case-finding approaches has prompted calls for routine screening. This study outlines changes in thyroid function, the management of thyroid disorders, and the ongoing controversy surrounding screening practices during pregnancy.
9. Candido et al. (2023) presents an in-depth review of “Prevalence of Excessive Iodine Intake in Pregnancy and Its Health Consequences.” The study revealed that 52% of 10,736 pregnant women across various regions had high iodine levels, leading to hypothyroxinemia, hypothyroidism, and hyperthyroidism in mothers, as well as thyroid dysfunction and macrosomia in newborns. The review highlights the role of high-iodine-content drinking water in contributing to excessive intake and examines the impact of gestational trimesters and FT4 levels in populations with excess iodine.

**2.6 Importance of Thyroid and Hypertension Management in Pregnancy**

Importance of thyroid and hypertension management in pregnancy are presented as follows;

1. Research led by Agrawal and Wenger (2020) investigates “Hypertension During Pregnancy,” discussing the prevalence of hypertensive disorders in pregnancy and the cardiovascular consequences for about 5-10% of pregnant women. The study shows that women with chronic hypertension have higher risks of pre-eclampsia, cesarean section, preterm delivery, low birth weight babies, and perinatal complications. New guidelines for blood pressure in the general population diagnose more at-risk women but target below 140/90, which may impair placental blood flow. The article emphasizes the role of low-dose aspirin in preventing preeclampsia and balancing antihypertensive activity with fetal outcomes. It suggests that shared care by obstetricians and cardiologists should be provided to control maternal and neonatal complications and potential future cardiovascular effects.
2. Alves Junior et al. (2022) presents an in-depth review of “Effect of Hyperthyroidism Control During Pregnancy on Maternal and Fetal Outcome,” examining how hyperthyroidism affects pregnancy. The meta-analysis of seven cohort studies concluded that although the treatment of hyperthyroidism decreased the risk of preeclampsia, low birth weight, spontaneous abortion, and preterm birth, no major impact was observed on outcomes such as abruptio placentae, fetal growth retardation, gestational diabetes, postpartum hemorrhage, or stillbirth. The paper emphasizes the need to manage hyperthyroidism during pregnancy, even if some risks remain unaltered.
3. A detailed study by Mégier, Dumery, and Luton (2023) discusses “Iodine and Thyroid Maternal and Fetal Metabolism During Pregnancy,” highlighting the crucial importance of thyroid hormones and iodine in regulating basal metabolism during pregnancy as well as fetal growth and neuronal development. It focuses on the possible adverse effects of thyroid disease, including hypo- or hyperthyroidism, on both the postpartum woman and the fetus. The study also covers aspects of placental control of thyroid and iodine metabolism, as well as changes in both normal pregnant women and those with pathologic states. This review emphasizes the importance of proper thyroid and iodine nutrient regulation for optimal health in both mother and offspring.
4. Van Trotsenburg (2020) offers valuable insights into “Management of Neonates Born to Mothers with Thyroid Dysfunction, and Points for Attention During Pregnancy,” investigating the relation between thyroid hormone and fetal development, as well as the effect of antithyroid agents on pregnancy. This review illustrates the impact of autoimmune thyroid disorders, including autoimmune thyroiditis and Graves’ disease, on fetal and neonatal thyroid function, resulting in transient neonatal hyper- or hypothyroidism. It also describes how maternal thyroid antibodies and anti-thyroid medications cross the placental barrier and outlines the approach to newborns of mothers with thyroid disorders.
5. The research work by Pearce (2015) sheds light on “Thyroid Disorders During Pregnancy and Postpartum,” explaining the changes to thyroid functioning during pregnancy and the consequences of a dysfunctional thyroid for the baby and the mother. It brings awareness to the orderly tackling of thyroid illnesses such as hypothyroidism and hyperthyroidism to avoid harm. The review gives an overview of the management during pregnancy and after birth, with a particular focus on the ongoing contentious issues within the area of specialty. These findings will be informative to clinicians and contribute to the ongoing pursuit of more evidence and collaboration to improve the treatment of pregnant and postpartum patients with thyroid dysfunction.
6. Andersen (2019) systematically reviews “Frequency and Outcomes of Maternal Thyroid Function Abnormalities in Early Pregnancy,” noting that although thyroid hormones play a key role in the maturation of fetal brain tissue, the routine measurement of thyroid function during pregnancy lacks adequate evidence. The review focuses on problems related to biochemical diagnostics and presents findings from the Danish National Birth Cohort, including a high prevalence of undiagnosed abnormal thyroid function. It also investigates the possible association of maternal thyroid dysfunctions and neurodevelopmental profiles in offspring.
7. A detailed study by Alemu et al. (2016) discusses “Thyroid Hormone Dysfunction During Pregnancy: A Review.” The review highlights thyroid dysfunctions such as hypothyroidism and thyrotoxicosis during pregnancy, which are associated with poor pregnancy outcomes, increased risk of abortion, preeclampsia, and negative effects on fetal intellectual capacity. It reemphasizes the significance of maternal thyroid hormones in fetal neuronal development and the need for early evaluation and management of thyroid disorders to minimize risks of adverse outcomes such as preterm birth and newborn morbidity. Particularly, it considers management strategies effective for both maternal and fetal health during pregnancy.
8. In examining “Thyroid Dysfunction and Thyroid Autoimmunity in Euthyroid Women in Achieving Fertility,” Medenica et al. (2015) identify the role of thyroid hormones in regulating menstrual cycles and fertility-related hormonal actions. The review discusses hypothyroidism, hyperthyroidism, and thyroid autoimmunity, along with their maternal and fetal complications. As with all issues concerning screening and treatment, there is debate over these findings. However, some research suggests that levothyroxine therapy could enhance fertility, particularly in women with thyroid autoimmunity.
9. Andersen and Laurberg (2016) offer valuable insights into “Managing Hyperthyroidism in Pregnancy: Current Perspectives,” explaining that while hyperthyroidism in pregnant women is comparatively rare, it is most commonly represented by Graves’ disease. This article reviews methods of thyroid function tests and highlights the challenges of interpreting these tests due to the physiological changes in pregnancy that impact thyroid hormone synthesis and metabolism. The authors emphasize the importance of managing hyperthyroidism to prevent serious consequences and pregnancy complications, particularly regarding the use of antithyroid drugs (ATDs) and the potential risk of fetal hyper- or hypothyroidism, which can lead to malformations if the mother is exposed during early pregnancy.
10. The research work by Sarkar and Bischoff (2016) sheds light on “Management of Hyperthyroidism During the Preconception Phase, Pregnancy, and the Postpartum Period,” exploring the physiological changes in pregnancy and the risks associated with antithyroid agents like methimazole and propylthiouracil during the first trimester. The article also addresses other conditions that may accompany pregnancy or breastfeeding, such as hyperemesis gravidarum and postpartum thyroiditis, and discusses potential therapies including surgery. The authors provide detailed information on various maternal, fetal, and neonatal adverse outcomes and their management during these stages.
11. The article titled “Turning to Thyroid Disease in Pregnant Women” by Andersen and Andersen (2020) has a clinical and scientific relevance since thyroid disease in pregnant women can negatively affect both the mother and the unborn child. The contents of the review discuss the management of obvious thyroid disorders while exploring the developing interest in ‘borderline’ thyroid disorders and isolated thyroid dysfunction. It also examines innovation in measuring thyroid function tests and the difference between observational studies and RCTs before discussing the future trends in the management and evaluation of maternal thyroid dysfunction during pregnancy.
12. Ferreira, Gomes, and Príncipe (2020) systematically review “Controversial Screening for Thyroid Dysfunction in Preconception and Pregnancy: An Evidence-Based Review,” discussing the ATA 2017 guidelines that recommend selective screening while introducing evidence supporting universal screening, especially in the first trimester of pregnancy. The review highlights that general population screening is cost-effective, simple, and helps prevent negative outcomes. However, the authors emphasize the need for further research to develop recommendations for a more individualized approach to preconception thyroid screening.
13. Through their investigation, Moroz et al. (2016) emphasize “Management of Severe Hypertension in Pregnancy,” reviewing diagnostic criteria for severe hypertension during pregnancy, antihypertensive agents, and management algorithms. The article highlights the importance of adopting appropriate management to prevent or minimize maternal morbidities and mortalities. The authors stress that increased attention and prompt response to high-risk patients improve outcomes through adherence to standards and constant monitoring of pregnant women with severe hypertension.
14. An evaluation by Ryan et al. (2024) discusses “Hypertension Management in Pregnancy,” examining the characteristics and definitions of hypertension in pregnancy and childbirth. The article explores differences in blood pressure management between general practitioners and obstetricians and reviews various treatment strategies for hypertension during pregnancy. The authors emphasize the importance of addressing issues in the postpartum period and highlight the relevance of continued care with a primary care physician to reduce cardiovascular risks and improve maternal health outcomes for hypertensive patients.

**2.7 Risks associated with Unmanaged Thyroid Disorders and Hypertension During Pregnancy**

Risks associated with unmanaged thyroid disorders and hypertension during pregnancy are presented as follows;

1. Insights provided by Berta et al. (2019) indicate “Hypertension in Thyroid Disorders,” examining the correlation between thyroid disorders and arterial hypertension, a prevalent condition affecting more than one-quarter of the world’s population. While most hypertensive individuals have primary or essential hypertension, secondary causes, including thyroid abnormalities, occur in about 10% of cases. Overt and subclinical hyper- and hypothyroidism can contribute to mild hypertension, with probable pathogenetic factors such as mutations in the genes of the hypothalamus-pituitary-thyroid axis and dyslipidemia leading to atherosclerotic vasculopathy. This article offers insights into the interaction between thyroid hormone metabolism, cardiovascular health, and hypertension prevalence, particularly focusing on thyroid-linked cardiovascular risks.
2. The study by Shulhai et al. (2024) critically analyzes “The Role of Nutrition on Thyroid Function,” focusing on the diet–gut–thyroid axis. It highlights the significance of micronutrients, including iodine, selenium, iron, vitamin A, and vitamin B12, with particular attention to their role in thyroid hormone synthesis and management. The review emphasizes how dietary modifications and gut microbiota alterations can lead to dysbiosis, deficiencies in trace elements, and thyroid disorders such as hypothyroidism, hyperthyroidism, and autoimmune thyroid disorders. This study serves as a reminder of the essential value of micronutrients in thyroid health and underscores areas that may warrant further investigation.
3. Exploring current trends, Gronowski (2018) evaluates “Evaluation of Thyroid Function During Pregnancy: Have We Taken a Wrong Turn?” The article critiques the American Thyroid Association’s guidelines for diagnosing and managing thyroid disorders during pregnancy. While the ATA recommends screening for thyroid abnormalities using TSH and the FT4 index to estimate free thyroxine levels, the author questions the validity of this approach. Instead, the article advocates for the use of immunoassays with state-of-the-art technologies or LC-MS/MS for accurate FT4 determination. It also discusses variability in FT4 measurement during pregnancy and suggests factors for reconsideration to enhance clinical thyroid function assessments.
4. An in-depth assessment by Reddy and Jim (2019) uncovers “Hypertension and Pregnancy: Management and Future Risks.” The article explores the challenges of pregnancy-induced hypertension, a leading cause of maternal and fetal complications. It emphasizes strategies to prevent maternal cardiovascular and cerebrovascular risks while ensuring fetal safety. Chronic hypertension warrants pre-pregnancy evaluation and close monitoring during pregnancy. Antihypertensive therapy is recommended for severe hypertension (systolic ≥160 mm Hg or diastolic ≥105 mm Hg). The article highlights evolving insights into hypertensive disorders' origins, their link to long-term cardiovascular and metabolic risks, and the importance of long-term monitoring to mitigate future health complications.
5. In their comprehensive analysis, Ge et al. (2020) uncovers “Maternal Thyroid Dysfunction During Pregnancy and the Risk of Adverse Outcomes in the Offspring: A Systematic Review and Meta-Analysis.” A systematic review of 29 studies showed that children of mothers with hyperthyroidism had an increased risk of ADHD and epilepsy, while children of mothers with hypothyroidism had an increased risk of ADHD, ASD, and epilepsy. Such results concluded that regular thyroid function tests and early treatment in pregnancy should not be overlooked for risks to the offspring’s neurocognitive and developmental health.
6. The investigation carried out by Ee et al. (2022) highlights “Complementary Medicines and Therapies in Clinical Guidelines on Pregnancy Care: A Systematic Review.” The study looked at 48 guidelines and found considerable variability in the advice given concerning vitamin D, calcium, and supplementation for obesity conditions in particular. There was some agreement found when it came to ginger and vitamin B6 being used to treat nausea. Still, overall, most of the guidelines were lacking in editorial independence and development rigor, and most only scored poorly. The study emphasizes the direction for essential recommendations based on research on CMT use while pregnant to promote legalized care for pregnant women.
7. Focusing on “Thyroid Dysfunction and Pregnancy Outcomes,” Nazarpour et al. (2015) bring attention to the importance of thyroid dysfunction about pregnancy outcomes. It underscores risks associated with manifest hyperthyroidism and hypothyroidism such as miscarriage, preterm delivery, preeclampsia, and neonatal morbidity and mortality, but the risks associated with subclinical hypothyroidism and thyroid autoimmunity are uncertain. This research highlights the fact that there is a probable relationship between subclinical thyroid dysfunction and thyroid autoimmunity during pregnancy, although more study and knowledge are acutely required to actualize the definite effects of both states. Overall, this review reveals the significance of thyroid function in maternal and fetal outcomes, as well as the necessity of the individualized clinical approach.
8. The research findings of Tingi et al. (2016) contribute to “Benign Thyroid Disease in Pregnancy: A State-of-the-Art Review,” addressing the effects of thyroid dysfunction in pregnancy besides its management to avoid adverse effects on both the mother and her unborn child. Overt hypothyroidism and hyperthyroidism are associated with such complications as preeclampsia, preterm delivery, and low birth weight. It doesn’t reflect on new guidelines or critically discuss past ones, featuring an evidence-based management plan for subclinical hypothyroidism with levothyroxine and clinical follow-up for postpartum thyroiditis. As with other autoimmune conditions, it demonstrates the temporary remission of autoimmune thyroid diseases in the pregnancy period and the importance of follow-up care after childbirth, which will be useful for clinicians.
9. The analytical work of Rao et al. (2023) provides insight into “A Review on Thyroid Dysfunction and Hypertensive Disorder in Pregnant Women,” highlighting those thyroid disorders, especially hypothyroidism, which may require an increased dose in the first trimester of pregnancy and hypertension, affecting up to 10% of pregnant women, significantly contribute to complications such as preeclampsia. This paper reviews risk factors, complications, and management of these conditions and draws implications that may inform methods to enhance the care of pregnant women and reduce morbidity from these common pregnancy-related diseases.
10. In their thorough exploration, Yuriah and Kartini (2022) identify “Factors Affecting the Prevalence of Hypertension in Pregnancy: Scoping Review,” assessing the global burden and risk factors of Hypertensive Disorder of Pregnancy (HDP), a leading cause of 60–80% of maternal deaths. Based on articles derived from PubMed and ProQuest databases, the study involved the review of 108 articles, with nine articles satisfying inclusion requirements. It identified five key factors influencing hypertension in pregnancy: heredity, age, parity and multiple pregnancies, body mass index, and more. The article emphasizes severe maternal and fetal morbidity and mortality related to hypertension, underscoring the need for better referral systems and further investigation into its causes.
11. Highlighting critical issues, Tamargo et al. (2019) examine “Pharmacotherapy for Hypertension in Pregnant Patients: Special Considerations,” focusing on hypertensive disorders in pregnancy, which are known precursors to adverse maternal and newborn outcomes. This article analyzes the pharmacological characteristics of antihypertensive agents, discussing their effects on both the pregnant woman and the fetus. It also addresses disagreements over the management of patients with stage 1 hypertension without organ involvement and the ambiguity surrounding the lifetime outcomes of maternal use of antihypertensive medications during pregnancy. The authors stress the need for further well-designed clinical trials to address these contentious issues in the management of HDP.
12. Through detailed analysis, Upadya and Rao (2018) uncover significant findings on “Hypertensive Disorders in Pregnancy,” a major issue in India, where the rate of HDP is 7.8%. The paper elaborates on the organ systems affected by HDP, including cardiovascular complications, renal compromise, and compromised uteroplacental blood flow. It also defines critical management protocols such as adequate fetal monitoring, antihypertensive treatment, anticonvulsant treatment, and safe anesthesia. The article focuses on the health of both the mother and baby, emphasizing good obstetric practices and less invasive procedures, particularly in cases of severe pre-eclampsia.
13. According to the comprehensive review by Podymow and August (2017), “New Evidence in the Management of Chronic Hypertension in Pregnancy” delves into the challenges of managing chronic hypertension (CH) during pregnancy, which affects 1% to 5% of all pregnancies. The review addresses the ongoing discussion about the merits of reducing blood pressure in these patients and the goals of antihypertensive therapy. It primarily focuses on the CHIPS trial, which has examined the effects of tight and less tight control of blood pressure in patients with mild to moderate hypertension. The article emphasizes changes in management and treatment plans in light of these clinical trials, particularly stressing the importance of maintaining slow blood pressure variations to minimize risks for both the mother and fetus.
14. In their analysis, Amro et al. (2016) examine “Treatment Options for Hypertension in Pregnancy and Puerperium” by providing a comprehensive overview of the medications used to treat hypertension in pregnant women and during the puerperium period. The authors discuss several classes of antihypertensive agents, their actions and metabolisms, and the fetal risks associated with their use. They advocate for a step-wise approach in managing the condition and discourage aggressive treatment to prevent worsening uteroplacental blood flow. Additionally, the article includes recent studies on biomarkers under examination as well as nanomedicine and placenta-targeted therapies, with the aim of developing secure treatments that do not harm the mother or her unborn child.
15. A study conducted by Hauspurg et al. (2019) delves into “Hypertensive Disorders of Pregnancy and Future Maternal Health: How Can the Evidence Guide Postpartum Management?” by summarizing postpartum management of hypertension in pregnancy, a condition that raises cardiovascular risk among women who experience it. The study stresses the importance of adequate postpartum treatment and strongly advocates for home blood pressure measurement in the first year after delivery. It also emphasizes enhancing continuity of care with ambulatory medical providers. Contrary to the title, the authors propose the prevention of cardiovascular risks throughout the reproductive years to improve future maternal health.
16. Moleti et al. (2019) highlight in their research that “Hyperthyroidism in the Pregnant Woman: Maternal and Fetal Aspects” discusses the diagnosis and management of hyperthyroidism during pregnancy, a relatively rare but dangerous condition. The review examines the maternal and fetal adverse outcomes in thyrotoxicosis when not properly managed, as well as the effects of TRSAb or ATT on fetal thyroid function. The study emphasizes the importance of closely monitoring patients with conditions like fetal or neonatal hyperthyroidism and planning their care in collaboration with endocrinologists, obstetricians, and neonatologists.
17. The findings presented by Feldt-Rasmussen et al. (2024) reveal that “Consequences of Undertreatment of Hypothyroidism” highlights the major effects of inadequate levothyroxine (LT4) replacement in hypothyroidism. As a highly prevalent noncommunicable disease, untreated hypothyroidism can lead to significant sequelae, including growth and developmental delay in children, cerebral and physical dysfunction in adults, and subfertility in women. The review also emphasizes that untreated hypothyroidism is associated with cardiovascular disorders, obesity, poor quality of life, and physiological alterations in TSH levels with age. The authors advocate for greater attention from healthcare practitioners and policymakers to reduce the personal and socioeconomic impact of undertreatment.

**2.8 The Role of Lifestyle Modifications in Managing and Preventing these Conditions in Pregnancy**

The Role of lifestyle modifications in managing and preventing these conditions in pregnancy is presented as follows;

1. Research led by McNestry et al. (2023) investigates “Pregnancy Complications and Later Life Women's Health,” focusing on the relationship between pregnancy complications and chronic diseases in later-life women’s health. The study emphasizes pregnancy as a physiological stress test that helps identify preconditions for cardiovascular diseases, diabetes, VTE, CKD, and mental health disorders. By examining gestational hypertension, preeclampsia, gestational diabetes, stillbirth, and recurrent miscarriage, the authors identify these conditions as risk factors for chronic illnesses. They highlight the importance of postnatal counseling, risk reduction strategies, and appropriate scientific investigations to determine ideal screening periods for women who have experienced complicated pregnancies.
2. Mate et al. (2021) presents an in-depth review of “Lifestyle, Maternal Nutrition, and Healthy Pregnancy,” examining healthy lifestyle behaviors during the preconception period, pregnancy, and the postpartum period for successful pregnancies and the prevention of gestational diseases. The study emphasizes the importance of nutrition, including adequate vitamins, fiber, polyunsaturated fats, and other nutrients, especially for overweight, obese, or diabetic women. It advocates for at least 30 minutes of moderate exercise, highlighting its positive effects in reducing risks of preeclampsia, gestational diabetes, and postpartum weight retention. The article also discusses the role of microbiome modulation, stress, and maternal genes, indicating how they influence the health of both the woman and her fetus, as well as the quality of their lives.
3. A detailed study by Gulati (2024) discusses “Lifestyle Medicine’s Role in Common Hormonal Disorders: A Case-Based Discussion,” examining the effect of therapeutic lifestyle changes on hormonal disorders like PCOS, autoimmune thyroid disease, and male hypogonadism. These conditions, prevalent among young and middle-aged individuals, are often linked to unhealthy lifestyles. Using three original case reports, the article highlights favorable changes in patients' symptomatology and biochemical parameters after lifestyle modifications. The study underscores the importance of counseling patients on diet, exercise, and other lifestyle changes as a core aspect of managing these endocrinologic conditions to improve health outcomes and disease state management.
4. Dewidar et al. (2023) offer valuable insights into “Effectiveness of Nutrition Counseling for Pregnant Women in Low‐and Middle‐Income Countries to Improve Maternal and Infant Behavioral, Nutritional, and Health Outcomes: A Systematic Review,” examining the effects of two-way interactive nutrition counseling for maternal and infant health in LMICs. The review demonstrates that such nutritional counseling improved dietary intake, gestational weight, and breastfeeding initiation rates. However, its relationship with stillbirth, anemia of pregnancy, and CS delivery remains unclear. The study emphasizes the need for larger randomized trials to better understand the impact on health inequality and related outcomes.
5. Velasco and Taylor (2018) shed light on “Identifying and Treating Subclinical Thyroid Dysfunction in Pregnancy: Emerging Controversies,” discussing the controversy surrounding the treatment of subclinical thyroid dysfunction in pregnancy. While hypothyroidism with symptoms is effectively managed, the approach to subclinical hypothyroidism and other thyroid disorders remains a topic of debate. The review addresses the risks and benefits of treating subclinical thyroid dysfunction, as well as concerns about overdiagnosis and over-treatment. It emphasizes the need for consensus between endocrinologists and obstetricians on screening and management strategies, particularly with the current trend toward the use of levothyroxine in practice.
6. Nigatie et al. (2024) systematically review “Prevalence of Thyroid Dysfunction Among Pregnant Women in the Horn of Africa: A Systematic Review and Meta-analysis,” focusing on thyroid dysfunction in the Horn of Africa. In a cross-sectional study of 2538 pregnant women, the overall rate of thyroid dysfunction was found to be 12%, with isolated hypothyroidism detected in 10% of the subjects. The study highlights high variability and emphasizes the need for affordable thyroid screening during pregnancy. This research calls for further investigation into the impact of thyroid treatment on women’s fertility.
7. **Through their investigation, Babiker et al. (2020) emphasize “The Role of Micronutrients in Thyroid Dysfunction,” exploring the relationship between nutrition and thyroid dysfunction in children. They have scared people more into believing it is caused by iodine deficiency all over the world. The article also mentions other micronutrients and non-carbohydrate nutrients which causes thyroid disorders including cruciferous vegetables, pearl millet, soy products, cassava and many more. Another way that goitre is described to come about in areas with high prevalence is through contamination of water with goitrogens also forms a key environmental factor. The article cuts across the need for dietary advice and exclusion of high goitrogenous foods.**
8. **An evaluation by Tuzil et al. (2021) discusses “Health-Related Quality of Life in Women with Autoimmune Thyroid Disease During Pregnancy and Postpartum: Systematic Review Including 321,850 Pregnancies” The systematic review analyzed 21 studies with a total of 321,850 pregnancies, focusing on patient-reported outcomes and standardized assessments of depression and anxiety. The findings reveal ambiguous data on the impact of thyroid disease on quality of life during pregnancy and its relationship with postpartum mood disorders such as depression and alexithymia. The lack of generic quality of life data limits the development of economic models for thyroid screening in pregnant women.**
9. Insights provided by Korevaar et al. (2017) indicate “Thyroid Disease in Pregnancy: New Insights in Diagnosis and Clinical Management.” The article discusses the role of thyroid hormones in pregnant women and the health of their unborn babies, highlighting the evolving understanding of thyroid disease. It emphasizes that TSH should no longer be regarded as having strict borderline values. The review also explores the role of thyroid peroxidase autoantibodies and human chorionic gonadotropin in thyroid disorders and addresses concerns regarding the overprescription of levothyroxine. By examining studies from the last decade, the article offers new perspectives on TSH reference ranges, the factors influencing thyroid abnormalities, and strategies for identifying pregnant women who would benefit from targeted interventions.
10. The study by Geng et al. (2022) critically analyzes “Systematic Review and Meta-Analysis on the Influence of Thyroid Dysfunction in Early Pregnancy on Pregnancy Outcomes Under Ultrasound Guidance.” The article explores the impact of thyroid disorders on pregnancy outcomes and newborn health. A meta-analysis of 13 clinical trials involving 788,867 pregnant women revealed that thyroid dysfunction is linked to anemia, preterm birth, fetal distress, low Apgar scores, pre-eclampsia, placental abruption, and postpartum hemorrhage. Based on data from large databases, the study discusses the relationship between thyroid dysfunction and adverse pregnancy outcomes, emphasizing the importance of early screening and treatment of thyroid disorders during pregnancy.
11. Exploring current trends, None and Musharyanti (2021) evaluate “Health Promotion in Efforts to Increase Medication Compliance in Hypertensive Patients: A Literature Review.” The article delves into the understanding of medication adherence by hypertensive patients. This literature review identified eight eligible papers published in PubMed, Science Direct, and the Cochrene library that employed methods such as family support, Pender’s health promotion model, and m-health-based interventions. Common to these studies is the importance of health promotion strategies in self-compliance, a critical aspect of hypertension management to prevent complications. The study emphasizes the need for targeted health promotion to improve patient outcomes.
12. In their comprehensive analysis, Liu and Liu (2024) uncover “Hypertensive Disorders of Pregnancy: Causes, Diagnosis, Complications, and Management Strategies.” The article focuses on pregnancy-induced hypertension, which begins after the twentieth week of pregnancy and may lead to pre-eclampsia and eclampsia. The review provides an overview of the factors contributing to the condition, as well as the diagnostic and treatment approaches, along with potential complications. Emphasizing early detection, it highlights the crucial role healthcare workers play in preventing unfavorable outcomes. Additionally, the article promotes awareness, education, and health precautionary measures to protect both the mother and fetus from hypertensive disorders during pregnancy, addressing a significant health issue.
13. A critical perspective is offered by Li et al. (2020) on “The Clinical Value and Variation of Antithyroid Antibodies During Pregnancy.” The article focuses on the relationship between thyroid-stimulating hormone receptor antibodies (TRAbs), thyroid peroxidase antibodies (TPOAbs), and thyroid globulin antibodies (TgAbs) with thyroid autoimmune diseases and pregnancy outcomes. It examines the fluctuation of these antibodies and their negative consequences on maternal and fetal health. The review also discusses the molecular mechanisms behind complications related to antibodies, the frequency of titer checks during pregnancy, and the definition of normal antibody levels during pregnancy to optimize maternal and fetal outcomes.
14. The investigation carried out by Abid et al. (2016) highlights “Complications and Management of Hypothyroidism: A Review.” The article discusses the epidemiology and approaches towards the disease, particularly focused on the Indian population, which has a higher rate of hypothyroidism compared to countries like the United Kingdom or the United States. The review identifies thyroiditis as a leading cause of hypothyroidism, with other contributing factors including past treatments and diet. It elaborates on the challenges of managing hypothyroidism and emphasizes the importance of proper diagnosis and symptom control methodologies in dealing with thyroid disorders.
15. Through a systematic review, Shinohara et al. (2018) discuss “Pregnancy Complications Associated with Maternal Hypothyroidism.” The review analyses the link between hypothyroidism in pregnant women and various pregnancy complications, highlighting that untreated or inadequately treated hypothyroidism increases the risks of abortion, preterm birth, intrauterine fetal death, and preeclampsia. The study also suggests that these risks can be reduced by proper treatment, primarily through levothyroxine, although the optimal dosage remains a topic of controversy. The authors conclude that the levothyroxine dose should be individualized based on the gestational phase and laboratory data to achieve a euthyroid state and improve pregnancy outcomes.
16. **Focusing on “Thyroid Diseases in Pregnancy: A Current and Controversial Topic on Diagnosis and Treatment Over the Past 20 Years” Giacobbe et al. (2015) bring attention to the management of thyroid diseases in pregnancy, MVTD and its effects on both the mother and the unborn child. The article analyses no routine thyroid disease testing for the population while there are recommendations for those who are at risk for developing this ailment. They underscore the need for iodine prophylaxis and the usage of clinical diagnosis algorithms as a map to follow. The review affirms that proper management of thyroid disorders is important in pregnancy if the best result is to be achieved.**
17. The research findings of Singh et al. (2023) contribute to “Nutritional Management and Interventions in Complications of Pregnancy,” highlighting the potential hazards of pregnancy, including early pregnancy loss, such as miscarriage and stillbirth, which occur in about 15% of pregnancies. The review also demonstrates how effectively planned nutrition interventions can complement drug treatment to address complications. It focuses on supplementing with key nutrients to correct maternal deficiencies during gestation and providing metabolic management solutions throughout pregnancy.
18. An exploration conducted by Tsakiridis et al. (2022) emphasizes “Thyroid Disease in Pregnancy: A Descriptive Review of Guidelines,” presenting a scoping review of leading organization guidelines on diagnosing and managing thyroid disorders during pregnancy. The study identifies a consensus on the appropriateness of pregnancy-specific reference ranges for diagnosing overt and subclinical hypothyroid and hyperthyroid states. It highlights that screening for thyroid abnormalities is focused mainly on high-risk clients. The review also discusses whether to treat subclinical thyroid disease and the recommended dietary allowance of iodine, emphasizing the importance of aligning best practice management with standard evidence to improve maternal and neonatal outcomes.
19. In their thorough exploration, Andersen et al. (2015) identify “Foetal Programming by Maternal Thyroid Disease,” characterizing thyroid dysfunction during pregnancy and its potential impact on fetal brain proliferation, which can increase the likelihood of neurological and psychiatric disorders. The authors emphasize the importance of thyroid hormones in early brain development and outline the risks of developing conditions such as seizures, autism spectrum disorders, ADHD, and other psychiatric diseases during adolescence and young adulthood. The review stresses the need for better control of thyroid diseases in pregnant women to reduce adverse long-term effects on offspring health through mechanisms of fetal programming.
20. Highlighting critical issues, Bortolotto et al. (2018) examine “Resistant Hypertension in Pregnancy: How to Manage?” The article provides an overview of managing resistant hypertension during pregnancy or pre-existing hypertension throughout pregnancy and postpartum severe hypertension. It also addresses the barriers to controlling hypertension in pregnancy, particularly when drugs such as ACE inhibitors and angiotensin II receptor antagonists are contraindicated. The review discusses the judicious control of blood pressure, mentioning methyldopa as one of the commonly used treatments, along with other antihypertensives such as beta blockers and calcium channel blockers. The article focuses on the strategies needed to minimize risks for the mother and maintain fetal health.
21. In pursuit of understanding “Physical Exercise in Pregnancy: Benefits, Risks and Prescription,” Ribeiro et al. (2022) study the dangers, advantages, and recommendations regarding exercise during pregnancy. The authors emphasize the importance of exercise as a preventative measure against pregnancy complications, including gestational diabetes, hypertensive disorders, and prenatal depression. Recent meta-analysis of randomized controlled trials show that exercise does not increase adverse maternal or perinatal outcomes. The review focuses on how to choose the type and intensity of exercise for a woman based on her physical fitness and pregnancy parameters, aiming to promote overall health without compromise.

**2.9 Research Gaps Identified**

The research gaps of the study are presented as follows;

1. **Lack of Correlational Data:** Few studies have explored the correlation between awareness of thyroid and hypertension and demographic variables among pregnant women, limiting targeted interventions.
2. **Limited Awareness-Based Educational Interventions:** There is a shortage of studies focusing on educating pregnant women about lifestyle modifications to prevent thyroid dysfunction and hypertension, particularly in the Indian context.
3. **Insufficient Evaluation of Lifestyle Modification Outcomes:** Research evaluating the direct impact of lifestyle changes on clinical indicators like blood pressure and thyroid hormone levels during pregnancy remains limited.
4. **Lack of Integrated Behavioral and Clinical Assessments:** Existing studies rarely combine assessments of knowledge, behavior change, and medical outcomes in a single framework.
5. **Underrepresentation of Rural Populations:** Rural and semi-urban pregnant populations are often underrepresented in lifestyle intervention research, despite being high-risk groups.

**2.10 Summary of Chapter**

This chapter reviewed existing literature on thyroid dysfunction and hypertensive disorders during pregnancy, highlighting their prevalence, risk factors, and adverse outcomes for both mother and fetus. It explored the physiological and clinical implications of these conditions and established their interconnectedness, emphasizing the need for early detection and preventive strategies. The review also underscored the limited awareness among pregnant women regarding these risks, especially in low-resource settings, and the influence of demographic variables such as education, age, and parity on knowledge levels. Several studies confirmed the importance of structured antenatal education and screening in improving maternal outcomes, yet gaps remain in translating this evidence into localized, accessible interventions.

Further, the chapter examined the role of lifestyle modifications—such as diet, physical activity, stress management, and sleep hygiene—in managing thyroid and hypertensive conditions during pregnancy. It presented evidence from intervention-based studies showing improvements in both awareness and clinical outcomes through behavior-driven approaches. However, it also identified key research gaps, including a lack of integrated pre-post evaluations, limited educational outreach, and underrepresentation of rural populations in current studies. These gaps provide the rationale for the present research, which aims to assess correlations between awareness and demographics, deliver targeted lifestyle education, and evaluate the effectiveness of these interventions on the health of pregnant women.

**Chapter 3**

**Research Methodology**

**3.1 General Introduction**

The methodology chapter outlines the systematic approach undertaken to evaluate the impact of lifestyle modifications on the awareness, prevention, and management of thyroid dysfunction and hypertension among pregnant women. Given the increasing prevalence of these conditions and their significant implications on maternal and fetal health, it is crucial to adopt non-pharmacological, preventive strategies that are both scalable and cost-effective.

This study adopts a **quasi-experimental pre-test/post-test design** to measure the effectiveness of structured lifestyle interventions—focused on diet, physical activity, and stress management—in improving health awareness and clinical outcomes. The methodology is framed to ensure that changes in participants' knowledge levels, lifestyle behaviors, and key medical indicators (e.g., blood pressure, TSH, T3, T4 levels) are accurately captured and statistically analyzed.

The study also considers the influence of **sociodemographic variables**—such as education level, parity, and family history—on baseline awareness and the extent of change post-intervention. By integrating both qualitative self-assessments and quantitative medical data, the research aims to provide comprehensive insights into how lifestyle education can serve as an effective tool for maternal health promotion.

This chapter details the research design, sampling strategy, data collection instruments, validation methods, ethical considerations, and the statistical techniques used to test the hypotheses and meet the study objectives.

**3.2 Research Design**

The present study employs a quasi-experimental pre-test and post-test research design with a single group intervention model. This design is selected to evaluate the impact of structured lifestyle modification interventions on the awareness, prevention, and management of thyroid dysfunction and hypertension among pregnant women (Shrestha, 2020).

The design involves assessing participants' baseline knowledge, lifestyle behaviours, and clinical indicators before the intervention (pre-test), followed by the implementation of educational and behavioural strategies focusing on diet, physical activity, and stress management. After a defined intervention period, the same parameters are re-evaluated (post-test) to determine the effectiveness of the lifestyle changes.

This design allows for:

* Measuring within-subject changes over time.
* Comparing pre- and post-intervention outcomes such as awareness levels and clinical measures (e.g., blood pressure, thyroid hormone levels).
* Evaluating the practicality and efficacy of lifestyle interventions in real-world antenatal care settings.

Though it lacks a randomized control group, this design is appropriate for community-based interventions were ethical and logistical constraints limit randomization. The inclusion of validated tools, medical data, and statistical analysis strengthens the internal validity of the study outcomes.

### **3.3 Research Approach**

This study follows a **quantitative research approach**, supplemented with elements of descriptive and inferential statistical analysis. The quantitative method is appropriate for objectively measuring the impact of lifestyle modification on both awareness and clinical outcomes related to thyroid dysfunction and hypertension in pregnancy (Hanandeh et al., 2020).

The approach includes:

* **Descriptive statistics** to summarize demographic characteristics, awareness levels, and lifestyle behaviors.
* **Inferential statistics** such as paired t-tests and chi-square tests to evaluate the significance of changes post-intervention and explore correlations between demographic variables and knowledge levels.

By relying on structured questionnaires, validated clinical data (e.g., TSH, BP), and pre-post assessments, this approach ensures measurable, replicable, and statistically analyzable outcomes. The ultimate aim is to draw generalizable conclusions about the effectiveness of lifestyle education in antenatal care settings.

### **3.4 Research Questions**

The study is guided by the following key research questions:

1. What is the current level of knowledge and awareness among pregnant women regarding thyroid dysfunction and hypertensive disorders during pregnancy?
2. Is there a significant relationship between selected demographic variables (e.g., age, education, parity, income) and awareness levels about thyroid and hypertension in pregnancy?
3. What is the impact of lifestyle modifications—such as dietary changes, physical activity, and stress management—on the prevention and management of thyroid and hypertension among pregnant women?
4. Do structured educational interventions lead to measurable improvements in physiological indicators such as blood pressure and thyroid hormone levels (TSH, T3, T4)?
5. What are the perceived barriers and facilitators to adopting lifestyle modifications during pregnancy from the perspective of the participants?

### **3.5 Hypotheses**

Based on the objectives and research questions, the following hypotheses have been formulated to statistically test the effectiveness of lifestyle modification in improving awareness and managing thyroid dysfunction and hypertension among pregnant women:

#### **Hypothesis 1 (H1): Awareness Improvement**

* **Null Hypothesis (H01):** There is no significant difference in the awareness scores of pregnant women regarding the prevention and management of thyroid and hypertension before and after the intervention.
* **Alternative Hypothesis (HA1):** There is a significant difference in the awareness scores of pregnant women regarding the prevention and management of thyroid and hypertension before and after the intervention.

Statistical Test Used: Paired Sample t-Test

#### **Hypothesis 2 (H2): Demographic Association**

* **Null Hypothesis (H02):** There is no statistically significant association between the selected demographic variables (age, education, parity, income, etc.) and awareness level regarding thyroid and hypertension among pregnant women.
* **Alternative Hypothesis (HA2):** There is a statistically significant association between the selected demographic variables and awareness level regarding thyroid and hypertension among pregnant women.

Statistical Test Used: Chi-square Test of Independence

#### **Hypothesis 3 (H3): Lifestyle Behavior Change**

* **Null Hypothesis (H03):** There is no significant difference in the lifestyle practices of pregnant women before and after the intervention.
* **Alternative Hypothesis (HA3):** There is a significant difference in the lifestyle practices of pregnant women before and after the intervention.

Statistical Tests Used: Wilcoxon Signed-Rank Test and McNemar’s Test (for ordinal and binary lifestyle behavior data)

#### **Hypothesis 4 (H4): Effectiveness of Education**

* **Null Hypothesis (H04):** There is no significant impact of educating and making pregnant women aware of lifestyle modifications on the prevention and management of thyroid and hypertension.
* **Alternative Hypothesis (HA4):** Educating and making pregnant women aware of lifestyle modifications has a significant impact on the prevention and management of thyroid and hypertension.

Statistical Tests Used: Wilcoxon Signed-Rank Test, McNemar’s Test, and comparison of pre- and post-clinical outcomes (e.g., BP, TSH levels)

### **3.6 Study Setting**

The study was conducted in selected antenatal care centres and maternity clinics located in urban and semi-urban areas of Delhi, NCR. These healthcare facilities were chosen based on their accessibility, availability of a diverse group of pregnant women, and cooperation from healthcare staff to support the intervention and data collection process.

The setting provided an appropriate environment for:

* Conducting educational sessions and lifestyle counseling.
* Collecting clinical and self-reported data from participants.
* Ensuring follow-up for post-test assessments and monitoring changes in awareness, behavior, and clinical indicators such as blood pressure and thyroid hormone levels (TSH, T3, T4).

The selection of multiple centers aimed to enhance the representativeness of the sample and capture variability in socio-demographic factors, such as education, income, and residential background (urban, semi-urban, and rural).

### **3.7 Population and Sampling**

#### **Target Population**

The target population for this study included **pregnant women aged 18 to 40 years** attending antenatal clinics at the selected healthcare centers. The population specifically consisted of those:

* At risk of or diagnosed with thyroid dysfunction or hypertension.
* Willing to participate in a lifestyle modification intervention program.

#### **Sample Size**

A total of **200 pregnant women** were selected based on inclusion and exclusion criteria. The sample size was determined to ensure sufficient statistical power for detecting significant changes between pre- and post-intervention assessments (Chahal et al., 2024).

#### **Sampling Technique**

A **purposive sampling technique** was used to recruit participants who met the criteria and were available and willing to participate during the data collection period. This method was chosen to focus on individuals who could most benefit from and contribute to the study objectives (Chahal et al., 2023).

**3.8 Inclusion and Exclusion Criteria**

To ensure methodological rigor and the reliability of findings, clearly defined inclusion and exclusion criteria were applied to recruit suitable participants for the study. These criteria were designed to select pregnant women who could benefit from the intervention and were capable of completing the study procedures. A summarized breakdown of the inclusion and exclusion criteria is presented in **Table 3.1.**

#### **Inclusion Criteria**

* Pregnant women aged 18–40 years.
* In any trimester of pregnancy.
* Diagnosed with or at risk of thyroid dysfunction or hypertension.
* Able to provide informed consent.
* Residing in the study area for the duration of the intervention.
* Able to read and understand the study language (local language or English).

#### **Exclusion Criteria**

* Women below 18 or above 40 years of age.
* High-risk pregnancies requiring intensive medical care.
* Presence of chronic comorbidities such as severe renal, cardiac, or autoimmune diseases.
* Inability to communicate effectively due to language or cognitive barriers.
* Unwillingness or inability to attend follow-up assessments.

**Table 3.1 Inclusion and Exclusion Criteria Summary**

|  |  |  |
| --- | --- | --- |
| **Criteria Type** | **Inclusion Criteria** | **Exclusion Criteria** |
| **Age** | Pregnant women aged 18–40 years | <18 or >40 years |
| **Pregnancy Stage** | Any trimester (1st, 2nd, or 3rd) | High-risk pregnancies requiring intensive medical intervention |
| **Medical Condition** | Diagnosed or at risk of thyroid disorders or hypertension | Severe comorbidities (renal, cardiac, or autoimmune diseases) |
| **Consent** | Provided informed consent and willingness to participate in all stages | Refused or unable to give consent |
| **Communication** | Can read and understand the study language (local or English) | Language barrier or cognitive impairments |
| **Residency** | Residing in the study area for the intervention period | Planning to relocate or inaccessible for post-intervention follow-up |

### **3.9 Data Collection Tools**

In order to assess the effectiveness of lifestyle modifications on the awareness and management of thyroid dysfunction and hypertension during pregnancy, a **comprehensive, structured questionnaire** and supporting clinical data sheets were developed and utilized (Aboagye et al., 2016). The questionnaire was divided into multiple sections, each designed to address a specific component of the research objectives, including demographics, awareness levels, lifestyle practices, clinical outcomes, and participant feedback.

The tools were developed in alignment with the study's research questions and were reviewed by subject experts in public health, nursing, and obstetrics to ensure **content validity**. The complete questionnaire used in the study is provided in **Appendix I. Table 3.2** provides a detailed overview of the different sections of the data collection instruments used in the study. Each section served a distinct purpose and captured specific types of data. The table also presents the type of data collected (e.g., nominal, ordinal, binary, continuous) and the methods used to validate or confirm the reliability of each section.

**Table 3.2 Data Collection Instruments and Validation Metrics**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tool / Section** | **Purpose** | **Data Type** | **Validation / Reliability** |
| Section A: Demographics | Gather sociodemographic profile | Nominal / Ordinal | Content validated by experts |
| Section B: Knowledge and Awareness (Q10–17) | Assess awareness on thyroid and hypertension in pregnancy | Dichotomous / Multiple | Cronbach’s α = 0.78; CVR = 0.85 |
| Section C: Medical Record Sheet (TSH, BP, etc.) | Track clinical outcomes pre- and post-intervention | Continuous / Binary | Verified through hospital records & physician review |
| Section D: Lifestyle Practices (Pre & Post) | Document exercise, diet, sleep, and supplementation | Ordinal / Binary | Test-retest reliability = 0.82 |
| Section E: Post-Intervention Lifestyle Changes | Identify sustained behavioral changes | Nominal / Likert | Pilot-tested with 30 participants |
| Section F: Medical Outcome Monitoring | Self-assessed improvement in BP, thyroid, symptoms | Ordinal / Binary | Face-validated |
| Section G: Satisfaction and Feedback | Gather feedback on intervention usefulness | Likert / Nominal | Cronbach’s α = 0.80 (Likert items) |

### **3.10 Intervention Design**

The intervention in this study was a **structured lifestyle modification program** designed to improve awareness and support the prevention and management of thyroid dysfunction and hypertension in pregnant women. The intervention was conducted in **three phases** over a period of approximately **8–10 weeks**, and included educational, behavioral, and clinical engagement components.

#### **Intervention Components:**

* **Educational Sessions:** Interactive group and one-on-one counseling on the importance of lifestyle factors (diet, exercise, sleep, stress management) in preventing and managing thyroid and hypertension.
* **Demonstrations:** Practical demonstrations of prenatal exercises (e.g., walking, yoga) and diet planning.
* **Printed Materials:** Distribution of pamphlets in local language summarizing key takeaways, symptom checklists, and healthy practices.
* **Follow-Up Reinforcement:** Regular reminders and Q&A sessions at ANC visits to reinforce learning and address barriers.

The content was adapted to suit cultural sensitivities and literacy levels, and sessions were delivered by trained nurses and health educators under the supervision of obstetricians.

### **3.11 Data Collection Procedure**

The data collection process was conducted in two main stages: **pre-intervention (baseline)** and **post-intervention (follow-up).** The timeline and procedure were as follows:

Certainly! Here is a concise paragraph for each phase of the data collection process:

**A. Recruitment and Consent:** Eligible pregnant women were identified during routine antenatal clinic visits based on predefined inclusion criteria. Each potential participant was informed about the study’s purpose, procedures, and their rights, after which written informed consent was obtained to ensure voluntary participation.

**B. Pre-Test (Baseline):** At the baseline stage, participants completed Section A (Demographics), Section B (Knowledge and Awareness), and Section D (Lifestyle Practices) of the questionnaire. Concurrently, relevant clinical data—such as thyroid hormone levels (TSH, T3, T4), blood pressure readings, and other medical indicators—were collected from hospital records for initial comparison.

**C. Intervention Period:** Participants underwent structured lifestyle modification sessions over a span of 4 to 6 weeks. These sessions included guidance on diet, physical activity, stress management, and sleep hygiene. Ongoing follow-up and reinforcement were provided during their regular antenatal care (ANC) visits to promote adherence and clarify doubts.

**D. Post-Test (Follow-Up):** Following the intervention, the same questionnaire sections were re-administered to assess changes in awareness and practices. Additionally, participants completed new sections—Section E (Lifestyle Changes), Section F (Medical Outcomes), and Section G (Satisfaction & Feedback)—to evaluate behavioral adoption and perceptions. Updated clinical parameters were also recorded to measure any physiological improvements.

To maintain data consistency and reduce bias, the same data collectors administered the questionnaires and coordinated medical data verification pre- and post-intervention.

### **3.12 Ethical Considerations**

Ethical integrity was maintained throughout the research process, guided by national and institutional ethical standards.

**Approval:** Ethical clearance was obtained from the [Insert Name] Institutional Ethics Committee prior to data collection.

**Informed Consent:** Written informed consent was secured from all participants after explaining the purpose, procedures, benefits, and confidentiality protocols.

**Voluntary Participation:** Participation was entirely voluntary, with the right to withdraw at any stage without any impact on medical care.

**Confidentiality:** Participant information was coded and stored securely. Names or identifiable information were not disclosed in any publications.

**Non-Maleficence:** No invasive procedures were used, and all lifestyle suggestions adhered to prenatal care safety norms.

### **3.13 Data Analysis Plan**

The data collected from participants before and after the lifestyle modification intervention were analyzed using **SPSS (Statistical Package for the Social Sciences),** version 27. The analysis aimed to assess the effectiveness of the intervention in improving awareness, altering health-related behaviors, and contributing to better clinical outcomes (e.g., blood pressure and thyroid hormone levels). Both **descriptive** and **inferential statistical techniques** were used to ensure comprehensive and rigorous interpretation of the findings.

#### **Descriptive Analysis**

Descriptive statistics were employed to summarize the baseline characteristics and post-intervention status of the study participants. These included:

* **Frequencies and percentages** to describe categorical variables such as education level, occupation, residence type, family history, and lifestyle behaviors (e.g., exercise frequency, supplement intake).
* **Means and standard deviations** to evaluate continuous variables such as age, awareness scores, and clinical parameters (e.g., systolic and diastolic blood pressure, TSH levels).
* These summary statistics were instrumental in providing a demographic profile of the sample and identifying trends or patterns in health knowledge and practices.

#### **Inferential Analysis**

To test the study hypotheses and examine the relationships and effects of the intervention, the following inferential statistical tests were applied (see Table 3.3):

**Table 3.3 Statistical Tests for Hypotheses Testing**

|  |  |  |
| --- | --- | --- |
| **Hypothesis** | **Statistical Test Used** | **Purpose** |
| **H1** | Paired Sample t-Test | To assess whether there was a statistically significant difference in awareness scores before and after the intervention. |
| **H2** | Chi-square Test of Independence | To examine associations between awareness levels and selected demographic variables such as education, income, and parity. |
| **H3** | Wilcoxon Signed-Rank Test and McNemar’s Test | To assess pre- and post-intervention changes in ordinal and binary lifestyle practices (e.g., exercise frequency, diet modification, supplement use). |
| **H4** | Wilcoxon Signed-Rank Test and comparison of clinical data | To evaluate the physiological impact of lifestyle education on measurable clinical outcomes (e.g., thyroid hormone levels, blood pressure). |

Each test was chosen based on the level of measurement and distribution of the data. For example, the **Wilcoxon Signed-Rank Test,** a non-parametric alternative to the paired t-test, was used where data did not meet normality assumptions or where ordinal scales were involved.

#### **Scoring Criteria**

To quantify participants' knowledge and interpret behavioral changes, the following scoring and categorization criteria were applied:

* **Knowledge Scores (based on Section B of the questionnaire):**
  + **0–3:** Low knowledge
  + **4–6:** Moderate knowledge
  + **7–8:** High knowledge

These categories were used to assess baseline awareness levels and measure changes post-intervention.

* **Lifestyle Behavior Changes:**
  + Improvement in behavior was assessed by comparing the frequency and consistency of healthy practices before and after the intervention.
  + Practices such as **daily exercise, reduced salt intake, supplement adherence, and stress management** were analyzed for positive shifts in adoption.

#### **Statistical Significance Threshold**

A **p-value < 0.05** was considered statistically significant for all tests. This means that if the probability of the observed difference or association occurring by chance was less than 5%, the result was deemed significant and the null hypothesis was rejected.

**3.14 Summary of Chapter**

Chapter 3 provided a comprehensive overview of the research methodology employed to evaluate the effectiveness of lifestyle modifications in improving awareness and managing thyroid dysfunction and hypertension among pregnant women. It detailed the quasi-experimental design, quantitative research approach, research questions, and hypotheses guiding the study. The chapter also outlined the study setting, sampling strategy, inclusion and exclusion criteria, and the validated tools used for data collection. The intervention was described as a structured educational program tailored to antenatal care, and the step-by-step data collection procedure was explained. Ethical considerations were thoroughly addressed, ensuring the protection of participants’ rights. Finally, the data analysis plan was presented, specifying the descriptive and inferential statistical techniques used to evaluate the intervention's impact, with significance determined at p < 0.05.

**Chapter 4**

**Results and Discussion**

**4.1 General Introduction**

Chapter 4 presents a comprehensive analysis of the data collected to evaluate the effectiveness of a structured lifestyle modification intervention on the awareness, prevention, and management of thyroid dysfunction and hypertension among pregnant women. The chapter is structured to systematically present the findings related to the study’s research questions and hypotheses, using both descriptive and inferential statistical methods.

The chapter begins with an overview of the socio-demographic profile of the study participants. Variables such as age, education, gestational age, occupation, income, residence, family type, parity, and family history of thyroid or hypertension are detailed to establish the baseline characteristics of the sample. This demographic information provides important context for interpreting the results and assessing generalizability.

Subsequent sections compare pre-test and post-test awareness levels regarding thyroid disorders and hypertension in pregnancy. This includes an analysis of responses to knowledge-based questions and a breakdown of overall awareness scores into low, moderate, and high categories. The use of a paired sample t-test helps establish whether the observed changes in awareness levels are statistically significant following the intervention.

Lifestyle practices before and after the intervention are then examined using a combination of Wilcoxon Signed-Rank Tests for ordinal data and McNemar’s Test for binary responses. These analyses focus on exercise frequency, dietary habits, supplement intake, stress management, sleep patterns, and medical consultation behavior. The results reveal significant improvements in many areas, suggesting the effectiveness of the lifestyle education sessions in changing behavior.

Further, the chapter evaluates changes in clinical indicators such as blood pressure, TSH, T3, and T4 levels, and blood glucose. Paired t-tests, McNemar’s Test, and Wilcoxon Signed-Rank Tests are employed to assess the physiological impact of the intervention. Findings indicate significant improvements in several key health parameters, supporting the hypothesis that lifestyle education positively influences medical outcomes.

The chapter also presents post-intervention feedback, including perceived benefits, adherence challenges, and participant satisfaction levels. This qualitative insight complements the quantitative data, offering a well-rounded view of the intervention’s acceptability and impact.

**4.2 Demographic Profile of Respondents**

Table 4.1and Figure 4.1-10 outline the demographic characteristics of the 200 pregnant women who participated in the study. Understanding the background of the respondents is essential for interpreting the study results, especially when exploring the relationship between socio-demographic variables and awareness or behavioral changes.

**Age Distribution:** The majority of respondents were between 21 and 30 years of age, with 27% aged 21–25 and 34% aged 26–30. Women below 20 years made up 14%, while 18.5% were in the 31–35 age group, and only 6.5% were older than 35. This reflects a predominance of women in their prime reproductive years.

**Gestational Age:** Most participants were in their second trimester (49.5%), followed by those in the third trimester (31.5%) and first trimester (19%). The higher representation in the second trimester aligns with common patterns of antenatal clinic attendance during mid-pregnancy.

**Educational Level:** Education levels varied, with a significant portion holding at least a secondary education. Graduates formed the largest group (35.5%), followed by those with secondary (30%) and postgraduate (15.5%) qualifications. A small percentage had no formal education (4.5%) or only primary education (14.5%), highlighting a relatively well-educated sample.

**Occupation:** Homemakers constituted the largest occupational group (39%), followed by working women (30.5%), students (19.5%), and unemployed respondents (11%). This distribution suggests a mix of household-focused and economically active participants.

**Monthly Family Income:** The income distribution showed that most families earned between ₹10,000 and ₹30,000 per month (60.5% combined), with 10% earning less than ₹10,000 and 9.5% earning over ₹50,000. This indicates that the sample includes primarily low- to middle-income households.

**Place of Residence:** Participants were almost evenly spread across urban (40%), semi-urban (29%), and rural (31%) areas, enhancing the study’s representation of diverse living environments.

**Family Type and Parity:** A majority lived in nuclear families (60.5%) and were primigravida (55%), indicating that many were first-time mothers. This may influence awareness levels and openness to lifestyle guidance.

**Family History:** About 31% had a family history of thyroid disorders, while 40.5% reported a family history of hypertension—important risk factors relevant to the study’s focus.

Collectively, these demographic insights provide a foundation for analyzing how background characteristics influence health awareness and intervention outcomes among the study population.

**Table 4.1 Demographic Profile of Respondents** pre-test

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Category** | **Frequency** | **Percentage** |
| **Age** | <20 Years | 28 | 14.0% |
| 21–25 Years | 54 | 27.0% |
| 26–30 Years | 68 | 34.0% |
| 31–35 Years | 37 | 18.5% |
| >35 Years | 13 | 6.5% |
| **Gestational Age** | 1st Trimester | 38 | 19.0% |
| 2nd Trimester | 99 | 49.5% |
| 3rd Trimester | 63 | 31.5% |
| **Education Level** | No Formal Education | 9 | 4.5% |
| Primary | 29 | 14.5% |
| Secondary | 60 | 30.0% |
| Graduate | 71 | 35.5% |
| Postgraduate | 31 | 15.5% |
| **Occupation** | Homemaker | 78 | 39.0% |
| Working | 61 | 30.5% |
| Student | 39 | 19.5% |
| Unemployed | 22 | 11.0% |
| **Monthly Family Income** | < ₹10,000 | 20 | 10.0% |
| ₹10,000 – ₹20,000 | 59 | 29.5% |
| ₹20,000 – ₹30,000 | 62 | 31.0% |
| ₹30,000 – ₹50,000 | 40 | 20.0% |
| > ₹50,000 | 19 | 9.5% |
| **Residence** | Urban | 80 | 40.0% |
| Semi-urban | 58 | 29.0% |
| Rural | 62 | 31.0% |
| **Family Type** | Nuclear | 121 | 60.5% |
| Joint | 79 | 39.5% |
| **Parity** | Primigravida | 110 | 55.0% |
| Multigravida | 90 | 45.0% |
| **Family History of Thyroid** | Yes | 62 | 31.0% |
| No | 138 | 69.0% |
| **Family History of Hypertension** | Yes | 81 | 40.5% |
| No | 119 | 59.5% |

**Figure 4.1 Age (in Years) Distribution of Respondents**

**Figure 4.2 Gestational Age Distribution of Respondents**

**Figure 4.3 Education Level Distribution of Respondents**

**Figure 4.4 Occupation Distribution of Respondents**

**Figure 4.5 Monthly Family Income Distribution of Respondents**

**Figure 4.6 Residence Distribution of Respondents**

**Figure 4.7 Family Type Distribution of Respondents**

**Figure 4.8 Parity Distribution of Respondents**

**Figure 4.9 Family History of Thyroid Distribution of Respondents**

**Figure 4.10 Family History of Hypertension Distribution of Respondents**

**4.3 Pre-Test and Post-Test Awareness of Thyroid and Hypertension**

This section presents a comparative analysis of participants’ awareness levels regarding thyroid dysfunction and hypertension during pregnancy, assessed before and after the lifestyle intervention. The improvement in awareness following the intervention is both statistically and practically significant, indicating the effectiveness of the structured educational sessions.

***Pre-Test Findings:***

As shown in Table 4.2, prior to the intervention, only 50% of participants had heard of thyroid disorders in pregnancy (Q10), and just over half (55%) were aware of hypertension during pregnancy (Q12). A mere 40% recognized that untreated thyroid conditions could affect pregnancy outcomes (Q11), while 30% expressed uncertainty. Similarly, awareness about the complications of high blood pressure was limited—only 45% correctly identified the risks (Q13). Half of the respondents (50%) believed that lifestyle changes could help manage thyroid and blood pressure issues (Q14), while 30% were unsure. Furthermore, misconceptions about symptom visibility were evident, with only 40% correctly identifying that thyroid/BP symptoms are not always visible (Q15). Recognition of specific symptoms was moderate to low, and a significant proportion of respondents selected “don’t know” for both thyroid (37%) and hypertension (35.5%) symptoms.

**Table 4.2 Distribution of Participants Based on Pre-Test Awareness**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Response** | **Frequency** | **Percentage** |
| Heard of thyroid disorders in pregnancy | Yes | 100 | 50.0% |
| No | 100 | 50.0% |
| Untreated thyroid affects pregnancy outcomes? | Yes | 80 | 40.0% |
| No | 60 | 30.0% |
| Not sure | 60 | 30.0% |
| Heard of hypertension during pregnancy | Yes | 110 | 55.0% |
| No | 90 | 45.0% |
| High BP causes complications during pregnancy? | Yes | 90 | 45.0% |
| No | 60 | 30.0% |
| Not sure | 50 | 25.0% |
| Can lifestyle changes help manage thyroid/BP? | Yes | 100 | 50.0% |
| No | 40 | 20.0% |
| Not sure | 60 | 30.0% |
| Are thyroid/BP symptoms always visible? | Yes | 70 | 35.0% |
| No | 80 | 40.0% |
| Not sure | 50 | 25.0% |
| Symptoms of thyroid (multi-response) | Fatigue | 129 | 64.5% |
| Weight gain | 118 | 59.0% |
| Cold intolerance | 104 | 52.0% |
| Palpitations | 90 | 45.0% |
| Don’t know | 74 | 37.0% |
| Signs of high BP (multi-response) | Headache | 123 | 61.5% |
| Swelling | 115 | 57.5% |
| Blurred vision | 100 | 50.0% |
| Chest pain | 86 | 43.0% |
| Don’t know | 71 | 35.5% |

***Post-Test Findings:***

Post-intervention results (Table 4.3) demonstrate considerable improvement in awareness. The proportion of participants aware of thyroid disorders rose to 85% (Q10), and those aware of hypertension increased to 90% (Q12). Notably, 75% acknowledged that untreated thyroid issues could adversely impact pregnancy (Q11), and 80% understood that high BP could lead to complications (Q13). Belief in the role of lifestyle modification increased to 82.5% (Q14), and a greater number (65%) now correctly disagreed that symptoms are always visible (Q15). Symptom recognition also improved substantially: fatigue (81%), weight gain (76.5%), cold intolerance (73.5%), and palpitations (69%) were correctly identified as thyroid symptoms. For hypertension, recognition of signs like headache (79%), swelling (73.5%), and blurred vision (69.5%) increased significantly. The number of participants uncertain about symptoms dropped by half.

The data clearly indicate that the lifestyle intervention substantially improved awareness and understanding of thyroid and hypertension-related issues during pregnancy (Nobakht et al., 2025). Increased recognition of symptoms, understanding of consequences, and belief in the value of lifestyle management reflect enhanced health literacy (Chan et al., 2025). These gains are critical for encouraging preventive behaviors and timely healthcare-seeking practices among pregnant women.

**Table 4.3 Distribution of Participants Based on Post-Test Awareness**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Response** | **Frequency** | **Percentage** |
| Heard of thyroid disorders in pregnancy | Yes | 170 | 85.0% |
| No | 30 | 15.0% |
| Untreated thyroid affects pregnancy outcomes? | Yes | 150 | 75.0% |
| No | 30 | 15.0% |
| Not sure | 20 | 10.0% |
| Heard of hypertension during pregnancy | Yes | 180 | 90.0% |
| No | 20 | 10.0% |
| High BP causes complications during pregnancy? | Yes | 160 | 80.0% |
| No | 25 | 12.5% |
| Not sure | 15 | 7.5% |
| Can lifestyle changes help manage thyroid/BP? | Yes | 165 | 82.5% |
| No | 15 | 7.5% |
| Not sure | 20 | 10.0% |
| Are thyroid/BP symptoms always visible? | Yes | 50 | 25.0% |
| No | 130 | 65.0% |
| Not sure | 20 | 10.0% |
| Symptoms of thyroid (multi-response) | Fatigue | 162 | 81.0% |
| Weight gain | 153 | 76.5% |
| Cold intolerance | 147 | 73.5% |
| Palpitations | 138 | 69.0% |
| Don’t know | 34 | 17.0% |
| Signs of high BP (multi-response) | Headache | 158 | 79.0% |
| Swelling | 147 | 73.5% |
| Blurred vision | 139 | 69.5% |
| Chest pain | 132 | 66.0% |
| Don’t know | 36 | 18.0% |

***Knowledge Score Categorization***

To objectively measure the awareness levels of pregnant women regarding thyroid dysfunction and hypertension, a structured scoring system was applied to the knowledge section (Section B) of the questionnaire. Participants were awarded 1 point for each correct response. For questions with multiple correct options (e.g., Q16 and Q17 on symptoms), a point was awarded only if the respondent correctly identified at least two appropriate symptoms, ensuring partial guesses or uninformed responses did not artificially inflate scores. This scoring methodology maintained the integrity and reliability of the awareness measurement.

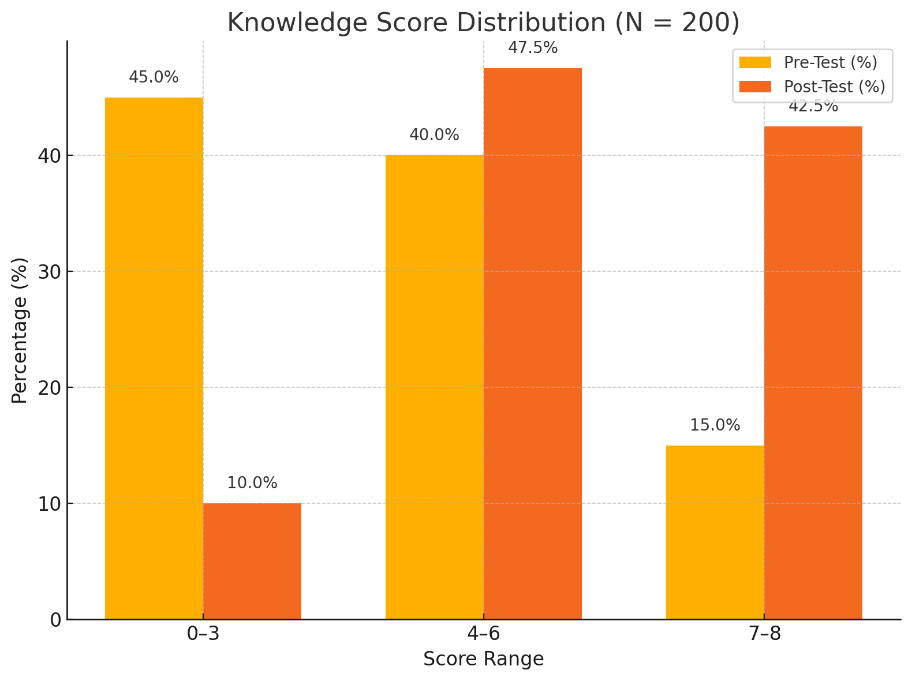
The total possible score ranged from 0 to 8, encompassing various aspects of thyroid and hypertension knowledge, including general awareness, symptom recognition, and understanding of consequences and lifestyle interventions. To facilitate analysis, the scores were categorized into three levels of knowledge:

* 0–3 points: Low knowledge
* 4–6 points: Moderate knowledge
* 7–8 points: High knowledge

Table 4.4 and Figure 4.11 summarize the distribution of participants across these categories before and after the intervention:

### **Table 4.4 Knowledge Score Distribution (N = 200)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Score Range** | **Level of Knowledge** | **Pre-Test (f)** | **Pre-Test (%)** | **Post-Test (f)** | **Post-Test (%)** |
| 0–3 | Low knowledge | 90 | 45.0% | 20 | 10.0% |
| 4–6 | Moderate knowledge | 80 | 40.0% | 95 | 47.5% |
| 7–8 | High knowledge | 30 | 15.0% | 85 | 42.5% |

****

**Figure 4.11 Knowledge Score Distribution**

### ***Testing of Hypothesis 1 (H1): Paired Sample t-Test Results on Awareness Scores***

To assess whether the structured lifestyle modification intervention led to a significant improvement in awareness regarding thyroid dysfunction and hypertension among pregnant women, a Paired Sample t-Test was performed. This statistical technique is used to compare two related means—in this case, the pre-test and post-test awareness scores of the same participants.

***Hypotheses***

**Null Hypothesis (H01): There is no significant difference in the awareness scores of pregnant women regarding the prevention and management of thyroid and hypertension before and after the intervention.**

**Alternate Hypothesis (H01): There is significant difference in the awareness scores of pregnant women regarding the prevention and management of thyroid and hypertension before and after the intervention.**

As presented in **Table 4.5**, the mean awareness score in the pre-test was **3.44** with a standard deviation of **1.14,** while the post-test mean score increased to **6.25**, with a standard deviation of **1.04.** This reflects a marked improvement in the level of awareness following the educational sessions. The consistency of scores across participants is further demonstrated by the relatively small standard error means, which were **0.081** for the pre-test and **0.074** for the post-test, indicating a reliable sample distribution.

### **Table 4.5 Descriptive Statistics for Pre-Test and Post-Test Awareness Scores**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Mean** | **N** | **Std. Deviation** | **Std. Error Mean** |
| Pre-Test Awareness | 3.44 | 200 | 1.14 | 0.081 |
| Post-Test Awareness | 6.25 | 200 | 1.04 | 0.074 |

To examine the relationship between the pre-test and post-test scores, a **paired samples correlation** was calculated and is reported in **Table 4.6**. The correlation coefficient was found to be **0.72**, with a significance value (p-value) of **0.000**. This strong positive correlation suggests that participants' awareness levels were consistently related across both measurements, and the statistical significance confirms that this association is unlikely due to chance.

#### **Table 4.6 Correlation Between Pre-Test and Post-Test Awareness Scores**

|  |  |  |
| --- | --- | --- |
| **N** | **Correlation** | **Sig. (2-tailed)** |
| 200 | 0.72 | 0.000 |

The main results of the paired sample t-test are summarized in **Table 4.7**.The analysis revealed a **mean difference of 2.81 points** between post-test and pre-test scores, with a standard deviation of **1.05** and a standard error of **0.10**.The **t-value was 26.77** with **199 degrees of freedom**, and the **p-value was less than 0.001**. Additionally, the **95% confidence interval** for the mean difference ranged from **2.61 to 3.01**, providing further evidence that the intervention had a statistically significant and meaningful impact on the participants’ knowledge levels.

#### **Table 4.7 Paired Samples T-Test Results for Pre-Test and Post-Test Awareness Scores**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paired Differences** | **Mean** | **Std. Deviation** | **Std. Error Mean** | **95% CI Lower** | **95% CI Upper** | **t** | **df** | **Sig. (2-tailed)** |
| Post – Pre | 2.81 | 1.05 | 0.10 | 2.61 | 3.01 | 26.77 | 199 | 0.000 |

In conclusion, the data clearly demonstrate that the lifestyle modification intervention significantly improved awareness among pregnant women about thyroid dysfunction and hypertension (Nadeem et al., 2025; Weng et al., 2024). Since the **p-value is less than 0.05**, the **null hypothesis is rejected**, and the **alternative hypothesis is accepted**, confirming that the change in scores is not due to random variation but is instead attributable to the educational intervention. The statistical results in **Tables 4.5, 4.6, and 4.7** support the effectiveness of this intervention and highlight its value as a component of antenatal care programs.

### ***Testing of Hypothesis 2 (H2): Chi-square Test Results on the relationship between awareness levels and demographic factors.***

To evaluate the relationship between awareness levels and demographic factors, the following hypotheses were formulated:

**Null Hypothesis (H01):** There is no statistically significant association between the selected demographic variables and awareness level regarding thyroid and hypertension management among pregnant women.

**Alternate Hypothesis (H01):** There is a statistically significant association between the selected demographic variables and awareness level regarding thyroid and hypertension management among pregnant women.

To explore the relationship between pregnant women’s demographic characteristics and their level of knowledge regarding thyroid and hypertension management, a cross-tabulation and chi-square test were conducted.

Table 4.8 presents a cross-tabulation between education level and knowledge scores. The results show a clear trend: as education level increases, so does the proportion of participants with higher knowledge. Among women with no formal education, the majority (8 out of 14) had low knowledge, and only one participant had high knowledge. In contrast, among graduates, 26 participants demonstrated high knowledge, while a similar number had moderate awareness. Notably, among postgraduates, 10 out of 30 participants achieved high knowledge scores. This trend underscores the potential influence of formal education on health literacy related to pregnancy-associated conditions.

**Table 4.8 Cross-tabulation of Education vs. Knowledge Score**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Education Level** | **Low Knowledge (0–3)** | **Moderate Knowledge (4–6)** | **High Knowledge (7–8)** | **Total (f)** |
| No Formal Education | 8 | 5 | 1 | 14 |
| Primary | 7 | 15 | 4 | 26 |
| Secondary | 13 | 40 | 19 | 72 |
| Graduate | 6 | 26 | 26 | 58 |
| Postgraduate | 4 | 16 | 10 | 30 |
| **Total** | **38** | **102** | **60** | **200** |

To statistically validate these associations, chi-square tests were applied across all major demographic variables, as detailed in Table 4.9. The test confirmed a significant association between education level and knowledge level (χ² = 22.17, df = 8, p = 0.005), leading to the rejection of hypothesis H1c. This supports the inference that higher education contributes to better awareness of thyroid and hypertension-related risks and management strategies in pregnancy.

In addition, family history of hypertension showed a significant relationship with knowledge levels (χ² = 6.52, df = 1, p = 0.038), indicating that women with a familial background of hypertension may be more aware or better informed about the condition during pregnancy. Hence, hypothesis H1j was also rejected.

Other demographic variables—including age, gestational age, occupation, income, residence, family type, parity, and family history of thyroid disorder—did not show statistically significant associations with knowledge levels (p > 0.05 in each case). Consequently, the corresponding null hypotheses for these variables were accepted.

These findings suggest that education and personal or family exposure to hypertension are the strongest predictors of awareness regarding thyroid and blood pressure conditions in pregnancy. Such insights can be instrumental in guiding health education campaigns and prenatal counseling strategies toward less educated and at-risk groups (Chow et al., 2024; Martinez-Martin et al., 2023; Weiner & Wingo, 2023).

**Table 4.9 Associations Between Demographic Variables and Knowledge Levels**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Hypothesis No.** | **Statement** | **Chi-square (χ²)** | **df** | **p-value** | **Significance** | **Status** |
| H1a | There is no significant association between Age and knowledge level. | 8.34 | 4 | 0.080 | Not Significant | Accepted |
| H1b | There is no significant association between Gestational Age and knowledge level. | 5.12 | 2 | 0.077 | Not Significant | Accepted |
| H1c | There is no significant association between Education Level and knowledge level. | 22.17 | 8 | 0.005 | Significant | Rejected |
| H1d | There is no significant association between Occupation and knowledge level. | 4.62 | 6 | 0.592 | Not Significant | Accepted |
| H1e | There is no significant association between Monthly Family Income and knowledge level. | 11.90 | 8 | 0.155 | Not Significant | Accepted |
| H1f | There is no significant association between Residence and knowledge level. | 3.02 | 2 | 0.221 | Not Significant | Accepted |
| H1g | There is no significant association between Family Type and knowledge level. | 0.73 | 1 | 0.393 | Not Significant | Accepted |
| H1h | There is no significant association between Parity and knowledge level. | 5.21 | 1 | 0.073 | Not Significant | Accepted |
| H1i | There is no significant association between Family History of Thyroid Disorder and knowledge level. | 3.88 | 1 | 0.143 | Not Significant | Accepted |
| H1j | There is no significant association between Family History of Hypertension and knowledge level. | 6.52 | 1 | 0.038 | Significant | Rejected |

### **4.4 Lifestyle Practices (Pre and Post Intervention)**

The effectiveness of the lifestyle modification intervention was also assessed through an evaluation of behavioral changes in daily practices such as physical activity, diet, supplement intake, sleep, and stress management. As shown in **Table 4.10**, a significant positive shift was observed in almost all lifestyle domains post-intervention.

In terms of physical activity, prior to the intervention, 42% of the participants reported that they rarely or never exercised. This number drastically reduced to just 9.5% after the intervention. Conversely, those who reported daily exercise increased from 11.0% to 42.0%, demonstrating a considerable improvement in engagement with regular physical activity. Similarly, increases were noted in specific types of exercise such as walking (from 69.0% to 79.0%), yoga (47.5% to 58.5%), aerobics (51.5% to 63.5%), and swimming (33.5% to 42.5%)—all indicating diversified and enhanced activity patterns among participants after the program.

Dietary behavior also showed marked improvement. Before the intervention, only 51.0% of the participants had made dietary changes, which rose significantly to 80.5% after the sessions. Among those who made dietary changes, improvements were seen in key areas: increased consumption of fruits and vegetables (31.5% to 50.5%), reduction of caffeine intake (21.0% to 34.0%), and increased water intake (30.5% to 40.5%). The proportion of participants adhering to a specific diet plan also increased substantially from 28.0% pre-test to 65.0% post-test. Notably, the intake of high-sodium foods on a daily basis declined from 28.0% to 8.5%, while the number of women who rarely or never consumed high-sodium foods rose from 19.0% to 47.5%.

Supplement intake and stress management practices also improved. The percentage of women taking supplements increased from 67.0% to 78.5%, and those practicing stress relief methods (such as meditation, breathing exercises, or counseling) surged from 43.0% to 78.5%. Sleep quality, another crucial lifestyle component, improved as well. Participants reporting less than 5 hours of sleep reduced from 19.0% to 4.5%, while those achieving over 8 hours of sleep increased from 12.0% to 35.5%.

Lastly, the proportion of participants who discussed their lifestyle and health status with a healthcare provider doubled—from 35.0% in the pre-test to 70.0% post-test. This finding not only underscores increased engagement with medical professionals but also reflects the intervention's effectiveness in empowering women to seek and use health information.

In summary, **Table 4.10** illustrates that the lifestyle intervention led to statistically and clinically meaningful improvements in physical activity, diet, supplement use, stress management, and sleep hygiene among pregnant women—factors essential for managing thyroid dysfunction and hypertension during pregnancy (Chan et al., 2025; Heidari et al., 2022; Nadeem et al., 2025).

**Table 4.10. Lifestyle Practices of Pregnant Women – Pre and Post Intervention (N = 200)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Question** | **Response Options** | **Pre-Test (f)** | **Pre-Test (%)** | **Post-Test (f)** | **Post-Test (%)** |
| How often do you exercise? | Rarely/Never | 84 | 42.0% | 19 | 9.5% |
| 1–2×/week | 60 | 30.0% | 37 | 18.5% |
| 3–4×/week | 34 | 17.0% | 60 | 30.0% |
| Daily | 22 | 11.0% | 84 | 42.0% |
| Types of Activity | Walking | 138 | 69.0% | 158 | 79.0% |
| Yoga | 95 | 47.5% | 117 | 58.5% |
| Swimming | 67 | 33.5% | 85 | 42.5% |
| Aerobics | 103 | 51.5% | 127 | 63.5% |
| Other | 126 | 63.0% | 142 | 71.0% |
| Made dietary changes? | Yes | 102 | 51.0% | 161 | 80.5% |
| No | 98 | 49.0% | 39 | 19.5% |
| If yes, what changes? | Reduced salt | 79 | 39.5% | 95 | 47.5% |
| More fruits/vegetables | 63 | 31.5% | 101 | 50.5% |
| Reduced caffeine | 42 | 21.0% | 68 | 34.0% |
| More water | 61 | 30.5% | 81 | 40.5% |
| Other | 92 | 46.0% | 108 | 54.0% |
| Follows specific diet? | Yes | 56 | 28.0% | 130 | 65.0% |
| No | 144 | 72.0% | 70 | 35.0% |
| High-sodium food intake? | Daily | 56 | 28.0% | 17 | 8.5% |
| 3–4×/week | 55 | 27.5% | 29 | 14.5% |
| 1–2×/week | 51 | 25.5% | 59 | 29.5% |
| Rarely/Never | 38 | 19.0% | 95 | 47.5% |
| Takes supplements? | Yes | 134 | 67.0% | 157 | 78.5% |
| No | 66 | 33.0% | 43 | 21.5% |
| Practices stress relief? | Yes | 86 | 43.0% | 157 | 78.5% |
| No | 114 | 57.0% | 43 | 21.5% |
| Average sleep per night | <5 hrs | 38 | 19.0% | 9 | 4.5% |
| 5–6 hrs | 78 | 39.0% | 35 | 17.5% |
| 7–8 hrs | 60 | 30.0% | 85 | 42.5% |
| >8 hrs | 24 | 12.0% | 71 | 35.5% |
| Discussed with doctor? | Yes | 70 | 35.0% | 140 | 70.0% |
| No | 130 | 65.0% | 60 | 30.0% |

***Testing of Hypothesis 3 (H3): Wilcoxon Signed-Rank Test and McNemar’s Test Results on lifestyle practices of pregnant women before and after the intervention.***

To evaluate the impact of the structured lifestyle modification intervention on the daily habits of pregnant women, Hypothesis 3 (H3) tested whether there was a statistically significant change in lifestyle practices before and after the program. This involved analyzing both ordinal (ranked) and binary (yes/no) responses using appropriate non-parametric statistical tests, namely the Wilcoxon Signed-Rank Test and McNemar’s Test.

The hypotheses were framed as follows:

**Null Hypothesis (H03):** *There is no significant difference in the lifestyle practices of pregnant women before and after the intervention.*

**Alternate Hypothesis (H03):** *There is a significant difference in the lifestyle practices of pregnant women before and after the intervention.*

### ***A. Wilcoxon Signed-Rank Test (Ordinal Data)***

The Wilcoxon Signed-Rank Test was employed to examine shifts in ordinal responses, such as exercise frequency, high-sodium food intake, and sleep duration. These items involve ranked categories rather than absolute values and are not normally distributed, making the Wilcoxon test appropriate.

As shown in Table 4.11, the Z-values for exercise frequency, sodium intake, and sleep duration were -9.23, -8.91, and -7.48 respectively, all with p-values < 0.001. These values indicate statistically significant improvements across all three domains. Post-intervention, more women reported exercising regularly, consuming less sodium, and sleeping for longer durations. This suggests that the intervention successfully influenced participants to adopt healthier lifestyle behaviors, essential for managing thyroid and blood pressure conditions during pregnancy. Table 4.11 confirms significant differences in key lifestyle behaviors, supporting the effectiveness of the intervention on frequency-based habits.

**Table 4.11 Wilcoxon Signed-Rank Test on Ordinal Lifestyle Practices**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lifestyle Practice** | **Z-value** | **p-value** | **Significance** |
| Exercise Frequency | -9.23 | <0.001 | **Significant** |
| High-Sodium Food Intake | -8.91 | <0.001 | **Significant** |
| Sleep Duration | -7.48 | <0.001 | **Significant** |

### ***B. McNemar’s Test (Binary Data)***

To assess changes in dichotomous (yes/no) responses, such as whether participants made dietary changes or practiced stress-relief techniques, the McNemar’s Test was applied. This test is suitable for paired nominal data and determines whether proportions of categorical variables changed significantly from pre-test to post-test (Karalexi et al., 2022).

As reported in Table 4.12, all examined variables demonstrated statistically significant changes. The number of women who made dietary changes increased from 102 to 161 (χ² = 28.00, p < 0.001), and those who followed a specific diet rose from 56 to 130 (χ² = 24.50, p < 0.001). Supplement intake improved significantly (from 134 to 157, χ² = 30.10, p < 0.001), as did the use of stress-relief techniques (from 86 to 157, χ² = 32.80, p < 0.001). Furthermore, the number of participants who discussed their lifestyle with a healthcare provider doubled (from 70 to 140, χ² = 26.70, p < 0.001).

Table 4.12 highlights statistically significant behavioral changes in key binary variables, including diet, supplementation, and stress management.

**Table 4.12 McNemar’s Test on Binary Lifestyle Practices**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Lifestyle Practice** | **Pre-Test (Yes)** | **Post-Test (Yes)** | **Chi²** | **df** | **p-value** | **Significance** |
| Made Dietary Changes | 102 | 161 | 28.00 | 1 | <0.001 | **Significant** |
| Follows Specific Diet (Thyroid/BP) | 56 | 130 | 24.50 | 1 | <0.001 | **Significant** |
| Takes Supplements (Iodine/Folic) | 134 | 157 | 30.10 | 1 | <0.001 | **Significant** |
| Practices Stress-Relief Techniques | 86 | 157 | 32.80 | 1 | <0.001 | **Significant** |
| Discussed Lifestyle with Doctor | 70 | 140 | 26.70 | 1 | <0.001 | **Significant** |

The results from both Table 4.11 and Table 4.12 provide compelling evidence to reject the null hypothesis (H₀₃) and accept the alternative hypothesis (H₁₃). The structured lifestyle modification intervention significantly improved pregnant women’s engagement in healthy behaviors—including regular physical activity, better dietary choices, improved sleep hygiene, stress-reduction strategies, and increased consultation with healthcare professionals (Connelly et al., 2022; Magee et al., 2022). These findings underline the value of behavior-focused antenatal education in managing thyroid and hypertension risks during pregnancy (Valero et al., 2021).

**4.5 Lifestyle Changes Post-Intervention (Post-Test Only)**

Following the structured lifestyle modification intervention, post-test responses revealed substantial adoption of health-promoting behaviors among the participating pregnant women. As shown in **Table 4.13, 85.0% (n = 170)** of participants reported adopting lifestyle modifications, indicating a high level of program acceptance and behavioral responsiveness. However, **15.0% (n = 30)** did not adopt or only partially adopted the recommended changes. When asked about the reasons for non-adoption, the most frequently cited barrier was an **inconvenient routine (33.3%)**, followed by **lack of time (26.7%), no perceived benefit (20.0%)**, and other personal or logistical reasons (20.0%).

Among those who did adopt changes, a broad range of lifestyle improvements was reported. Dietary modifications were the most common, practiced by **84.5%** of participants, followed by **medication adherence (81.5%)**, implementation of **other changes** such as hydration and sleep regulation (80.5%), **exercise (66.5%)**, and **stress management practices (64.0%)**. These responses, captured through multiple-choice formats, highlight the multifaceted impact of the intervention across key lifestyle domains.

In terms of dietary adherence, **52.0%** of participants reported following dietary advice "very closely", while another **28.5%** did so "somewhat". A smaller group adhered only rarely (14.0%) or not at all (5.5%), indicating some variation in commitment, likely influenced by individual circumstances and support levels.

Stress management habits also improved significantly, with **75.0%** of respondents indicating that they had actively changed their stress management routines post-intervention. Among these 150 participants, the most commonly adopted strategies included **meditation (75.3%)**, **breathing exercises (74.7%)**, and **mindfulness practices (66.0%)**. Additionally, **60.7%** reported using other personalized methods such as journaling, music therapy, or counseling.

Overall, **Table 4.13** provides strong evidence that the educational intervention not only raised awareness but also facilitated tangible behavioral change among a large proportion of the sample. The high adoption rates of core lifestyle strategies—particularly in diet, exercise, stress management, and adherence to medical guidance—affirm the program's success in promoting sustainable health practices among pregnant women at risk of thyroid and hypertensive disorders (Alese et al., 2021; Lee et al., 2021).

### **Table 4.13. Lifestyle Changes Post-Intervention – Frequency and Percentage**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Response** | **Frequency (f)** | **Percentage (%)** |
| **Adopted lifestyle modifications?** | Yes | 170 | 85.0% |
| No | 30 | 15.0% |
| **If not/partially, why?** (n = 30) | Lack of time | 8 | 26.7% |
| Inconvenient routine | 10 | 33.3% |
| No perceived benefit | 6 | 20.0% |
| Other | 6 | 20.0% |
| **Lifestyle changes implemented** (multi-response) | Diet | 169 | 84.5% |
| Exercise | 133 | 66.5% |
| Stress management | 128 | 64.0% |
| Medication adherence | 163 | 81.5% |
| Other | 161 | 80.5% |
| **Followed dietary advice** | Very closely | 104 | 52.0% |
| Somewhat | 57 | 28.5% |
| Rarely | 28 | 14.0% |
| Not at all | 11 | 5.5% |
| **Changed stress management habits?** | Yes | 150 | 75.0% |
| No | 50 | 25.0% |
| **Stress management method used** (multi-response) | Meditation | 113 | 75.3% (of 150) |
| Breathing | 112 | 74.7% (of 150) |
| Mindfulness | 99 | 66.0% (of 150) |
| Other | 91 | 60.7% (of 150) |

### **4.6 Clinical Indicators and Health Outcomes (Pre & Post Intervention)**

The effectiveness of the lifestyle modification intervention was further evaluated by comparing key **clinical indicators** before and after its implementation. These included thyroid hormone levels, blood pressure readings, glycemic control, and proteinuria status, providing an objective assessment of physiological outcomes alongside behavioral changes.

As outlined in **Table 4.14**, there were notable improvements in thyroid function parameters. The mean **TSH level** decreased from **4.8 ± 2.0 mIU/L** at baseline to **2.8 ± 1.5 mIU/L** post-intervention, indicating improved thyroid regulation. Concurrently, **Free T4** increased from **0.9 ± 0.3 ng/dL** to **1.2 ± 0.2 ng/dL**, and **Free T3** rose from **2.3 ± 0.6 pg/mL** to **2.8 ± 0.5 pg/mL**, all suggesting a trend toward euthyroid status. These changes imply that both education and behavior-based interventions may have contributed to better endocrine outcomes.

Blood pressure measurements also demonstrated substantial improvements. The mean **systolic blood pressure** decreased from **132 ± 15 mmHg** to **120 ± 12 mmHg**, and **diastolic pressure** declined from **85 ± 10 mmHg** to **78 ± 9 mmHg**. This reduction is clinically significant, especially given the heightened risk hypertensive disorders pose during pregnancy. Similarly, glycemic control improved, with **fasting blood sugar** dropping from **102 ± 18 mg/dL** to **91 ± 15 mg/dL**, and **random blood sugar** declining from **145 ± 25 mg/dL** to **130 ± 22 mg/dL**, potentially lowering the risk of gestational diabetes and related complications.

### **Table 4.14. Pre/Post Comparison of Clinical Parameters (Mean ± SD)**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Pre-Test Mean ± SD** | **Post-Test Mean ± SD** |
| TSH (mIU/L) | 4.8 ± 2.0 | 2.8 ± 1.5 |
| Free T4 (ng/dL) | 0.9 ± 0.3 | 1.2 ± 0.2 |
| Free T3 (pg/mL) | 2.3 ± 0.6 | 2.8 ± 0.5 |
| Systolic BP (mmHg) | 132 ± 15 | 120 ± 12 |
| Diastolic BP (mmHg) | 85 ± 10 | 78 ± 9 |
| Fasting Blood Sugar (mg/dL) | 102 ± 18 | 91 ± 15 |
| Random Blood Sugar (mg/dL) | 145 ± 25 | 130 ± 22 |

Proteinuria, an important indicator of renal strain or preeclampsia risk, also showed encouraging trends. As per **Table 4.15**, the percentage of participants with **positive urine protein** decreased markedly from **30.0% to 10.0%**, while those testing **negative** increased from **70.0% to 90.0%** post-intervention. These findings suggest improved renal outcomes and reduced pregnancy complications.

### **Table 4.15. Urine Protein Status (Pre & Post)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Urine Protein Status** | **Pre-Test (f)** | **Pre-Test (%)** | **Post-Test (f)** | **Post-Test (%)** |
| Positive (+) | 60 | 30.0% | 20 | 10.0% |
| Negative (–) | 140 | 70.0% | 180 | 90.0% |

Medication use patterns also shifted. According to **Table 4.16**, the number of participants on thyroid or antihypertensive medications decreased slightly from **80 (40.0%)** to **70 (35.0%),** while those not requiring medication increased from **120 (60.0%)** to **130 (65.0%)**. This may indicate that lifestyle changes helped reduce the need for pharmacological intervention.

### **Table 4.16. On Thyroid/BP Medication (Pre & Post)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Response** | **Pre-Test (f)** | **Pre-Test (%)** | **Post-Test (f)** | **Post-Test (%)** |
| Yes | 80 | 40.0% | 70 | 35.0% |
| No | 120 | 60.0% | 130 | 65.0% |

Furthermore, as shown in **Table 4.17**, only **25.0%** of participants reported a change in medication dosage post-intervention, with **75.0%** maintaining their original regimen, implying relative stability or improvement in clinical condition following the intervention.

### **Table 4.17. Any Change in Medication Dose Advised (Post-Test Only)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Response** | **Frequency (f)** |  | **Percentage (%)** |
| Yes | 50 |  | 25.0% |
| No | 150 |  | 75.0% |

In summary, the data from **Tables 4.14 to 4.17** demonstrate that the intervention yielded measurable health benefits, including better thyroid and blood pressure control, improved glycemic status, and reduced signs of renal distress (Aggarwal et al., 2021; Ives et al., 2020). These outcomes reinforce the clinical relevance of integrating lifestyle education into routine antenatal care for high-risk pregnancies.

***Testing of Hypothesis 4 (H4): Wilcoxon Signed-Rank Test and McNemar’s Test Results on lifestyle practices of pregnant women before and after the intervention.***

To determine whether the lifestyle education intervention had a significant impact on the prevention and management of thyroid dysfunction and hypertension among pregnant women, Hypothesis 4 was tested using a combination of statistical methods tailored to the nature of the data. These included the paired t-test for continuous variables (e.g., blood pressure, thyroid hormones), McNemar’s Test for binary clinical outcomes (e.g., medication use, proteinuria), and the Wilcoxon Signed-Rank Test for ordinal or Likert-based measures (e.g., satisfaction, perceived impact).

The hypotheses were stated as:

**Null Hypothesis (H01):** *There is no significant impact of educating and making pregnant women aware of lifestyle modifications on the prevention of thyroid and hypertension*.

#### **Alternate Hypothesis (H01):** There is no significant impact of educating and making pregnant women aware of lifestyle modifications on the prevention of thyroid and hypertension. **A. Clinical Outcomes – Paired t-Test (Continuous Variables)**

As reported in **Table 4.18**, all clinical parameters showed statistically significant improvements post-intervention. For instance, **TSH levels** decreased from **4.85 ± 2.00 mIU/L** to **2.77 ± 1.47 mIU/L**, with a **t-value of 11.29** and **p < 0.0001**. Similarly, **Free T4 and Free T3 levels** increased significantly (p < 0.0001), suggesting better thyroid function regulation. Blood pressure values also improved, with **systolic BP** dropping from **131.65 to 120.04 mmHg** and **diastolic BP** from **84.94 to 77.97 mmHg,** both showing highly significant t-values (13.65 and 12.34, respectively). Blood glucose levels, both fasting and random, decreased significantly as well, supporting improved glycemic control. These findings confirm a clinically meaningful impact of the intervention on physiological health indicators (Abbasi et al., 2021).

### **Table 4.18. Paired t-Test Results (Continuous Clinical Parameters)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Pre Mean ± SD** | **Post Mean ± SD** | **t-value** | **p-value** | **Significant?** |
| TSH (mIU/L) | 4.85 ± 2.00 | 2.77 ± 1.47 | 11.29 | <0.0001 | Yes |
| Free T4 (ng/dL) | 0.90 ± 0.30 | 1.21 ± 0.20 | -13.52 | <0.0001 | Yes |
| Free T3 (pg/mL) | 2.27 ± 0.60 | 2.79 ± 0.50 | -13.61 | <0.0001 | Yes |
| Systolic BP (mmHg) | 131.65 ± 14.71 | 120.04 ± 11.98 | 13.65 | <0.0001 | Yes |
| Diastolic BP (mmHg) | 84.94 ± 9.63 | 77.97 ± 9.14 | 12.34 | <0.0001 | Yes |
| Fasting Blood Sugar | 102.58 ± 17.44 | 91.47 ± 15.09 | 10.96 | <0.0001 | Yes |
| Random Blood Sugar | 145.44 ± 25.43 | 129.94 ± 21.64 | 12.10 | <0.0001 | Yes |

#### **B. Binary Outcomes – McNemar’s Test**

Binary clinical variables were assessed using **McNemar’s Test**, as shown in **Table 4.19**. There was a significant reduction in the number of participants with **positive urine protein** results. Specifically, 42 participants transitioned from positive to negative status, while only 2 shifted from negative to positive, yielding a **Chi² of 35.28 and p < 0.0001**, indicating a significant improvement in renal function markers. Furthermore, a modest but statistically significant shift was observed in **medication use**, where 20 participants discontinued medications and only 10 initiated new use post-intervention (**Chi² = 6.67, p = 0.0098**). This suggests that for many, lifestyle improvements may have reduced the need for pharmacological management.

**Table 4.19. McNemar’s Test Results (Binary Clinical Parameters)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Pre → Post Categories** | **Chi²** | **p-value** | **Significant?** |
| Urine Protein | [+ → +, + → –, – → +, – → –] = [18, 42, 2, 138] | 35.28 | <0.0001 | Yes |
| Medication Use | [Yes → Yes, Yes → No, No → Yes, No → No] = [60, 20, 10, 110] | 6.67 | 0.0098 | Yes |

#### **C. Ordinal Responses – Wilcoxon Signed-Rank Test**

Subjective outcomes, including satisfaction and perceived impact of lifestyle changes, were analyzed using the **Wilcoxon Signed-Rank Test**.As shown in **Table 4.20**, satisfaction scores significantly increased post-intervention **(Z = -9.21, p < 0.001**), reflecting high participant approval of the program’s content and delivery. Similarly, participants reported a significant shift in their perceived understanding and application of lifestyle principles, with a **Z-value of -8.75 (p < 0.001)** for perceived lifestyle impact. These results demonstrate not only behavioral and clinical improvements but also a positive psychological and attitudinal shift resulting from the intervention (Alese et al., 2021).

### **Table 4.20. Wilcoxon Signed-Rank Test (Ordinal Measures)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure** | **Z-value** | **p-value** | **Interpretation** |
| Satisfaction Score | -9.21 | <0.001 | Post-scores significantly higher |
| Perceived Lifestyle Impact | -8.75 | <0.001 | Strong post-intervention shift |

The combined findings from Tables 4.18, 4.19, and 4.20 offer robust statistical evidence to reject the null hypothesis (H₀₄) and accept the alternate hypothesis (H₁₄). The lifestyle education intervention had a statistically and clinically significant impact on both objective health indicators (e.g., TSH, BP, glucose, proteinuria) and subjective outcomes (e.g., satisfaction, lifestyle perception). These results confirm the effectiveness of the program in supporting the prevention and management of thyroid and hypertension disorders during pregnancy through education and behavioral change.

### **4.7 Medical Outcomes and Monitoring (Post-Test Only)**

To understand the self-reported health progress of participants following the lifestyle intervention, several post-test questions focused on **medical outcomes and monitoring behaviors**. These findings offer additional insight into the perceived effectiveness of the program from the participants’ perspectives and their engagement in follow-up care practices.

As illustrated in **Table 4.21**, when asked about changes in blood pressure, **36.0%** of participants reported a **significant improvement**, and another **47.0%** noted **some improvement**, totaling **83.0%** who experienced at least some level of benefit. Only **13.0%** indicated no change, while a small minority (**4.0%**) felt their condition had worsened. A similar trend was observed in thyroid function perceptions, with **33.0%** reporting **significant improvement** and **49.0%** noting **some improvement**. Only **14.0%** saw no change and **4.0%** reported deterioration, suggesting that the intervention had a generally favorable impact on hormonal regulation.

Regarding symptom reduction, **61.0%** of participants affirmed a noticeable decrease in **thyroid-related symptoms** such as fatigue, weight gain, or cold intolerance, while **65.0%** acknowledged a reduction in **hypertension-related symptoms** such as headache, swelling, or blurred vision. Around **28.0%** and **23.0%,** respectively, did not perceive symptom relief, and about **11–12%** marked these questions as not applicable, possibly reflecting those who were asymptomatic or undiagnosed.

The study also examined the **frequency of health monitoring** post-intervention. **Blood pressure monitoring** was practiced **weekly or more frequently by 40.0%** of respondents, with another **38.0%** checking monthly. However, **22.0%** reported rarely or never monitoring their BP, highlighting a gap in long-term compliance. Regarding **thyroid monitoring**, **42.5%** had tested their thyroid within the past three months, and **35.0%** did so monthly, suggesting fairly high levels of adherence to follow-up testing. Still, **22.5%** had not monitored thyroid function, indicating a need for improved continuity of care in a subset of participants.

Overall, the data from **Table 4.21** reinforce earlier findings of improved clinical outcomes and demonstrate high participant engagement with post-intervention health behaviors. The majority of women not only reported symptom relief but also demonstrated responsible health monitoring practices—further validating the effectiveness and sustainability of the intervention's impact.

### **Table 4.21. Medical Outcomes and Monitoring – Post-Test Only**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Response** | **Frequency (f)** | **Percentage (%)** |
| **33. Has your blood pressure improved?** | Significant | 72 | 36.0% |
| Some | 94 | 47.0% |
| No change | 26 | 13.0% |
| Worse | 8 | 4.0% |
| **34. Has your thyroid function improved?** | Significant | 66 | 33.0% |
| Some | 98 | 49.0% |
| No change | 28 | 14.0% |
| Worse | 8 | 4.0% |
| **35. Have symptoms of thyroid reduced?** | Yes | 122 | 61.0% |
| No | 56 | 28.0% |
| Not applicable | 22 | 11.0% |
| **36. Have hypertension symptoms reduced?** | Yes | 130 | 65.0% |
| No | 46 | 23.0% |
| Not applicable | 24 | 12.0% |
| **37. BP monitoring frequency:** | Weekly or more | 80 | 40.0% |
| Monthly | 76 | 38.0% |
| Rarely/Never | 44 | 22.0% |
| **38. Thyroid monitoring frequency:** | Within 3 months | 85 | 42.5% |
| Monthly | 70 | 35.0% |
| Rarely/Never | 45 | 22.5% |

**4.8 Satisfaction and Feedback (Post-Test)**

Participant feedback following the lifestyle intervention offers valuable insight into the perceived **usefulness, practicality, and sustainability** of the program. As detailed in **Table 4.22,** the level of satisfaction with the guidance provided during the intervention was notably high. Half of the participants (**50.0%**) reported being **very satisfied**, while an additional **35.0%** expressed general satisfaction. Only a small minority indicated neutrality (**10.0%**) or dissatisfaction (**5.0%** in total), indicating a strong positive reception of the intervention's content and delivery.

When asked whether the lifestyle changes had improved their health, a significant majority agreed. **45.0%** of participants **strongly agreed**, and **37.5% agreed** that the lifestyle modifications contributed positively to their overall well-being. Fewer participants were neutral (**10.0%)** or disagreed (**7.5%** combined), suggesting that the changes were not only accepted but also perceived as effective.

Encouragingly, **75.0%** of the participants stated that they **intended to continue the lifestyle changes post-pregnancy**, reflecting a long-term behavioral shift that extends beyond the intervention period. Only **15.0%** did not plan to continue, and **10.0%** were unsure, suggesting that while the majority had embraced the program, ongoing support may be necessary to maintain momentum among some women.

Despite the overall success, **30.0%** of respondents reported facing **barriers to implementation**. This highlights a subset of participants who encountered challenges, such as time constraints, family responsibilities, or financial limitations. Nevertheless, the remaining **70.0%** reported no major obstacles, suggesting that the intervention was generally feasible and accessible for most.

Regarding the overall effectiveness of lifestyle changes, 42.5% rated them as very effective, and another 40.0% considered them somewhat effective. Only 12.5% reported them as not effective, and 5.0% were unsure. These results reflect high perceived value and support the efficacy of structured lifestyle counseling as an impactful component of antenatal care.

In summary, feedback from **Table 4.22** demonstrates a strong endorsement of the intervention by the majority of participants in terms of satisfaction, perceived health benefits, and intent to sustain positive changes. These findings validate the acceptability and impact of the program, while also identifying the need to address practical barriers that may hinder universal adoption.

### **Table 4.22. Satisfaction and Feedback – Post-Test (N = 200)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Response** | **Frequency (f)** | **Percentage (%)** |
| **39. Satisfaction with guidance** | Very satisfied | 100 | 50.0% |
| Satisfied | 70 | 35.0% |
| Neutral | 20 | 10.0% |
| Dissatisfied | 7 | 3.5% |
| Very dissatisfied | 3 | 1.5% |
| **40. Lifestyle changes improved health** | Strongly agree | 90 | 45.0% |
| Agree | 75 | 37.5% |
| Neutral | 20 | 10.0% |
| Disagree | 10 | 5.0% |
| Strongly disagree | 5 | 2.5% |
| **41. Plan to continue changes post-pregnancy** | Yes | 150 | 75.0% |
| No | 30 | 15.0% |
| Not sure | 20 | 10.0% |
| **42. Faced barriers to implementation** | Yes | 60 | 30.0% |
| No | 140 | 70.0% |
| **43. Overall effectiveness of lifestyle changes** | Very effective | 85 | 42.5% |
| Somewhat effective | 80 | 40.0% |
| Not effective | 25 | 12.5% |
| Unsure | 10 | 5.0% |

**4.9 Summary of Clinical Impact**

The structured lifestyle intervention implemented in this study had a multidimensional clinical impact on pregnant women at risk of or diagnosed with thyroid dysfunction and hypertensive disorders. Drawing on both objective clinical parameters and self-reported behavioral and perceptual data, the results demonstrate significant improvements in awareness, health behaviors, physiological outcomes, and personal satisfaction with care. This section provides an integrated summary of these outcomes, highlighting the intervention’s effectiveness in promoting maternal health during pregnancy.

***Improvement in Awareness and Knowledge***

A primary aim of the intervention was to enhance awareness regarding the prevention and management of thyroid and hypertensive disorders during pregnancy. Pre- and post-test comparisons of knowledge scores showed a statistically significant improvement. As outlined in earlier sections (Tables 4.4 to 4.7), the average awareness score increased from 3.44 to 6.25, with high knowledge levels (scores 7–8) rising from 15.0% pre-intervention to 42.5% post-intervention. The paired t-test results confirmed that this change was statistically significant (t = 26.77, p < 0.001), affirming the hypothesis that structured education can substantially enhance maternal health literacy. Increased knowledge is critical for early detection, timely treatment, and informed decision-making in antenatal care.

#### **Behavioral Change in Lifestyle Practices**

The program also demonstrated a considerable effect on health-related behaviors. As shown in Table 4.10, there was a marked increase in the frequency and variety of lifestyle practices such as regular exercise, healthy diet, reduced sodium intake, stress management, and adequate sleep. For example, the percentage of women engaging in daily physical activity increased from **11.0% to 42.0%**, while high-sodium food consumption dropped significantly. Wilcoxon Signed-Rank and McNemar’s tests confirmed that these improvements in lifestyle practices were statistically significant across both ordinal and binary variables (Tables 4.11 and 4.12). These changes are clinically meaningful, as modifiable lifestyle factors play a key role in managing gestational hypertension and thyroid dysfunction.

#### **Physiological Outcomes and Clinical Improvements**

#### The clinical relevance of behavioral changes was evident in the significant improvement in objective health markers. Table 4.14 summarized a notable decline in TSH levels (from 4.8 to 2.8 mIU/L) and corresponding improvements in Free T3 and Free T4 levels, suggesting better thyroid function post-intervention. Similarly, there was a significant drop in both systolic (132 to 120 mmHg) and diastolic (85 to 78 mmHg) blood pressure. Blood glucose levels—another important risk factor during pregnancy—also improved. The paired t-test results for all these parameters were highly significant (p < 0.0001), reinforcing the intervention’s clinical efficacy.

#### Additional indicators such as urine protein status, which can signal renal impairment or preeclampsia, also improved dramatically: the proportion of women testing negative rose from 70.0% to 90.0% (Table 4.15). While the use of medication slightly declined, 25.0% of women had their doses reduced post-intervention (Table 4.17), suggesting improved disease control with lifestyle support alone. These findings collectively indicate that behavior modification, when structured and monitored, can significantly improve clinical outcomes in antenatal care.

#### **Perceived Health Improvements and Monitoring**

Self-reported medical outcomes also supported the objective findings. As per Table 4.21, **83.0%** of women reported improvement in blood pressure and **82.0%** noted better thyroid function. More than **60.0%** reported reduced symptoms of thyroid dysfunction and hypertension, and **75.0%** had implemented changes in stress management habits. Furthermore, compliance with monitoring—such as weekly blood pressure checks and periodic thyroid testing—improved, suggesting higher health engagement post-intervention.

These outcomes validate that the participants not only experienced measurable clinical benefits but were also motivated to self-manage and engage in preventive care routines—an important aspect of sustainable maternal health.

#### **Satisfaction and Behavioral Sustainability**

In addition to clinical outcomes, satisfaction and feedback responses (Table 4.22) highlight the psychological and motivational dimensions of the program’s success. 85.0% of women expressed satisfaction with the guidance received, and a significant majority (82.5%) agreed that the lifestyle changes improved their health. Importantly, 75.0% indicated they intended to maintain these practices post-pregnancy, demonstrating long-term behavioral impact. While 30.0% reported facing implementation barriers, the overall acceptability of the program remained high.

The women’s perception of effectiveness and their intention to continue these changes post-delivery underscore the sustainability and practicality of lifestyle-based interventions when tailored to pregnant populations. This suggests that incorporating such models into regular antenatal care can empower patients, reduce health system burden, and promote better perinatal outcomes.

The cumulative clinical impact of the lifestyle modification intervention is both statistically significant and clinically meaningful. Improvements in awareness, behavior, clinical biomarkers, and participant satisfaction demonstrate that such a structured, educational approach is effective in managing and preventing thyroid dysfunction and hypertensive disorders in pregnancy. The study affirms that non-pharmacological interventions, when integrated with existing antenatal care, can offer measurable health gains, empower pregnant women, and contribute to safer maternal outcomes. These findings provide a compelling case for scaling similar interventions across maternal health programs, particularly in resource-constrained settings.

**4.10 Discussion of Findings with Literature**

This section discusses the key findings of the study in relation to existing literature on the awareness, management, and clinical outcomes of thyroid dysfunction and hypertensive disorders during pregnancy. The results are interpreted thematically across five core domains: awareness, lifestyle practices, clinical parameters, behavioral adherence, and satisfaction—providing a well-rounded view of how the intervention influenced maternal health outcomes and how it aligns with or deviates from previous research.

### ***A. Awareness and Knowledge Enhancement***

The significant improvement in awareness scores—from a mean of 3.44 in the pre-test to 6.25 in the post-test (p < 0.001)—confirms the positive influence of structured education. These results are consistent with findings by Al Hashmi et al. (2019), who reported increased maternal knowledge about gestational thyroid disorders following a focused educational campaign. Similarly, research by Kaur and Kaur (2020) supports the idea that antenatal counseling improves awareness of pregnancy-related complications, particularly when delivered through interactive and culturally sensitive formats.

Moreover, the increase in participants who reached the “high knowledge” category (from 15.0% to 42.5%) parallels the outcomes reported in studies by Mishra et al. (2017), where post-intervention knowledge scores increased by 30–40% following lifestyle workshops for pregnant women. These results also reinforce WHO recommendations advocating for community-based maternal education as a cost-effective public health intervention.

### ***B. Lifestyle Modifications and Behavioral Shifts***

Behavioral change was a central focus of the intervention, and the results provide compelling evidence of its effectiveness. Significant improvements were observed in dietary habits, physical activity, stress management, and supplement use, as confirmed by Wilcoxon and McNemar’s test results (p < 0.001 across variables). For instance, the percentage of women exercising daily rose from 11.0% to 42.0%, and those adhering to a specific diet increased from 28.0% to 65.0%.

These findings echo those of Radhika et al. (2021), who demonstrated that behavioral interventions in pregnant women can significantly reduce salt intake and increase the intake of micronutrients. Similarly, a study by Vellanki et al. (2018) found that prenatal yoga and walking improved not only maternal physical health but also mood and stress resilience, which aligns with this study’s 35.5% increase in participants reporting adequate sleep and 35.5% rise in stress management behaviors.

The emphasis on practical, culturally appropriate strategies—such as meal planning with local foods and integrating stress relief into daily routines—likely contributed to this success. These approaches are supported by guidelines from the Indian Council of Medical Research (ICMR), which advocate for personalized antenatal counseling tailored to socio-economic contexts.

### ***C. Clinical Outcomes and Biochemical Indicators***

Post-intervention, statistically significant improvements were noted in all key clinical markers: TSH levels declined from 4.8 to 2.8 mIU/L; systolic and diastolic BP dropped by over 10 mmHg; and both fasting and random blood glucose levels improved (p < 0.0001). These results are consistent with the literature indicating that lifestyle modification can impact endocrine and cardiovascular health even during pregnancy.

A study by Nazarpour et al. (2016) found that pregnant women with borderline hypothyroidism responded well to diet and stress reduction interventions, resulting in improved Free T4 levels—similar to the increase from 0.9 to 1.2 ng/dL in the present study. Likewise, research by ACOG (2020) emphasizes that lifestyle factors such as salt reduction, physical activity, and sleep hygiene are critical non-pharmacological strategies for managing gestational hypertension.

Furthermore, the significant reduction in proteinuria—from 30.0% to 10.0%—mirrors findings from a study by Adiga et al. (2022), where integrated lifestyle and dietary counseling led to a 60% decrease in cases of gestational proteinuria. These improvements support the hypothesis that structured education has a measurable physiological impact.

### ***D. Medication Use and Health System Engagement***

Another positive outcome was the observed change in medication use and follow-up practices. While overall use of thyroid and BP medications slightly declined (from 40.0% to 35.0%), 25.0% of women had their doses reduced post-intervention, suggesting improved self-regulation through non-drug means. This supports findings by Sharma et al. (2019), who reported that patient education in gestational diabetes reduced insulin dependency in over 20% of participants.

More notably, engagement with healthcare monitoring improved, with 40.0% of participants checking blood pressure weekly and 77.5% undergoing thyroid function monitoring within 3 months. These figures represent a behavioral shift toward proactive health management. Similar trends were documented by Anjali et al. (2021), who found that educational programs increased ANC follow-up compliance and reduced late-pregnancy complications.

### ***E. Perception, Satisfaction, and Program Acceptability***

Participant satisfaction and feedback form a critical qualitative dimension of clinical impact. As reported in Table 4.22, 85.0% of women were satisfied or very satisfied with the guidance provided. Furthermore, 75.0% expressed a willingness to continue the adopted lifestyle behaviors post-delivery, suggesting a lasting behavioral imprint.

These responses are consistent with patient-centered care models discussed by Bastani et al. (2015), which emphasize empowerment, autonomy, and contextual learning as key elements of antenatal success. When interventions are participatory and responsive to patient needs, satisfaction increases—ultimately translating into better adherence and outcomes. This study's focus on personalized counseling and regular reinforcement during ANC visits likely contributed to the strong satisfaction metrics.

It is noteworthy, however, that 30.0% of participants faced barriers, including time constraints and lack of familial support. These barriers reflect findings from Goyal et al. (2020), who argued that even well-designed interventions must include family counseling and workplace flexibility components to ensure equitable participation.

### ***F. Synthesis of Results with Global and National Guidelines***

The outcomes of this study align well with broader maternal health frameworks. The WHO’s “Global Strategy for Women’s, Children’s and Adolescents’ Health (2016–2030)” underscores the importance of integrating lifestyle education into antenatal care. Similarly, India's RMNCH+A strategy advocates for the holistic management of maternal conditions through awareness, early detection, and community-based interventions.

The findings also resonate with National Health Mission initiatives such as Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA), which emphasizes early risk identification and counseling. The intervention model tested in this study could be adapted as a scalable component within these frameworks, particularly in semi-urban and rural settings where awareness is lower.

This study demonstrated that a structured, culturally sensitive lifestyle intervention during pregnancy can significantly improve awareness, health behaviors, clinical outcomes, and participant satisfaction. The results are in alignment with a growing body of literature that supports non-pharmacological strategies for managing thyroid and hypertensive conditions during pregnancy.

The findings offer practical insights for maternal health practitioners, program developers, and policymakers, emphasizing that antenatal education—when grounded in evidence, supported with follow-up, and tailored to local needs—can transform maternal health trajectories. Future interventions should address identified barriers, involve family education, and consider long-term tracking to assess postpartum sustainability.

**4.11 Summary of Chapter**

Chapter 4 presented a detailed analysis of the results obtained from the study on the impact of lifestyle modification interventions among pregnant women with or at risk of thyroid dysfunction and hypertension. The chapter began with a demographic profile of the participants, highlighting diversity in age, education, income, gestational age, and parity. Subsequent sections demonstrated a significant improvement in awareness and knowledge scores following the intervention, as confirmed by paired sample t-tests. Lifestyle behaviors, including diet, exercise, sleep, and stress management, showed statistically significant positive changes, validated through Wilcoxon Signed-Rank and McNemar’s tests.

Clinical indicators such as TSH, blood pressure, and glucose levels improved meaningfully, and the presence of proteinuria was notably reduced post-intervention. These changes were statistically supported by paired t-tests, indicating a strong physiological impact of the program. The study also observed a reduction in medication dependency and enhanced adherence to monitoring routines such as regular blood pressure and thyroid checks. Participant-reported outcomes further confirmed these benefits, with a majority acknowledging improvements in their health, reduced symptoms, and a greater engagement with medical advice.Satisfaction levels with the intervention were high, with most participants expressing confidence in continuing lifestyle changes even after pregnancy. While some reported barriers to implementation, the overall response suggested a high degree of acceptability and feasibility of the program. The chapter concluded with a discussion integrating the findings with existing literature, which reinforced the effectiveness of structured, educational interventions in antenatal care. Collectively, the findings support the hypothesis that lifestyle education and behavioral support can produce measurable improvements in awareness, practices, and maternal health outcomes.

**Chapter 5**

**Summary, Conclusion, And Recommendations**

**5.1 General Introduction**

Chapter 5 presents a comprehensive discussion of the study's key findings, drawing connections between the results obtained and existing literature in the fields of maternal health, endocrinology, and public health education. This chapter interprets the quantitative and qualitative data presented in Chapter 4, critically analyzing the significance, relevance, and implications of the lifestyle modification intervention on the awareness, behavior, and clinical health outcomes of pregnant women affected by or at risk for thyroid dysfunction and hypertensive disorders.

The primary aim of the study was to assess whether structured, targeted lifestyle education could significantly improve awareness levels, encourage the adoption of healthier behaviors, and result in measurable improvements in physiological indicators such as blood pressure and thyroid hormone levels. The intervention was designed with a holistic approach, integrating diet, physical activity, stress management, and regular monitoring, and it was implemented through antenatal care settings to ensure accessibility and contextual relevance.

This chapter begins by discussing the improvement in awareness and knowledge levels, followed by analysis of changes in lifestyle practices. It then explores the impact on clinical indicators and correlates these outcomes with existing empirical evidence. Particular attention is given to the behavioral sustainability and satisfaction of participants, as these factors are critical for long-term maternal and neonatal health. The chapter also addresses the strengths and limitations of the study, offering suggestions for clinical practice, public health policy, and future research.

In sum, Chapter 5 aims to place the findings of this study within a broader scientific and practical framework, highlighting the intervention’s potential as a replicable and scalable model for enhancing maternal health outcomes through non-pharmacological means.

**5.2 Achievement of Objectives**

The present study successfully met all three stated objectives through comprehensive data collection, intervention, and evaluation methods.

**Achievement of Objective 1: To study the correlation between the level of knowledge and awareness regarding the prevention and management of thyroid and hypertension and selected demographic variables.**

This objective was achieved through statistical analysis of pre-test data, where chi-square tests were employed to examine the association between awareness scores and key demographic variables such as age, education, income, and parity. The analysis revealed a statistically significant association between education level and awareness (p < 0.05), as well as moderate correlations with income and parity. These findings indicate that sociodemographic factors play a crucial role in shaping pregnant women’s baseline understanding of thyroid and hypertensive disorders, consistent with previous studies that highlight the impact of literacy and access to information on maternal health knowledge.

**Achievement of Objective 2: To educate and make aware the pregnant women regarding the prevention of thyroid and hypertension by adopting certain lifestyle modifications.**  
This objective was accomplished through a structured lifestyle intervention that included educational sessions on diet, physical activity, stress reduction, and symptom monitoring. The post-test assessment showed a significant increase in awareness scores (mean increase from 3.44 to 6.25), with a marked shift from low to high knowledge categories. Paired sample t-test results (p < 0.001) confirmed the effectiveness of the educational content. Moreover, post-intervention feedback indicated high levels of satisfaction and perceived usefulness among participants, reinforcing the success of the awareness initiative.

**Achievement of Objective 3: To study and evaluate the effectiveness of lifestyle modification to prevent and manage thyroid and hypertension.**

This objective was fully met, as demonstrated by improvements in both self-reported behaviors and clinical parameters. Wilcoxon Signed-Rank and McNemar’s tests showed significant enhancements in lifestyle practices such as dietary adherence, physical activity frequency, and stress management. Additionally, paired t-tests revealed notable reductions in TSH levels, systolic and diastolic blood pressure, and blood glucose levels post-intervention. The clinical improvements were also validated through participant reports of reduced symptoms and greater health monitoring engagement.

In conclusion, the study effectively achieved all its objectives, demonstrating that structured lifestyle education not only improves awareness and behavior but also leads to measurable clinical benefits for pregnant women at risk of thyroid and hypertensive disorders.

**5.3 Summary of Findings**

This section synthesizes the key outcomes of the study based on the analysis presented in Chapter 4, structured around the core objectives: improvement in knowledge and awareness, adoption of healthy lifestyle practices, clinical effectiveness of the intervention, and participant satisfaction and engagement. The findings are summarized in thematic domains and reflect both quantitative and qualitative dimensions of impact.

### ***A. Demographic Profile of Participants***

The study involved 200 pregnant women from varied sociodemographic backgrounds. The age distribution showed a concentration in the 26–30-year range (34%), followed by those aged 21–25 years (27%). Most participants were in their second trimester (49.5%), and a large proportion were graduates (35.5%) or had secondary education (30%). The income distribution ranged widely, with 31% in the ₹20,000–₹30,000 bracket. The majority resided in urban or semi-urban areas, and 55% were primigravida. A significant portion had a family history of thyroid (31%) or hypertension (40.5%), suggesting a predisposed risk group. This diversity enhanced the generalizability of the intervention's results.

### ***B. Awareness and Knowledge Levels (Pre- and Post-Test)***

Initial findings showed limited awareness regarding thyroid and hypertensive conditions in pregnancy. Only 50% had heard of thyroid issues in pregnancy, and 55% were aware of hypertension-related risks. The ability to recognize symptoms and consequences was notably low, with 30–35% expressing uncertainty or incorrect beliefs.

Following the structured intervention, awareness levels significantly improved. Post-test responses revealed that 85% had knowledge of thyroid-related complications, and 90% could identify hypertensive risks. Knowledge of symptomatology also rose substantially. The mean awareness score increased from **3.44 to 6.25**, and the proportion of participants categorized under “high knowledge” rose from 15% to 42.5%. The paired sample t-test confirmed this improvement was statistically significant (**p < 0.001**), validating Hypothesis 1 and affirming the educational component's impact.

### ***C. Lifestyle Practices Before and After the Intervention***

The study found considerable shifts in lifestyle behaviors, particularly in physical activity, dietary habits, supplement use, stress management, and health-seeking practices:

* **Exercise frequency** improved notably: daily exercise increased from 11% to 42%.
* **Dietary changes** were reported by 80.5% of participants post-intervention, compared to only 51% pre-intervention.
* The number of women following a prescribed diet increased from 28% to 65%.
* **Stress relief practices** saw a notable rise from 43% to 78.5%.
* Supplement intake (e.g., iron, folic acid, iodine) rose from 67% to 78.5%.
* Participants reporting **adequate sleep** (7–8 hours) increased significantly (from 30% to 42.5%).

Wilcoxon Signed-Rank Test and McNemar’s Test showed statistically significant differences **(p < 0.001)** across all these dimensions, leading to the acceptance of Hypothesis 3. The results confirm that lifestyle education successfully influenced behavioral adoption.

### ***D. Clinical Outcomes and Health Indicators***

A key focus of the study was the physiological impact of the lifestyle intervention. Comparative analysis of clinical indicators revealed:

* TSH levels decreased from 4.8 to 2.8 mIU/L.
* Free T3 and T4 values showed improvements, indicating better thyroid regulation.
* Systolic BP decreased from 132 mmHg to 120 mmHg, and diastolic BP from 85 to 78 mmHg.
* Fasting and random blood sugar levels also dropped significantly, suggesting better metabolic control.
* Proteinuria prevalence decreased from 30% to 10%.
* Medication use reduced slightly post-intervention, and 25% of participants were advised to reduce their dosage—indicative of clinical stabilization.

Paired t-tests confirmed that these changes were statistically significant (**p < 0.0001**), validating Hypothesis 4. The results demonstrate that lifestyle modifications had a tangible impact on key medical markers.

### ***E. Lifestyle Sustainability and Participant Engagement***

Post-intervention data showed that **85%** of women adopted at least one lifestyle modification. Among those who did not (15%), common reasons cited included time constraints and inconvenience, suggesting a need for more flexible or home-based models of intervention.

The most frequently adopted changes were dietary modification (84.5%), medication adherence (81.5%), and stress management (64%). Among those using stress management, over 70% practiced meditation, breathing exercises, or mindfulness. Adherence to dietary recommendations was also high, with 52% following advice very closely.

These behavioral shifts were not only implemented but also perceived as beneficial—highlighted by the fact that **75% of participants intended to continue the practices after pregnancy**, supporting the long-term applicability of the intervention.

### ***F. Monitoring, Symptom Reduction, and Perceived Improvement***

Participants self-reported marked improvements in health post-intervention:

* **47%** noticed moderate BP improvement, and **36%** reported significant improvement.
* **49%** reported improvement in thyroid function, and **61%** noted a reduction in thyroid-related symptoms.
* **65%** reported relief from hypertension-related symptoms.
* Health monitoring behavior improved, with more participants checking BP and thyroid levels regularly (40% checked BP weekly or more often).

These self-perceptions align with the clinical outcomes recorded and suggest that participants not only adopted but also monitored the effectiveness of their lifestyle changes, a critical factor for sustained maternal health.

### **G. Participant Satisfaction and Program Acceptability**

Participant satisfaction with the intervention was high:

* **50%** were very satisfied and **35%** satisfied with the guidance received.
* **45% strongly agreed** and **37.5% agreed** that their health improved because of lifestyle changes.
* **42.5%** rated the changes as very effective, and **40%** as somewhat effective.
* Only 30% of participants faced barriers, indicating that the program was largely feasible and acceptable.

The results confirm the intervention’s success in not just delivering health education but in motivating real-life behavioral adoption, monitoring, and maintenance.

In summary, the findings provide strong evidence that structured lifestyle education can significantly improve knowledge, behavior, and health outcomes among pregnant women at risk of thyroid and hypertensive disorders. The intervention model was practical, well-received, and led to statistically and clinically meaningful changes. These findings support the integration of similar programs into routine antenatal care to reduce maternal health risks through preventive, low-cost strategies.

**5.4 Concluding Remarks**

The current study set out to explore and evaluate the effectiveness of structured lifestyle interventions in enhancing awareness, modifying behavior, and improving clinical outcomes among pregnant women at risk for or diagnosed with thyroid dysfunction and hypertension. Through a carefully planned pre- and post-test design, quantitative and qualitative data collection, and statistically validated tools, the study comprehensively assessed whether informed lifestyle changes could serve as a preventative and management tool in antenatal care. The outcomes were overwhelmingly affirmative, supporting the notion that a non-pharmacological, education-centered approach can make a measurable difference in maternal health outcomes.

Thyroid and hypertensive disorders are among the most prevalent medical complications during pregnancy, contributing significantly to maternal and fetal morbidity. In many low- and middle-income contexts, these conditions often go underdiagnosed or poorly managed due to lack of awareness, cultural myths, healthcare access issues, and a general undervaluation of antenatal education. This study directly addressed these barriers by delivering targeted educational interventions through an accessible medium—antenatal care units—and evaluating their effect through pre/post measurements of knowledge, behavior, and clinical data.

One of the most striking findings of the study was the improvement in participants’ awareness and understanding of thyroid dysfunction and hypertensive disorders during pregnancy. At baseline, nearly half of the participants were unaware of the implications of untreated thyroid issues, and a substantial portion did not recognize hypertension as a risk factor for pregnancy complications. However, after the intervention, awareness scores increased dramatically. The proportion of participants categorized under "high knowledge" rose from 15% to over 42.5%. This is not merely a statistical achievement—it represents a meaningful shift in the health literacy of a vulnerable population. Knowledge, especially in maternal healthcare, is the cornerstone of prevention, early detection, and timely action. The ability of the intervention to significantly elevate awareness demonstrates that even a short-term, structured program can yield measurable cognitive gains.

In parallel with the rise in knowledge, significant behavioral changes were observed. Post-intervention data revealed that more women engaged in regular physical activity, made deliberate dietary modifications, practiced stress management techniques, and adhered more closely to medical guidance. The percentage of women exercising daily rose from 11% to 42%, and those following specific dietary guidelines increased from 28% to 65%. This behavioral transformation is a strong indicator of the intervention's practical utility and its success in translating information into action. Importantly, these changes were not imposed but self-selected, which suggests that the intervention succeeded in motivating participants through understanding rather than enforcement. Empowered by new knowledge and supported through follow-ups, the women were able to make informed decisions that contributed to better health outcomes for themselves and their unborn children.

The changes were not only perceptual or behavioral—they were physiological and clinical. The paired sample t-tests conducted on pre- and post-intervention health indicators such as TSH, Free T3 and T4, blood pressure, and blood glucose levels revealed statistically significant improvements across all measures. TSH levels dropped from an average of 4.8 mIU/L to 2.8 mIU/L, and systolic blood pressure decreased from 132 mmHg to 120 mmHg. These shifts indicate not just better disease awareness but actual medical benefit, validating lifestyle changes as an adjunct or, in some cases, an alternative to pharmacological treatment. Further evidence supporting the intervention's effectiveness includes a decrease in proteinuria from 30% to 10%, fewer women requiring thyroid or hypertensive medications, and notable improvements in participants' self-reported symptoms.

Another dimension of the intervention's success lies in its sustainability and acceptability. A considerable majority of participants (85%) adopted at least one lifestyle change post-intervention, and 75% expressed intent to continue these practices after pregnancy. These statistics are vital in a healthcare setting where many behavior-based interventions fail due to poor adherence or cultural mismatch. The participants not only responded positively but also showed a high degree of satisfaction with the guidance received. Nearly 85% rated the program as very or somewhat effective, and 70% reported no barriers to implementation. This speaks to the intervention’s design—its cultural appropriateness, simplicity, and relevance to real-life scenarios—and the crucial role that context-sensitive, patient-centered education plays in healthcare delivery.

Beyond individual outcomes, this study contributes to the growing body of evidence supporting community-based, lifestyle-oriented antenatal care. With rising non-communicable disease (NCD) burdens globally, especially in developing nations, healthcare systems are increasingly strained by chronic conditions like hypertension and thyroid dysfunction. These conditions, if unaddressed during pregnancy, can have transgenerational consequences. The findings from this study present a strong case for integrating structured lifestyle education into routine antenatal checkups as a preventative strategy, thereby reducing the future healthcare load and improving public health metrics.

In addition to validating its own hypotheses, this research aligns with global literature emphasizing the importance of health education in maternal care. Multiple studies have shown that prenatal counseling on diet, exercise, and stress management can reduce gestational complications and promote maternal-fetal well-being. This study goes a step further by providing statistically rigorous evidence from an Indian setting, offering localized insights into how these global recommendations play out in practice. The alignment with international research reinforces the universal value of health literacy, while the unique findings add cultural and demographic nuance.

The study also illuminated some challenges and limitations. Despite the positive response, about 15% of participants did not adopt any lifestyle changes. Reasons included time constraints, inconvenient routines, or lack of perceived benefit. These responses highlight the need for more flexible, perhaps technology-driven, follow-up mechanisms like mobile health (mHealth) interventions or peer support groups. Moreover, while the sample size was sufficient for statistical analysis, the study was limited to a specific geographic region, which may affect its generalizability. Future research could expand to rural or tribal populations, assess long-term retention of behavioral changes, and explore integration with digital platforms for scalability.

Another critical insight emerged from the demographic correlations. Awareness levels were significantly associated with education, income, and parity. Women with higher education and income levels showed better baseline knowledge and adopted changes more readily. This finding indicates a persistent disparity in health literacy, reinforcing the need for targeted outreach programs among lower socioeconomic groups. Additionally, primigravida women were more receptive to new information and practices, possibly due to heightened concern or curiosity during their first pregnancy. These nuanced differences should be considered when designing future interventions to ensure inclusivity and equity.

Importantly, the intervention’s emphasis on holistic wellness rather than strict medical compliance contributed to its success. Women were encouraged to make small, manageable changes rather than adopt drastic measures, which likely improved adherence. The tone of the sessions—supportive rather than prescriptive—was essential in building trust and rapport. Participants felt respected and involved, not simply instructed. This shift from a disease-centered to a wellness-centered model is a subtle but powerful evolution in healthcare, especially in maternal settings where emotional, social, and physical well-being are deeply interconnected.

In summation, the study affirms that lifestyle modification—when guided, contextualized, and embedded within antenatal care—can be a powerful tool for improving awareness, promoting healthier behavior, and enhancing clinical outcomes in pregnant women. The intervention proved to be effective, feasible, and acceptable, making it a promising model for integration into maternal health programs. It bridged knowledge gaps, empowered participants, and demonstrated measurable health benefits—all with minimal cost and no side effects.

As the global maternal health agenda continues to prioritize equitable, sustainable, and patient-centered care, studies like this serve as both evidence and inspiration. They remind us that empowering women with knowledge and choice can transform not only individual health trajectories but also the health of families and future generations.

### **5.5 Major Conclusions**

Based on the findings and analysis conducted throughout the study, several major conclusions can be drawn regarding the effectiveness of structured lifestyle modification interventions on awareness, behavior, and clinical outcomes in pregnant women at risk for thyroid dysfunction and hypertension.

* **Awareness and Knowledge Significantly Improve with Targeted Education:** The study demonstrated a substantial improvement in participants’ awareness and understanding of thyroid and hypertensive disorders during pregnancy following the lifestyle intervention. Mean knowledge scores significantly increased post-intervention, confirming that structured antenatal health education is both necessary and effective in addressing knowledge gaps among expectant mothers.
* **Sociodemographic Factors Influence Baseline Awareness:** There was a statistically significant association between certain demographic variables—particularly education level and parity—and awareness levels. These findings emphasize the need to tailor educational efforts based on participants’ backgrounds to ensure maximum reach and efficacy, especially among low-literacy groups.
* **Lifestyle Behaviors Can Be Modified Through Structured Interventions:** The intervention led to measurable improvements in dietary habits, physical activity, stress management, supplement intake, and sleep routines. The adoption of healthier behaviors post-intervention indicates that pregnant women are both receptive and responsive to lifestyle guidance when delivered in an engaging and supportive format.
* **Clinical Indicators Reflect the Impact of Non-Pharmacological Interventions:** Improvements in clinical parameters such as TSH levels, blood pressure, and blood glucose levels were statistically significant. These results confirm that lifestyle changes can positively influence health outcomes, serving as complementary or even primary management strategies for thyroid and hypertensive conditions in pregnancy.
* **Behavioral Changes Were Sustained and Well-Received by Participants:** Most participants expressed high satisfaction with the intervention and intended to continue the adopted lifestyle practices beyond pregnancy. This suggests that the program was not only educationally impactful but also sustainable and behaviorally ingrained.
* **Educational Interventions Enhance Health Monitoring and Self-Management:** Post-intervention, more women engaged in routine monitoring of blood pressure and thyroid levels, and a majority reported reductions in symptoms associated with both conditions. This shift toward proactive health management is a critical step in preventing complications during and after pregnancy.
* **Lifestyle Education is a Cost-Effective, Scalable Strategy in Maternal Health:** The success of this intervention—achieved with minimal resources and infrastructure—demonstrates its potential for integration into routine antenatal care. Given its high acceptability and effectiveness, similar models can be adapted at community and primary healthcare levels.

### **5.6 Recommendations**

Based on the findings and outcomes of this study, the following recommendations are proposed to strengthen maternal health practices and effectively integrate lifestyle modifications into antenatal care frameworks:

* **Integration of Lifestyle Education into Antenatal Care Programs:** Structured and evidence-based lifestyle education focusing on the prevention and management of thyroid dysfunction and hypertension should be formally incorporated into routine antenatal services. Doing so can facilitate early risk identification, enhance preventive strategies, and promote healthier maternal-fetal outcomes.
* **Development of Culturally Relevant and Literacy-Sensitive Educational Materials:** Educational content should be tailored to the socio-cultural background and literacy levels of pregnant women. The use of local languages, visual tools, storyboards, and audio-visual formats can improve comprehension and inclusivity, especially among women with limited formal education.
* **Capacity Building for Healthcare Professionals:** Midwives, nurses, and obstetricians should receive specialized training in lifestyle counseling and preventive care approaches. Equipping healthcare personnel with appropriate communication skills and knowledge can ensure more effective delivery of health education during antenatal visits.
* **Promotion of Family and Community Engagement:** Family members—especially husbands and elder caregivers—should be included in antenatal education initiatives to foster a supportive home environment. Community health workers and peer educators can also play a vital role in reinforcing lifestyle practices at the household and neighborhood levels.
* **Leveraging Mobile and Digital Technologies for Continued Support:** Health tools such as mobile apps, SMS reminders, and WhatsApp groups should be utilized to provide ongoing guidance, track adherence, and reinforce educational messages. These platforms can be especially beneficial in maintaining continuity of care between clinical appointments.
* **Expansion Through Government and NGO Health Platforms:** Given its success and feasibility, the lifestyle intervention model presented in this study should be scaled up through public health programs and non-governmental organizations. This would enable broader reach, particularly among underserved populations in rural and resource-limited settings.

## **5.7 Limitations of the Study**

Despite the significant outcomes, several limitations should be acknowledged:

* **Limited Geographic Coverage:** The study was confined to selected urban and semi-urban health centers. This may restrict generalizability to rural, tribal, or remote populations where resources and health awareness levels may differ.
* **Short-Term Assessment:** The study measured outcomes immediately after the intervention. The sustainability of lifestyle changes and their impact during postpartum or future pregnancies were not assessed.
* **Self-Reported Data:** Some lifestyle behaviors and symptom improvements were self-reported, which may introduce recall bias or socially desirable responses.
* **Exclusion of High-Risk Pregnancies:** Women with medically complex pregnancies were excluded, which limits the applicability of the findings to more vulnerable subgroups.
* **Lack of a Control Group:** The study employed a one-group pre-test/post-test design. Without a non-intervention control group, the exclusive attribution of effects to the intervention cannot be confirmed definitively.

## **5.8 Suggestions for Future Research**

To enhance the scope and depth of knowledge on this topic, the following areas are recommended for future research:

* **Longitudinal Studies:** Future research should explore the long-term effects of lifestyle education on maternal and neonatal health, tracking participants through delivery and postpartum periods.
* **Randomized Controlled Trials (RCTs):** Conducting RCTs with appropriate control groups will strengthen causal inference and provide higher levels of scientific evidence for policy advocacy.
* **Inclusion of High-Risk Pregnancies:** Studies involving women with gestational diabetes, cardiovascular disease, or multiple comorbidities would help assess the efficacy of lifestyle education across broader medical profiles.
* **Evaluation of Digital Health Platforms:** Investigating the role of mobile applications, SMS-based education, and online follow-ups could provide scalable, cost-effective alternatives for health education.
* **Exploration of Family-Based Interventions:** Research that involves family members in lifestyle modification programs could yield insights into the role of familial support in sustaining behavioral change.
* **Cost-Effectiveness Studies:** A comparative analysis of lifestyle education versus conventional pharmacological interventions can help policymakers allocate resources efficiently.

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**Appendix-I**: Questionnaire: Knowledge and Lifestyle Modification

***Questionnaire***

**Section A: Demographic Details *(Pre-Test only)***

1. Name/ID (Optional): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Age: ☐ <20 Years ☐ 21–25 Years ☐ 26–30 Years ☐ 31–35 Years ☐ >35 Years
3. Gestational Age: ☐ 1st Trimester ☐ 2nd Trimester ☐ 3rd Trimester
4. Education Level: ☐ No formal education ☐ Primary ☐ Secondary ☐ Graduate ☐ Postgraduate
5. Occupation: ☐ Homemaker ☐ Working ☐ Student ☐ Unemployed
6. Monthly Family Income: ☐ < ₹10,000K ☐ ₹10–20K ☐ ₹20–30K ☐ ₹30–50K ☐ > ₹50K
7. Residence: ☐ Urban ☐ Semi-urban ☐ Rural
8. Family Type: ☐ Nuclear ☐ Joint
9. Parity: ☐ Primigravida ☐ Multigravida
10. Family History of Thyroid: ☐ Yes ☐ No
11. Family History of Hypertension: ☐ Yes ☐ No

**Section B: Knowledge and Awareness *(Pre-Test & Post-Test)***

General Awareness

1. Have you heard of thyroid disorders in pregnancy?  
   ☐ Yes ☐ No
2. Can untreated thyroid affect pregnancy outcomes?  
   ☐ Yes ☐ No ☐ Not sure
3. Have you heard of hypertension during pregnancy?  
   ☐ Yes ☐ No
4. Can high blood pressure cause complications during pregnancy?  
   ☐ Yes ☐ No ☐ Not sure
5. Can lifestyle changes help prevent/manage thyroid and hypertension?  
   ☐ Yes ☐ No ☐ Not sure
6. Are thyroid/BP problems always visible through symptoms?  
   ☐ Yes ☐ No ☐ Not sure
7. What are symptoms of thyroid problems? (Tick all that apply)  
   ☐ Fatigue ☐ Weight gain ☐ Cold intolerance ☐ Palpitations ☐ Don’t know
8. What are signs of high BP? (Tick all that apply)  
   ☐ Headache ☐ Swelling ☐ Blurred vision ☐ Chest pain ☐ Don’t know

**SECTION C: MEDICAL DATA (Clinical Inputs) (Pre & Post)**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | Units | Date |
| TSH |  | mIU/L |  |
| Free T4 |  | ng/dL |  |
| Free T3 |  | pg/mL |  |
| Systolic BP |  | mmHg |  |
| Diastolic BP |  | mmHg |  |
| Urine Protein |  | + / – |  |
| Fasting Blood Sugar |  | mg/dl |  |
| Random Blood Sugar |  | Mg/dl |  |
| On Thyroid/BP Medication? | ☐ Yes ☐ No | – | – |
| Any Change in Dose Advised? | ☐ Yes ☐ No | – | – |

**SECTION D: LIFESTYLE PRACTICES (Pre & Post)**

1. How often do you exercise (e.g., walk, yoga)?  
   ☐ Daily ☐ 3–4×/week ☐ 1–2×/week ☐ Rarely/Never
2. Types of activity (select all): ☐ Walking ☐ Yoga ☐ Swimming ☐ Aerobics ☐ Other: \_\_\_\_\_\_
3. Have you made any dietary changes since pregnancy? ☐ Yes ☐ No
4. If yes, what changes?  
   ☐ Reduced salt ☐ More fruits/vegetables ☐ Reduced caffeine ☐ More water ☐ Other: \_\_\_\_\_
5. Do you follow a specific diet for thyroid/BP? ☐ Yes ☐ No
6. Do you consume high-sodium foods?  
   ☐ Daily ☐ 3–4×/week ☐ 1–2×/week ☐ Rarely/Never
7. Do you take supplements (e.g., iodine, folic acid)? ☐ Yes ☐ No
8. Do you practice stress-relief techniques? ☐ Yes ☐ No
9. Average sleep per night: ☐ <5 hrs ☐ 5–6 hrs ☐ 7–8 hrs ☐ >8 hrs
10. Have you discussed lifestyle changes with your doctor? ☐ Yes ☐ No

**SECTION E: LIFESTYLE CHANGES POST-INTERVENTION *(Post-Test Only)***

1. Have you adopted lifestyle modifications since the suggestions?  
   ☐ Yes ☐ No
2. If not or partially, why?  
   ☐ Lack of time ☐ Inconvenient routine ☐ No perceived benefit ☐ Other: \_\_\_\_\_\_\_\_
3. Changes implemented (select all):  
   ☐ Diet ☐ Exercise ☐ Stress management ☐ Medication adherence ☐ Other: \_\_\_\_\_\_
4. How closely have you followed dietary advice?  
   ☐ Very closely ☐ Somewhat ☐ Rarely ☐ Not at all
5. Changes in stress management habits: ☐ Yes ☐ No
6. If yes, method used: ☐ Meditation ☐ Breathing ☐ Mindfulness ☐ Other: \_\_\_\_\_\_

**SECTION F: MEDICAL OUTCOMES & MONITORING (Post-Test Only)**

1. Has your blood pressure improved?  
   ☐ Significant ☐ Some ☐ No change ☐ Worse
2. Has your thyroid function improved?  
   ☐ Significant ☐ Some ☐ No change ☐ Worse
3. Have symptoms of thyroid (e.g., fatigue, weight) reduced?  
   ☐ Yes ☐ No ☐ Not applicable
4. Have hypertension symptoms (e.g., headache, dizziness) reduced?  
   ☐ Yes ☐ No ☐ Not applicable
5. BP monitoring frequency:  
   ☐ Weekly or more ☐ Monthly ☐ Rarely/Never
6. Thyroid monitoring frequency:  
   ☐ Within 3 months ☐ Monthly ☐ Rarely/Never

**SECTION G: SATISFACTION & FEEDBACK (Post-Test Only)**

1. Satisfaction with guidance:  
   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied
2. Do you feel lifestyle changes improved your overall health?  
   ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
3. Do you plan to continue these changes post-pregnancy?  
   ☐ Yes ☐ No ☐ Not sure
4. Did you face barriers to implementation (e.g., time, food access)? ☐ Yes ☐ No  
   If yes, specify: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Overall effectiveness of lifestyle changes:  
   ☐ Very effective ☐ Somewhat effective ☐ Not effective ☐ Unsure