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MASTERS' THESIS

Osama Sallom ALABD

T.C.

ANKARA YILDIRIM BEYAZIT UNIVERSITY

PUBLIC HEALTH INSTITUTE

ASSESSMENT OF DIETARY PRACTICE AND ANTHROPOMETRIC STATUS AND RELATED RISK FACTORS OF PREGNANT WOMEN IN NORTHWEST SYRIA

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APPROVAL of the THESİS

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We declare that this thesis, which we have read and listened to, has met all the scope and quality requirement for a master's degree.

Prof. Dr. Salih MOLLAHALİLOĞLU

Institution Director

I certify that this thesis meets all the requirements for a master's degree.

PLAGIARISM

I declare here that everything in this thesis is my unique work. I have explicitly referenced in accordance with Ankara Yildirim Beyazit University guidelines, academic rules, and ethical conduct, and I accept full legal responsibility for the academic procedure of my thesis.

01.10.2024

Osama SALLOM ALABD

DECLARATION

I declare that this thesis is my original, unpublished work; it has never been presented for the same reason before, and since every other information from other people's work contained in my thesis is fully acknowledged, it does not violate anyone's copyright or breach any property rights.

01/10/2024

Osama SALLOM ALABD

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ABSTRACT

Master's Thesis

ASSESSMENT OF DIETARY PRACTICE AND ANTHROPOMETRIC STATUS AND RELATED RISK FACTORS OF PREGNANT WOMEN IN NORTHWEST SYRIA

Osama Sallom ALABD

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Background: The conflict in Northwest Syria has severely impacted the dietary habits and nutritional status of pregnant women, posing serious risks to maternal and neonatal health. This study explores the link between dietary practices and maternity outcomes in conflict-affected areas, focusing on Northwest Syria. Methods: Using an adapted Biopsychosocial Model of Health, this study evaluates the nutritional status and dietary habits of pregnant women. Data on food consumption, nutritional deficiencies, and pregnancy complications were analyzed to understand the unique challenges in conflict zones. A questionnaire was designed with ten question sets covering demographics, social data, medical history, family and reproductive details, dietary patterns from seven main food groups, and physical activity. Results: The study included 315 participants, revealing that many experienced negative health outcomes, with 50% showing low food intake and an average hemoglobin level of 11.4 g/dl, indicating widespread anemia. Pregnant women in Aleppo had higher rates of anemia, gestational diabetes mellitus (GDM), and electrolyte imbalances compared to those in Idleb, highlighting regional disparities. Socioeconomic conditions were significant, with 81.8% of those reporting low food intake living in overcrowded homes. Findings showed that 41.9% of participants had inadequate food consumption, and only 10.2% had sufficient intake. Additionally, 87.3% were internally displaced persons (IDPs) residing in informal settings, which restricted healthcare access and worsened nutritional deficiencies. Higher educational levels were associated with

better dietary practices. Conclusion: This study emphasizes the urgent need for targeted interventions to improve maternal health in Northwest Syria, where anemia, GDM, and other health issues are prevalent, particularly among low-income and overcrowded households. Addressing geographic disparities requires tailored public health strategies, especially in Aleppo. Humanitarian efforts must focus on providing diverse nutritional support for displaced pregnant women. Nutrition and health literacy programs can empower women to make informed dietary choices, and policymakers should advocate for agricultural and food security initiatives, supported by community involvement and international cooperation.

October 2024, 193 pages

Keywords: Conflict, Northwest Syria, Pregnant Women, Dietary Habits, Nutritional Status, Maternal Health Outcomes

ÖZET

Yüksek Lisans Tezi

KUZEYBATI SURIYE'DE HAMILE KADINLARIN DIYET UYGULAMASI VE ANTROPOMETRIK DURUMUNUN VE ILGILI RISK FAKTÖRLERININ DEĞERLENDIRILMESI

Osama SALLOM ALABD

Ankara Yıldırım Beyazıt Üniversitesi
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Sağlık Politikası ve Küresel Sağlık Programı

Danışman: Doç. Dr. Nimetcan Mehmet ORHUN
İkinci Danışman: Prof. Dr. Salih MOLLAHALILOĞLU

Arka Plan: Kuzeybatı Suriye'deki çatışma, hamile kadınların beslenme alışkanlıklarını ve beslenme durumlarını ciddi şekilde etkilemiş ve anne ve yenidoğan sağlığı açısından büyük riskler doğurmuştur. Bu çalışma, çatışmadan etkilenen bölgelerde, özellikle Kuzeybatı Suriye'ye odaklanarak beslenme alışkanlıkları ile annelik sonuçları arasındaki ilişkiyi incelemektedir. Yöntemler: Uyarlanmış bir Biyopsikososyal Sağlık Modeli kullanılarak, hamile kadınların beslenme durumları ve beslenme alışkanlıkları değerlendirilmiştir. Çatışma bölgelerindeki benzersiz zorlukları anlamak amacıyla, gıda tüketim kalıpları, besin eksiklikleri ve gebelikle ilgili komplikasyonlar üzerine veri analizi yapılmıştır. Genel demografik ve sosyal bilgiler, tıbbi geçmiş, aile durumu, üreme geçmişi, yedi ana gıda grubunun ve türevlerinin tüketim kalıpları ve fiziksel aktiviteyi içeren on soruluk bir anket oluşturulmuştur. Bulgular: Çalışmada 315 katılımcı yer almıştır. Bulgular, katılımcıların önemli bir bölümünün olumsuz sağlık sonuçları yaşadığını ortaya koymuştur; %50'si düşük gıda alımı göstermiş ve ortalama hemoglobin seviyesi 11.4 g/dl olarak tespit edilmiştir, bu da yaygın anemiyi göstermektedir. Halep'teki hamile kadınlar, İdlib'dekilere kıyasla daha yüksek anemi, gestasyonel diyabet (GDM) ve elektrolit dengesizlikleri oranları göstermiştir ve bu da bölgesel farklılıkları vurgulamaktadır. Sosyoekonomik koşullar önemli bir faktördü; düşük gıda tüketimi bildirenlerin %81.8'i kalabalık hanelerde yaşamaktaydı. Katılımcıların %41.9'unun yetersiz gıda alımı, sadece %10.2'sinin ise yeterli alımı olduğu görülmüştür. Katılımcıların %87.3'ü, sağlık hizmetlerine erişimlerini

kısıtlayan ve beslenme yetersizliklerini kötüleştiren gayriresmi ortamlarda yaşayan yerinden edilmiş kişilerdi. Yüksek eğitim düzeylerinin daha iyi beslenme alışkanlıkları ile ilişkili olduğu görülmüştür. Sonuç: Bu çalışma, Kuzeybatı Suriye'de özellikle düşük gelirli ve kalabalık hanelerdeki anemi, GDM ve diğer sağlık sorunlarının yaygın olduğu annelik sağlığını iyileştirmek için hedeflenen müdahalelere acil ihtiyaç olduğunu vurgulamaktadır. Coğrafi sağlık farklılıklarının ele alınması, özellikle Halep'te, özel halk sağlığı stratejileri gerektirir. İnsani yardımlar, yerinden edilmiş hamile kadınlara yönelik çeşitli besin desteğine öncelik vermelidir. Beslenme ve sağlık okuryazarlığı programları, kadınların sağlıklı beslenme seçimleri yapmalarını destekleyebilir. Politika yapıcılar, topluluk katılımı ve uluslararası iş birliği ile desteklenen tarımsal kalkınma ve gıda güvenliği girişimlerini desteklemelidir.

Ekim 2024, 193 sayfa

Anahtar Kelimeler: Çatışma, Kuzeybatı Suriye, Hamile Kadınlar, Beslenme Alışkanlıkları, Beslenme Durumu, Anne Sağlığı Sonuçları

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LIST OF ABBREVIATIONS

- ANC - Antenatal Care
- IDP - Internally Displaced Person
- UNFPA - United Nations Population Fund
- CARE - Cooperative for Assistance and Relief Everywhere
- NGO - Non-Governmental Organization
- HH - Household
- GDP - Gross Domestic Product
- EU - European Union
- WHO - World Health Organization
- EHSP - Essential Health Services Package
- UN - United Nations
- PHC - Primary Health Care
- KMC - Kangaroo Mother Care
- BE - Basic Emergency
- OC - Obstetric Care
- MVA - Manual Vacuum Aspiration
- CE - Comprehensive Emergency
- CMAM - Community-based Management of Acute Malnutrition
- IYCF - Infant and Young Child Feeding
- WASH - Water, Sanitation, and Hygiene
- UNICEF - United Nations International Children's Emergency Fund
- COVID - Coronavirus Disease
- SFH - Save the Family Health
- FCAS - Fragile and Conflict-Affected Situations
- LMIC - Low- and Middle-Income Countries
- DPT - Diphtheria, Pertussis, and Tetanus
- HIV - Human Immunodeficiency Virus
- AIDS - acquired immunodeficiency syndrome

- CRH - Center for Reproductive Health
- WRA - Women of Reproductive Age
- WFR - Women's Food Ratio
- DDS - Dietary Diversity Score
- SDG - Sustainable Development Goal
- MDD - Minimum Dietary Diversity
- GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)
- DHS - Demographic and Health Survey
- FAO - Food and Agriculture Organization
- GDQP - General Directorate of Quality and Productivity
- CAPI - Computer-Assisted Personal Interviewing
- HB - Hemoglobin
- BMC - BioMed Central
- GDM - Gestational Diabetes Mellitus
- USD - United States Dollar
- MUAC - Mid-Upper Arm Circumference
- SGA - Small for Gestational Age
- AGA - Appropriate for Gestational Age
- LGA - Large for Gestational Age
- BMI - Body Mass Index
- GWG - Gestational Weight Gain
- ISIS - Islamic State of Iraq and Syria
- ID - Identification
- SPSS - Statistical Package for the Social Sciences
- CI - Confidence Interval
- INDIKIT - Indicator Toolkit
- SD - Standard Deviation
- EXP - Exposure
- WFP - World Food Program
- IRC - International Rescue Committee

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1. INTRODUCTION

1.1. Background

Since 2011, Syria has experienced a complex and devastating conflict that has profoundly reshaped the country's geopolitical landscape, resulting in the division of the country into various regions under different controlling powers (1,2). These regions include the Northwest, Northeast, and areas under government control. The Northwest, in particular, falls outside government jurisdiction and is governed by a range of authorities, including the National Syrian Army, the Syrian Salvation Government, and other militaries (3).

What began as a series of peaceful protests rapidly escalated into a full-blown war, drawing in multiple factions and foreign powers (4). The ongoing conflict in Northwest Syria presents a humanitarian crisis of unprecedented scale, deeply impacting the infrastructure of healthcare and the general well-being of the population (5,6). Since the conflict's inception, the region has witnessed massive displacements, demolition of medical facilities, and a significant disturbance of food supply networks (3,7). These factors have collectively contributed to a public health crisis, with one of the most susceptible categories is pregnant women affected (8). Pregnant women in conflict zones face unique challenges that go beyond the general hardships endured by the population (9). The turmoil and instability inherent in such environments have direct implications on their access to adequate nutrition and healthcare services (10). The situation in Northwest Syria is particularly dire, as the conflict has led to a scarcity of essential food items, restricted availability of prenatal treatment, and a breakdown of traditional social support systems. These factors increase the possibility of adverse outcomes for mothers and newborns (11,12), making the study of dietary habits and nutritional behaviors in this group a matter of urgency.

The conflict has significantly altered the nutritional intake and dietary habits of expectant mothers in Northwest Syria (5). Limited access to a variety of nutritious food, coupled with the stress and anxiety of living in a conflict zone, can lead to nutritional deficiencies that are detrimental to both maternal and fetal health (13). Issues such as

anemia, vitamin deficiencies, and inadequate caloric intake are likely to be more pronounced in this setting (14,15).

Despite the well-established negative effects of conflict on health, little research has been done expressly on pregnant women's eating patterns and nutritional status in conflict zones like Northwest Syria (16). By investigating the relationship between dietary behaviors and maternal health outcomes, this study aims to close this gap in such challenging environments.

The core of the research problem lies in identifying and analyzing the specific nutritional challenges faced by pregnant women in this conflict zone. Conflicts and protracted crises result in a scarcity of food resources and disrupt traditional dietary practices (17,18). The frequency of nutritional deficiencies in pregnant women, their effects on the health of the mother and fetus, and the possible increase in pregnancy-related problems such gestational diabetes, hypertension, and preeclampsia are all important issues that are brought up by these disturbances.

The research problem is compounded by the lack of comprehensive data and studies focusing on this specific group in such an emergency setting. There is a pressing need for empirical research that can provide a detailed analysis of these issues. This information is essential for guiding healthcare policies and initiatives that can successfully handle the particular difficulties faced by expectant mothers in Northwest Syria.

1.2. Research Objectives

1.2.1. General Objectives

The central hypothesis of this thesis posits that in Northwest Syria, amidst the ongoing conflict, the dietary habits and nutritional behaviors of pregnant women significantly influence maternal health outcomes. Specifically, it hypothesizes that variations in dietary practices, compounded by the stress and disruptions of war, are closely associated with the prevalence of nutritional deficiencies, the incidence of pregnancy-related complications, and pregnant women's state of mental health.

Finding the link between pregnant women's eating patterns and their effects on maternity outcomes in conflict-affected areas—in this case, Northwest Syria—is the main goal of the study.

1.2.2. Specific Objectives

To achieve this overarching goal, the research is structured around several specific objectives:

1- Assess Nutritional Status and Dietary Habits: To evaluate the current dietary patterns and nutritional status of pregnant women in Northwest Syria, identifying common deficiencies and their potential causes. This objective involves collecting detailed data on food intake, preference, and accessibility among the study participants.

2- Identify Pregnancy-Related Health Complications: To investigate the prevalence of pregnancy-related complications such as gestational diabetes, and preeclampsia among the participants, and to explore their potential links to dietary practices and nutritional status.

It is anticipated that the results of this study will have a major impact on public health interventions and policies in communities affected by violence. The creation of focused nutritional programs and guidelines can be influenced by knowledge about pregnant women's eating patterns and nutritional status, which are crucial in improving maternal and neonatal health outcomes (19). Additionally, this research can provide valuable insights for aid organizations and healthcare providers working in similar conflict settings.

1.3. Research Hypothesis

Hypothesis 1 (H1): Pregnant women in Northwest Syria exhibit significant dietary deficiencies that correlate with adverse maternity outcomes, such as anemia and gestational diabetes, due to limited food accessibility and availability.

Hypothesis 2 (H2): There is a significant association between specific dietary habits (e.g., poor consumption of fruits, vegetables, and meals high in protein) and the frequency of pregnancy-related illnesses, such as preeclampsia and gestational diabetes among the study participants.

1.4. Research Theory

The study employs an adapted Biopsychosocial Model of Health tailored to address the unique challenges and complexities of maternal health outcomes (in this case, maternal health outcomes in the conflict-affected and emergency region of Northwest Syria). This model recognizes that maternal health is influenced by a dynamic interplay of biological (e.g., nutritional status, physical health), psychological (e.g., stress levels, mental health), and social factors (e.g., cultural dietary habits, socioeconomic status), each of which is profoundly impacted by the backdrop of conflict and emergency conditions (20,21).

1.5. Key Theoretical Points

- Biological Aspect: In this context, biological factors extend beyond basic nutritional status to include the compounded effects of limited access to food, disrupted supply chains, and the prevalence of chronic diseases exacerbated by the conflict. This includes a heightened focus on malnutrition, dietary deficiencies, and their direct impact on maternal and fetal health in an emergency setting (22).
- Social Aspect: Social factors in a conflict-affected region involve the examination of disrupted social structures, altered family dynamics due to displacement or loss, and the role of cultural practices in dietary habits under emergency conditions. This includes considering how socioeconomic status is impacted by the conflict, affecting access to food and healthcare resources (23).
- Adaptation to Emergency and Conflict Settings: This model specifically accounts for the impact of living in a war-torn region on maternal health. It addresses the scarcity of resources, healthcare infrastructure breakdown, and pregnant women's adaptability in such environments (24).
- Integrative Approach: The theory emphasizes an integrative approach to understanding maternal health in Northwest Syria, where conventional health determinants are intertwined with the complexities of living in a conflict zone. It

highlights the need for health interventions that are multifaceted, considering not just the physical but also the psychological and social well-being of pregnant women (25).

1.6. Significance of the Study

Conducting research on dietary habits and maternal health during pregnancy in conflict-affected Northwest Syria is crucial due to the vulnerability of pregnant women (57) and the critical effect of nutrition on mother and fetal health (26). The ongoing conflict has disrupted essential services and impacted dietary behaviors (27), creating a research gap in understanding these unique challenges (28). This research can guide tailored humanitarian efforts and policy-making, improve resource allocation, and design effective health programs. Additionally, it can provide insights on resilience and coping strategies for pregnant women under extreme conditions. Such knowledge is valuable not only for Northwest Syria but also for other conflict-affected regions, contributing to global health knowledge and crisis response. Overall, the research is vital for improving the outcomes of mother and child health in conflict areas and for responsive public health policy and interventions.

Definition of Key Terms

- **Dietary Habits:** This refers to the regular eating patterns, choices, and preferences of individuals (29). In the context of this study, it specifically relates to the eating behaviors of pregnant women in Northwest Syria.
- **Nutritional Behaviors:** These are the actions or decisions related to food intake and nutrition. It includes aspects such as food selection, meal frequency, and adherence to certain dietary practices or guidelines (30).
- **Maternal Health Outcomes:** These are the results or consequences of various health-related factors on pregnant women. It includes a wide range of outcomes, from physical health (like gestational diabetes and hypertension) to mental well-being (31–33).
- **Northwest Syria:** This is the specific geographical area of focus in the study, a region significantly impacted by ongoing conflict, which has influenced the health and nutrition of its inhabitants, particularly pregnant women (3).

- **Conflict Zone:** Refers to an area affected by armed conflict (34). In this study, it highlights the unique challenges and conditions that impact dietary habits and health outcomes.
- **Biopsychosocial Model of Health:** A paradigm for understanding health and illness that integrates social, psychological, and biological aspects (35). The study adapts this model to explore how these factors influence dietary habits and mother health in conflict situations.
- **Nutritional Assessment:** The process of evaluating dietary intake and nutritional status, particularly focusing on identifying deficiencies or imbalances that might affect health outcomes.
- **Food Security:** This term relates to the food availability and accessibility (36). In the context of the study, it examines how conflict has impacted food supply and availability, influencing nutritional behaviors.
- **Public Health Nutrition:** A branch of public health that emphasizes preventing nutrition-related diseases in the general population and promoting healthy eating habits (37).
- **Antenatal Care (ANC):** is the treatment that expectant mothers undergo. One crucial intervention to raise the percentage of newborns in the medical facility is ANC (38).

2. LITERATURE REVIEW

2.1. Region Profile

2.1.1. Geographical and Historical Context

Northwest Syria has been significantly impacted by the ongoing conflict since 2011. This region has experienced intense military activities, leading to widespread destruction, including healthcare facilities, and a breakdown in societal structures (39). The conflict has not only caused direct harm but also disrupted essential services and supplies, critically affecting the living conditions of the residents (40). Nowadays, the country is consisted of three areas according to the power of control (Figure 2.1). Northwest Syria region refers to areas in the governorates of Idleb and Aleppo that are out of government control. This region is governed by multiple powers, including the Turkish-supported forces, the Syrian Interim Government and the Syrian Salvation Government (3).

The region has witnessed massive internal displacement and influx of refugees. These populations often live in camps or improvised shelters with limited access to basic needs, including nutritious food and health (41,42). This displacement adds layers of complexity to the study of dietary habits, as traditional eating patterns are likely disrupted, and access to food is constrained because the protracted conflict in Syria has severely disturbed food supply networks, which resulted in food scarcity and a lack of variety in available food items (43). This impacts the dietary habits of pregnant women, as they may have limited access to essential nutrients required for a healthy pregnancy (5). With the destruction and degradation of healthcare facilities, access to maternal healthcare services, including nutritional guidance, is significantly hindered. This affects the ability of pregnant women to receive proper prenatal care, including dietary advice and nutritional supplements if needed (44). Northwest Syria has its own unique cultural and social norms, including dietary practices (45).

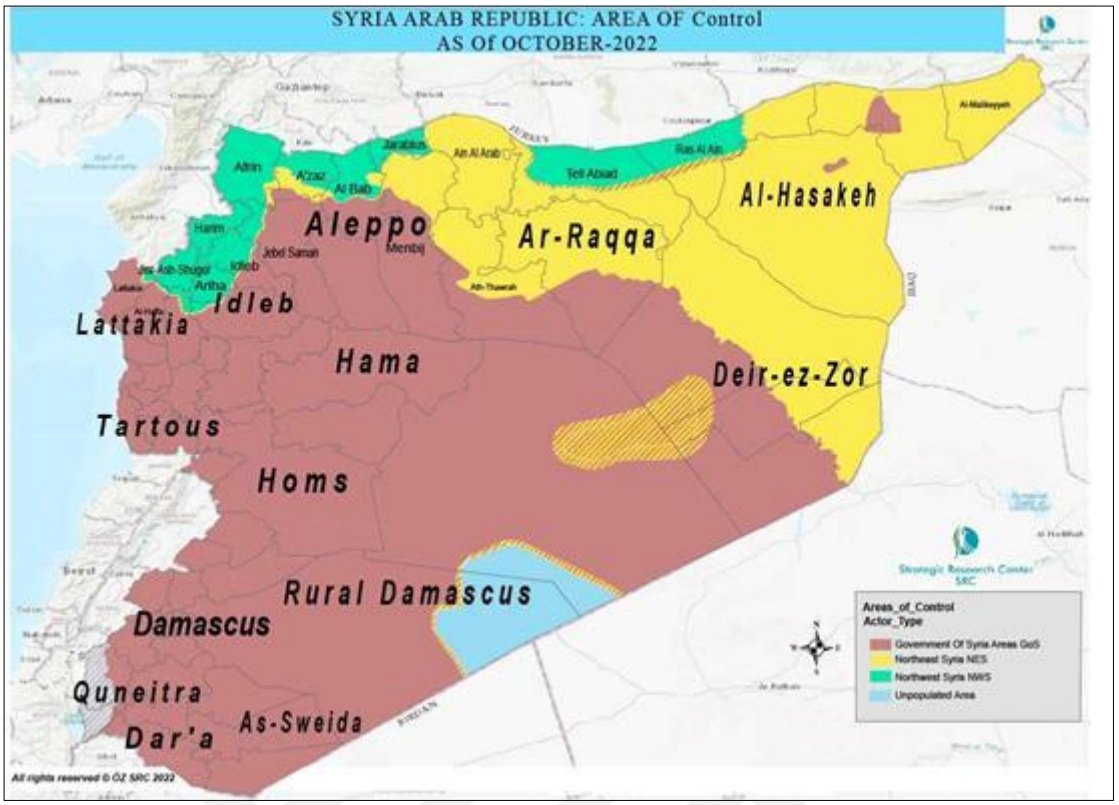


Figure 2.1. A map of Syria as of October 2022 with geological division of the country. The green color on the map refers to the region of Northwest Syria

2.1.2. Population

The total population of Syria as of 2023 was 23,227,013. There are about 4.5 million people living in northwest Syria, of whom 2.9 million are internally displaced, 3.3 million are food insecure, and 4.1 million require humanitarian aid, 80% of them are women and children. This population faces significant challenges exacerbated by the ongoing conflict, leading to widespread displacement and humanitarian needs (46,47).

Out of the total population in Northwest Syria, Tented settlements are home to over 1.4 million IDPs, while some people live in subpar shelters (48). The composition of people in Northwest Syria is Arab as a majority, Kurds, and some minorities of Yazidies in Idleb governorate (49). According to the latest United Nations estimates, between 2001 and 2010, the working-age population share, and the overall population grew at average annual rates of 0.8% and 2.5%, respectively. Forecasts released by the United Nations before the conflict (2011) anticipated that these rates would shift to 1.7% and 1.0% for 2011-2020, and then to 1.5% and 0.3% for 2021-2030, in contrast to the 2.5% and 0.5% observed over 2001-2010 (50). Syria experienced a decrease in the fertility rate between 2010 and 2020

from 3.5 to less than 3. This reduction is due to the ongoing war, displacement, lack of quality medical services, and poor socioeconomic status (18,51). The recent figures published by UNFPA about Syria showed that there were more than 4.2 million females of reproductive age. According to data released by CARE organization for the first quarter of 2023, the population of Northwest Syria included an estimated 925,000 women and adolescent females of reproductive age, encompassing approximately 148,000 who were pregnant.

Projections indicate that within every quarter of the year, approximately 37,000 of these women and girls are expected to give birth. Furthermore, it is anticipated that over 5,000 necessitate emergency obstetric care due to complications arising during childbirth (52).

The population pyramid of Syria for the year 2023 illustrates a youthful demographic structure with a broad base and a rapid narrowing toward the top. The broad base indicates a significant percentage of the populace is under the age of 15, suggesting high birth rates and potential for population growth in the coming few years. Additionally, the figures show a similar percentage of males and females in Syria (Figure 2.2).

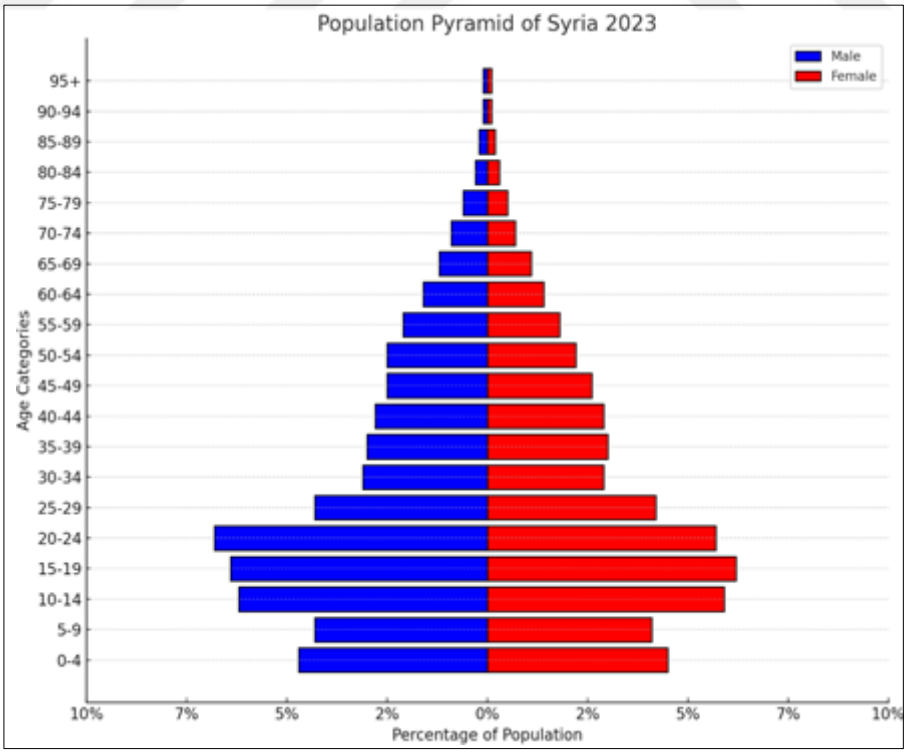


Figure 2.2. The population pyramid of Syria

2.1.3. Economy

Syria is currently a low-income country (53). The Syrian economy has faced substantial challenges in recent years, exacerbated by various domestic and international crises. Despite a reduction in large-scale armed conflicts, the country still experiences a high number of violent deaths. The war in Ukraine has significantly affected Syria's macroeconomic stability, as the nation imports nearly half of its oil and a third of its cereal consumption. These imports, coupled with rising global commodity prices, have strained fiscal and external accounts and driven inflation. Fiscal policies have tightened in response to the increased cost of essential goods, amplifying the vulnerability of Syrian households (HHs). As a result, there has been a notable increase in labor force participation among marginalized groups, including women, youth, and the elderly.

Syria's real GDP is expected to contract by 3.2% in 2023 after a 3.5% decline in 2022. Contributing factors include ongoing conflict, high input costs, water scarcity affecting agriculture, fuel shortages, and disrupted transportation and services. Although inflation is expected to decrease, it is expected to remain elevated due to exchange rate fluctuations, persistent shortages, and subsidy reductions. The economic outlook is fraught with risks, primarily from potential climate shocks that could devastate crops and livelihoods, as well as the possibility of increased commodity prices due to prolonged conflict in Ukraine. Additionally, the country's inadequate healthcare infrastructure poses a risk in the face of contagious diseases.

The World Bank, in collaboration with the EU, conducted a Damage Assessment of selected Syrian cities, revealing that the ongoing conflict has resulted in damages ranging from $8.7 to $11.4 billion across 14 cities and 11 sectors as of January 2022. This evaluation highlights the significant influence on the conflict on Syria's population, infrastructure, and service quality (54).

2.1.4. Education

The educational landscape in Syria has faced significant challenges due to the ongoing conflict. As of 2015, literacy rates stood at 86.4% in total, with a male literacy rate of 91.7% and a female literacy rate of 81%. Education in Syria is compulsory and free at the primary level, while secondary and higher education are available for a symbolic fee.

Despite these provisions, the Syrian Civil War has had a devastating impact on education, with more than 2.1 million children and youth forced out of school and an additional 3.3 million in need of educational assistance.

Enrollment rates in 2007 indicated a gender disparity, with a gender parity index of 0.955, signifying that the enrollment of females was lower than males. Moreover, vocational education at the secondary level accounted for a substantial proportion of students, with 36% of secondary school students in vocational schools in 2004.

The Ministry of Higher Education supervises educational institutions, and while most post-secondary education is state-provided, private universities and colleges have been established since 2001. Despite efforts to expand educational resources, matching the pace of population growth remains challenging (55).

2.1.5. Gender Equality and Women's Empowerment

In Northwest Syria, gender equality and women's empowerment face unique challenges exacerbated by the impact of the 2023 earthquake, which has disproportionately affected vulnerable populations, including children and women.

Gender equality and women's empowerment in Northwest Syria, particularly in relation to pregnancy and nutrition, is a critical area of concern. In conflict areas like Northwest Syria, women and girls often face heightened vulnerabilities, and these challenges are exacerbated during pregnancy. Access to adequate nutrition, healthcare, and education is limited, which is detrimental to maternal and fetal health outcomes. Efforts to empower women in these settings often focus on improving their access to quality health services, including prenatal and postnatal care, and ensuring food security for pregnant and lactating women (56).

2.2. Healthcare System in Northwest Syria

The healthcare system and services in Northwest Syria have evolved significantly, especially in response to the complex emergency situation arising from the protracted conflict. With over 4.1 million people in need of humanitarian assistance, WHO developed an Essential Health Services Package (EHSP) to establish a common standard of care

delivery and coordination among multiple providers. The WHO Gaziantep Field Presence has been instrumental in delivering healthcare, medicine, and medical supplies, through local NGOs since a UN resolution in 2014.

However, delivering healthcare in such an environment faces unique challenges, including difficulties in staff retention, medicine importation, and governance issues. The involvement of NGOs and humanitarian agencies has been crucial in maintaining access to health services, but coordination and sustainability remain persistent challenges (57).

The maternal healthcare system and services in Northwest Syria have faced significant setbacks due to the protracted conflict, which has disrupted the health system and reversed progress in maternal health. A recent study utilizing data from maternal health facilities in Northwest Syria highlighted several key issues in the region's maternal health services. For example, the conflict has impacted maternal mortality rates and the prevalence of morbidities associated with pregnancy and childbirth. Additionally, there has been a notable variation in cesarean section rates, which ranged from 16% to 64% of all births, with a decrease observed in healthcare facilities from 35% in March 2017 to 23% in July 2020. Underage pregnancy was significant, with girls under 18 accounting for 10% of births and generally having a lower proportion of cesarean sections. Moreover, the conflict has affected the availability and quality of perinatal care, which is crucial for both maternal and neonatal health (58).

2.2.1. Levels of healthcare in Northwest Syria

In Northwest Syria, the levels of healthcare functionality are assessed in three categories (59):

1- Fully Functioning: This includes health facilities that are open and providing a full package of essential services.
2- Partially Functioning: These are facilities that are open but are not providing the full package of essential services.
3- Not Functioning: These facilities are not operational at all.

According to the health cluster of WHO in Gaziantep, out of 554 assessed health facilities, 58% (346) were reported as fully functioning, and 12% (75) were partially functioning during the first half of 2023.

According to the same source, the types of health facilities in Northwest Syria include (59):

- Hospitals (general and specialized hospitals such as maternity hospitals): These constitute about 16.2% of the health facilities.
- Fixed Primary Health Care Centers (PHCs): These make up about 42.0% of the health facilities.
- Mobile Clinics: These are about 19.5% of the health facilities.
- Specialized Care Centers: These centers, accounting for about 9.5% of the health facilities, provide one specific health service, such as physical rehabilitation, leishmaniosis treatment, nutrition, dialysis, etc.
- Other Health Facilities: This category, constituting about 12.8%, includes facilities like ambulance networks, blood banks, central labs, and isolation centers.

2.2.2. Maternity Healthcare Services in Northwest Syria

In a study conducted in Northwestern Syria focusing on maternity and pregnant healthcare services, a total of 7,213 patients were included, with 11,284 visits recorded throughout the study period. Notably, 4,936 of these patients were pregnant, making up a significant 68.43% of the total patient count. However, the antenatal care attendance among these women was alarmingly low, 39% of women who gave birth between October and December 2017 (283 out of 730) did not receive any prenatal care. Only 4% met the WHO's ideal antenatal care (ANC) visit recommendation, and 14% met the focused antenatal care criteria. When it came to delivery methods, the study documented 2,057 deliveries, with 70% being vaginal and 30% requiring cesarean sections. The cesarean delivery specifics were also concerning, as 0.3% of these cases required hysterectomy to control bleeding, and the majority were conducted under spinal anesthesia. The study further recorded 216 cases of miscarriage, which is about 3% of all patient population, with a majority occurring among women living in refugee camps. These figures highlight the significant challenges and critical needs within maternity and pregnant healthcare services in the region, pointing towards an urgent need for improved access and quality of care for expecting mothers and newborns in Northwestern Syria (60).

The health facilities in Northwest Syria provide various types of Maternal and Newborn Health services. These include (59):

- Antenatal care includes evaluating emergency plans, pregnancy, and delivery; responding to issues that are noticed or reported; offering advice and counseling on family planning, nutrition, nursing, and self-care; and administering preventive therapies when necessary.
- Basic newborn resuscitation, eye prophylaxis, clean cord care, early and exclusive breastfeeding, and warmth (the Kangaroo Mother Care, or KMC) are all included in newborn care.
- Parenteral antibiotics, oxytocic/anticonvulsant medications, manual placenta removal, manual vacuum aspiration (MVA) for retained products, and round-the-clock assisted vaginal delivery are all included in Basic Emergency Obstetric Care (BEmOC).
- All BEmOC services are included in Comprehensive Emergency Obstetric Care (CEmOC), which also covers anesthesia, surgery, and blood transfusions.
- Safe induced abortion, uterine evacuation by medical or MVA means, antibiotic prophylaxis, management of abortion complications, and abortion counseling are all included in comprehensive abortion care, and comprehensive post-abortion care.

2.2.3. Nutrition Services for Pregnant and Lactating Women in Northwest Syria

In Northwest Syria, nutrition services for vulnerable populations, including pregnant and lactating women, are centered around several key programs and interventions. These include the Community-based Management of Acute Malnutrition (CMAM) and Infant and Young Child Feeding (IYCF) programs, which focus on screening, treatment, referral, and follow-up for malnourished individuals. Specifically, they distribute micronutrients to prevent anemia and malnutrition, promote healthy eating habits and keep an eye on the use and distribution of breast milk alternatives, and integrate nutrition supplementation with routine child and antenatal services. Additionally, these interventions are integrated with health, Water, Sanitation, and Hygiene (WASH), and child protection services, including screening and referral for medical cases, hygiene promotion, raising WASH awareness, and identifying visual signs of abuse or violence during nutrition screenings (61,62).

According to UNICEF, as of December 2022, 12.4% of pregnant and breastfeeding women in northwest Syria were malnourished. There is a higher chance of fatalities from

extreme winter weather in places where hunger is common, and children are particularly at danger (63).

2.3. Theoretical Framework

The study employs an adapted Biopsychosocial Model of Health tailored to address the unique challenges and complexities of health outcomes (in this case, maternal health outcomes) (Figure 2.3) (64) in the conflict-affected and emergency region of Northwest Syria. This model recognizes that maternal health is influenced by a dynamic interplay of biological (e.g., nutritional status, physical health), psychological (e.g., stress levels, mental health), and social factors (e.g., cultural dietary habits, socioeconomic status), each of which is profoundly impacted by the backdrop of conflict and emergency conditions (20). In our study, we considered this approach compound with other concepts related to conflict and emergency settings to tailor our methodology and results to the situation of Northwest Syria. Our research relies on specific key theoretical points besides the biopsychosocial model of health, which are the maternal outcomes due to the impact of conflicts or disasters on nutrition and dietary habits among pregnant women.

2.3.1. The Integrative Biopsychosocial Approach to Health in Conflict Zones

The biopsychosocial approach to healthcare is a comprehensive model that highlights how biological, psychological, and social aspects are integrated to understand health and illness (65). Originating from George Engel's landmark paper in 1977, this approach challenges the reductionist view of illness, advocating for a holistic understanding of patient health (66).

Current implementations of the biopsychosocial approach encompass various themes, including its conceptualization and practical adaptations, its use in addressing health issues beyond traditional biomedical boundaries, the role of inter professional teamwork, and educational innovations related to the approach. This approach has been particularly relevant in addressing complex health challenges, such as those faced in conflict zones, where traditional healthcare boundaries are often insufficient. For instance, the biopsychosocial approach has been used to address the health needs of women are impacted by intimate partner abuse in rural China, and to examine relationships between traditional practices and postpartum depression (67).

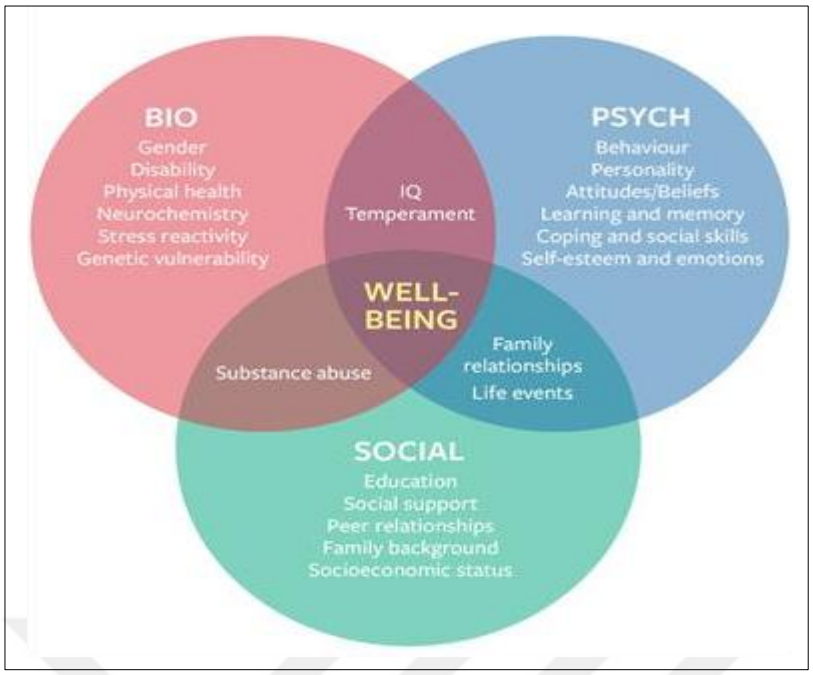


Figure 2.3. An illustration of the biopsychosocial model comprised of biological, psychological, and sociological influences

A recent study that was conducted in Ethiopia utilized a trauma and socio-culturally-informed phenomenological approach, considering the complex interaction between psychological trauma and sociocultural factors. The research concluded the importance of understanding the context in which these traumatic events occur, including the broader societal and cultural backdrop, thus aligning with the social component of the biopsychosocial model. The study's findings draw on interviews with survivors, offering insights into their psychological, emotional, and social experiences and the impacts of these traumatic events. This research underscores the importance of a comprehensive understanding of health that includes biological, psychological, and social factors, particularly in the context of conflict and trauma (68).

Another research study presented a theoretical framework integrating developmental science approaches to understand trauma in refugee situations as a multi-systemic and multilevel phenomenon. This model emphasizes the importance of considering the person-age-context fit, acknowledging how both trauma and ongoing major disruptions to daily life affect outcomes. The study aims to expand understanding for future trauma research and interventions, focusing on the varied impacts of traumatic events and severe disruptions to social ecology across different life stages. This research aligns with the biopsychosocial approach by acknowledging the complex interplay of individual, social, and environmental factors in the health and well-being of refugees. It underscores the need for a comprehensive understanding of trauma that goes

beyond traditional medical models, integrating psychological and social dimensions, especially in the context of displacement and conflict (69). A recent research targeted refugees in Indonesia focused on evaluating the biopsychosocial aspects of refugee women living in a state of limbo in Indonesia. This study, through qualitative methods including in-depth interviews, observation, and literature reviews, examined the biological, psychological, and social conditions of these women. It found that the biopsychosocial needs of these women are not adequately met during conflict settings, which adversely impacts their social functioning in the region (70). The COVID-19 pandemic highlighted the importance of the biopsychosocial approach, emphasizing the effects of isolation and social support in navigating health systems and disease management (71).

In fact, specific studies directly addressing the application of the biopsychosocial approach in conflict zones are not readily available in the current search results. This may indicate a gap in literature or the need for more targeted research in this specific area.

2.3.1.1. The Biological Impact of Conflict on Maternal Health

In conflict zones, the biological aspects of maternal health are deeply influenced by a variety of factors. These factors not only include direct impacts of the conflict, such as violence and displacement, but also encompass indirect consequences like disruptions in healthcare systems and food supply chains. The interaction of these factors contributes to a complex health landscape for pregnant women in these regions.

One key biological factor affecting pregnant women in conflict zones is the challenge in early identification of high-risk pregnancies, especially where advanced medical facilities like sonography are unavailable. A study on the effectiveness of symphysis-fundal height (SFH) in identifying high-risk pregnancies was carried out in Colombia during a conflict. Higher hemoglobin levels and using iron supplements were linked to higher SFH Z-scores, but a history of displacement was linked to lower SFH Z-scores. The study validates the use of SFH for pregnancy evaluation in conflict settings by showing that it was linked to both the history of displacement and biological parameters known to impact maternal/fetal health (72). Additionally, women in 37 fragile and conflict-affected settings (FCAS) around the world frequently encounter obstacles when trying to get sexual and reproductive services, including ANC, according to a systematic study of ANC utilization in these situations. According to this research, a large percentage of pregnant women in FCAS do not have the necessary number of ANC visits and

schedule their first ANC visit late in their pregnancy. Demographic factors that are directly related to the biological consequences of pregnancy, such as education, marital status, and socioeconomic level, can have an impact on the use of ANC. For instance, it was less likely for women with lower educational attainment to receive the necessary number of ANC visits, which can have direct implications on maternal and fetal health (73). In a broader context, a study assessing the correlation between armed conflict and mother and child health globally found that conflicts, particularly wars, have substantial and persistent effects on maternal and child mortality. The study, which included data from 181 countries over the period 2000–2019, observed an increase in maternal mortality and a decrease in key health measures such as vaccination coverage in conflict-affected regions. These outcomes highlight the biological impact of conflict, emphasizing how political instability, health system destabilization, and negative socioeconomic and environmental conditions contribute to the worsening of maternal and child health in these settings (74).

In general, these studies collectively illustrate the intricate web of biological factors influencing maternal health in conflict zones. From the challenges in prenatal care and the impact of displacement to the broader consequences of healthcare system disruptions, the biological aspect of health in these settings is complex and multifaceted, requiring a comprehensive and nuanced understanding to effectively address the unique needs of pregnant women in conflict-affected regions.

2.3.1.2. The Psychological Impact of Conflict on Maternal Health

The psychological impact of conflict on pregnant women is a critical area of concern (75,76). Several studies show that the perinatal period, it is characterized by notable physiological and social changes and lasts from pregnancy to 12 months following childbirth (77–79). These can have a detrimental effect on pregnant women's mental health, particularly in areas of conflict (80). The psychological impact of conflict on dietary habits among pregnant women is a multifaceted issue that intertwines with the physical and social environments. The review of existing literature reveals a notable gap in research regarding the psychological impact of conflicts on the dietary habits of pregnant women. Despite extensive searches, no studies were found that specifically address this aspect, highlighting a significant area for future research and investigation within the field. Therefore, we highlighted some evidence of how conflict affects the nutritional status and health outcomes of pregnant women.

A study highlighted psychological predictors of dietary change intentions among pregnant women. It found that pregnant women were more likely to plan to cut back on their diet of foods high in fat and sugar if they reported consuming excessive amounts of these foods already. Intentions to eat more fruits and vegetables were increased when benefits for the mother and child were perceived. However, the study did not show significant effects from perceived threats, barriers, or subjective norms, suggesting that pregnant women may understand the risks of unhealthy eating and perceive social approval for healthy dietary changes (81). A review of the literature identified that women, especially in Low- and Middle-Income Countries (LMICs), face high rates of acute malnutrition during armed conflicts. This review conceptualized various drivers of malnutrition and emphasized the need for future research to examine specific drivers affecting pregnant and breastfeeding women (82). A comprehensive study using data from 181 countries assessed the link between mother and child health and war. It found that armed conflicts, especially wars, are linked to significant increases in newborn and mother mortality, and a decrease in vaccination coverage. This indicates an indirect health impact of conflict due to the deterioration of health systems and worsening socioeconomic conditions (74).

These findings suggest that conflict has a profound impact on the dietary habits and nutritional status of pregnant women, primarily due to its effects on food availability, health systems, and overall living conditions. The psychological aspects, while not directly addressed in these studies, can be inferred to be significantly affected, as the stress and trauma of conflict can influence dietary choices and health behaviors. More research focusing explicitly on the psychological impact of conflict on the dietary habits of pregnant women would be beneficial to understand this aspect thoroughly. In this study we did not explore the relationship between the psychological impact of the crisis on nutritional behaviors and pregnancy outcomes due to the lack of psychological services in the region.

2.3.1.3. Socioeconomic Factors and Dietary Habits Among Pregnant Women

One of the most important areas of research in mother and child health is how socioeconomic variables affect pregnant women's eating habits. Numerous studies examined the connection between socioeconomic characteristics and food trends. In Brazil, a cross-sectional study found three eating habits in expectant mothers: 1). The western pattern, which includes processed cold meat, soft drinks or artificial juice, candy, milk, and dairy items,2). The healthy pattern, which refers to high weekly consumption rates of raw

vegetables, cooked vegetables, and fresh fruits; and 3). Traditional pattern that mainly includes beans and meat. This study found that older pregnant women (30 years or older) and those engaging in moderate/intense physical activity were more likely to adhere to the "healthy" dietary pattern. In contrast, adolescents and smokers were more inclined towards the "traditional" pattern. These findings indicate that age, smoking status, and physical activity are significant predictors of dietary habits during pregnancy (83).

Another study in São Paulo, Brazil, examined the relationship between several sociodemographic characteristics and the food habits of women prior to pregnancy. "Lentils, whole grains, and soups," "Snacks, sandwiches, sweets, and soft drinks," "Seasoned vegetables and lean meats," and "Sweetened juices, bread and butter, rice and beans" are the four different dietary patterns that the study found. According to the study, these trends were associated with mother age, educational attainment, employment position, birthplace, nutritional status, and a family history of hypertension. Particularly, higher maternal education was positively related to healthier dietary patterns, highlighting the role of education in influencing dietary choices (84). Although we could not find a specific study focusing solely on the impact of socioeconomic status on pregnant women's dietary habits, the aforementioned studies suggest that socioeconomic factors like education, employment status, and age play a crucial role in shaping dietary patterns. These factors indirectly indicate the level of access to resources, health literacy, and health-related choices, which significantly influence dietary habits during pregnancy.

The impact of conflict, war, or disaster settings on the socioeconomic factors and dietary habits of pregnant women is a multifaceted issue that has been explored in various research studies. These studies demonstrate how armed conflicts and other adverse situations significantly affect"0t0 maternal and child health, including dietary habits and outcomes for pregnant women.

A comprehensive study analyzed data from 181 countries between 2000–2019 to assess the association between armed conflict and maternal and child health. It found that conflicts, particularly wars, were associated with increased maternal mortality, infant mortality, and reduced vaccination coverage. Wars were linked with an increase in maternal mortality by 36.9 per 100,000 live births and a decrease in DPT and measles vaccination coverage by 4.9% and 7.3%, respectively. The study emphasizes the substantial and enduring impact of armed conflict on maternal and child health, highlighting the importance of protecting women and children from indirect harms, including health system deterioration and worsening socioeconomic conditions (74). A case study conducted in Colombia investigated the relationship between

displacement, food insecurity, stress, and maternal-fetal health in a conflict zone. It found that a history of displacement was associated with lower symphysis-fundal height Z-scores, indicating high-risk pregnancies. The study also observed that food insecurity, stress indicators, and lack of family support were significantly associated with maternal-fetal outcomes. This research underscores the complex interplay of biopsychosocial stressors on pregnant women in conflict zones and the need for systematic stress assessment (72). Pregnant women in a rural health zone in the Democratic Republic of the Congo participated in a qualitative study that examined their dietary behaviors, knowledge, and attitudes. According to the study, pregnant women lacked technical understanding about nutrients and nutrition sources, but they did have high general knowledge about the need for more and different diets. Their eating habits were greatly impacted by several factors, including poverty, limited access to a wide range of foods, food taboos, and customs. This study emphasizes the necessity of all-encompassing strategies to enhance nutrition and address cultural norms, food insecurity, and the general health outcomes of mothers and children in these environments (85).

Collectively, these studies illustrate the profound and complex impact that conflict and disaster settings can have on the socioeconomic factors and dietary habits of pregnant women. They emphasize the need for targeted interventions to address these challenges and improve maternal and fetal health outcomes in such environments. In conclusion, socioeconomic factors such as age, education, employment status, and lifestyle behaviors (like physical activity and smoking) significantly influence the dietary habits of pregnant women. These factors affect not only the quality of dietary intake but also the adherence to healthier or less healthy dietary patterns. Understanding these associations is vital for developing targeted nutritional interventions and public health strategies aimed at improving the dietary habits and overall health of pregnant women.

2.3.2. Nutrition and Pregnancy in Conflict Zones

The concept of nutrition in conflict zones is a central aspect of this study. Nutrition is a crucial element of maternal and fetal health, particularly during pregnancy (86). In conflict zones, the challenges of sustaining a balanced diet are exacerbated by food shortages, disrupted supply chains, and restricted access to varied food groups (87,88). Such conditions contribute to an increased prevalence of nutritional deficiencies among pregnant women, adversely impacting their health and that of their fetuses (89). Nutrition in these zones is a significant public health

issue, often marked by widespread malnutrition (90). The conflict adversely affects local economies, agricultural activities, and the availability of safe food and essential services. Consequently, in conflict-affected areas, disrupted supply chains and diminished resource accessibility lead to prevalent nutritional deficiencies, impacting whole communities and disproportionately affecting vulnerable populations, notably pregnant women and children (91–94).

Research by Collins (2001) emphasizes the need to change our approach to addressing severe malnutrition during famines and emergencies. Traditional methods of nutrition rehabilitation and food aid, while vital for short-term survival, fail to provide sustainable solutions. Instead, a more nuanced approach is required, one that acknowledges the complex interplay of various factors contributing to malnutrition in these contexts (95).

Salama et al. (2004) discuss lessons learned from complex emergencies over the past decade, highlighting the importance of understanding the dynamic nature of these crises and their impact on public nutrition. Their research underscores the need for adaptive and responsive strategies to meet the evolving nutritional needs of populations affected by conflict (96).

Young et al. (2004) further expand on this topic by discussing public nutrition in complex emergencies. Their work stresses the importance of integrating nutrition interventions with broader humanitarian efforts, emphasizing the need for a comprehensive approach that addresses both immediate and long-term nutritional needs in conflict zones (97).

Overall, these studies underline the critical need for integrated, context-specific strategies to address the nutritional challenges in conflict-affected areas. Such strategies should not only focus on immediate relief but also consider the long-term rehabilitation and resilience building of affected communities. Our study seeks to explore how the conflict in Northwest Syria has specifically altered the availability and consumption of nutritious food, and how these changes impact maternal health.

2.3.3. Maternal Health Outcomes in Conflict Zones

Maternal health outcomes refer to the physical and psychological well-being of women during pregnancy, childbirth, and the postnatal period (98). This concept is particularly complex in conflict settings where healthcare systems are often compromised, and access to prenatal and postnatal care can be severely limited (99,100). The research on maternal health outcomes in

conflict zones reveals a complex interplay of factors contributing to adverse health consequences for pregnant women and their newborns. The findings from various studies offer insights into how these outcomes are influenced by the unique challenges present in such environments. A study in Colombia conducted between 1998 and 2016 showed that maternal mortality ratios were higher in municipalities with greater victimization due to armed conflict. Additionally, the percentage of cesarean births and women receiving four or more ANC visits was lower in areas with high levels of victimization. Fertility rates among young women aged 15-19 were also higher in these areas. The study emphasized the scarcity of interventions because of instability, shortage of materials and human resources, and challenges with geographic access. Health programs were mainly provided by the national government, although there were issues with their continuity and quality. In order to reach isolated regions impacted by fierce armed conflict, UN agencies and NGOs were essential (101).

Armed conflict has been linked to poor maternal and reproductive health outcomes and limited access to services, according to a descriptive qualitative study conducted in Burundi and Northern Uganda. These issues were caused by a variety of conflict-related mechanisms, such as attacks on medical institutions, medical looting, targeted killings of medical staff, and provider abductions. Conflict had a profound impact on maternal and reproductive outcomes, leading to high rates of prostitution, adolescent pregnancy, clandestine abortions, high fertility, high rates of HIV/AIDS and sexual gender-based violence, and increased maternal and newborn morbidity and mortality. The study found that moving to displaced people's government-approved camps enhanced their access to medical care. This study highlights the significant and diverse impacts of armed conflict on maternal and reproductive health outcomes and services, which calls for specialized treatments (100).

This study examines various aspects of maternal health, including the incidence of pregnancy-related complications (such as gestational diabetes, hypertension, and preeclampsia), the prevalence of nutritional deficiencies (like anemia), and the general physical health of pregnant women in Northwest Syria.

2.3.4. Adaptation of Pregnant Women During Conflicts and Disasters

According to the available literature, resilience and adaptation in pregnant women living in conflict zones is a complex topic, encompassing various psychological and social factors. According to Alves et al. (2023), resilience during pregnancy reflects coping with pregnancy-

specific stress and includes physiological adaptations and factors from the socioeconomic context, like low income, domestic violence, and lack of support. This characteristic is dynamic and context-specific, and its association with perceived stress and social vulnerability is crucial yet not fully understood (102). Resilience and adaptation in conflict zones, especially concerning pregnant women, is an area of significant interest and importance. This topic intertwines multiple research variables, including psychological resilience, physical health, dietary habits, access to healthcare, and socioeconomic factors. In conflict zones, the capacity to adapt and maintain resilience is crucial for pregnant women, as they face unique challenges that can significantly impact both their well-being and that of their unborn children (103).

Pregnant women in conflict zones often experience heightened levels of stress, anxiety, and trauma. Research has shown that these psychological impacts can adversely affect maternal health outcomes, including risks of preterm birth and low birth weight (104). The ability to develop effective coping mechanisms is vital for psychological resilience. A study by Thabet et al. (2009) in Palestine showed that pregnant women utilized coping strategies like seeking social support and maintaining hope, which positively influenced their mental health (105).

A study in Colombia examined maternal and child health indicators and interventions in conflict-affected areas from 1998 to 2016. This mixed-method study found that maternal and child health indicators improved post-conflict, but significant disparities remained in highly victimized municipalities. Maternal mortality was higher, and the rate of cesarean births and ANC visits was lower in areas with higher victimization rates. The conflict affected access to healthcare due to lack of resources, geographical challenges, and insecurity. Conflict in these regions led to interrupted prenatal care services, late detection of complications, and difficulties in accessing sexual and reproductive health services. There was an increase in teenage pregnancies, sexually transmitted infections, and gender violence. The qualitative component of the study highlighted contextual factors like education levels, geographical barriers, and cultural factors impacting access to health services. Interventions and programs were provided both by the government and non-governmental organizations, focusing on mental health, gender-based violence, and contraceptive methods (101).

Pregnancy is a period where adaptation and resilience can be promoted in mothers and infants. This involves understanding how maternal and environmental signals during pregnancy program the fetus for postnatal conditions. For instance, prenatal maternal stress can

signal the fetus about the postnatal environment, which may have adaptive benefits for survival. However, these adaptations might also lead to long-term costs. Prenatal adaptations made by the offspring, like elevated placental Corticotrophin-Releasing Hormone (CRH), can impact postnatal growth and behavioral regulation. These adaptations may be beneficial in the short term but can increase the risk for subsequent mental health problems. Positive childhood experiences and existing social support throughout pregnancy are examples of protective and promoter factors that are linked to improved prenatal mental health and child outcomes. Pregnancy outcomes and maternal mental health are positively correlated with high-quality social support (106).

Three key themes emerged from a comprehensive assessment of qualitative research involving women from conflict-affected areas: altered living circumstances, health-related outcomes, and resilience-boosting tools and tactics. Women had to deal with issues such decreased safety, pregnancy risks, abuse, and inadequate access to healthcare. They showed tenacity and perseverance in the face of adversity, drawing strength from their own inner strength and societal support. The study highlights the value of peer support and other forms of social support as possible interventions (107).

Collectively, these studies illustrate the multifaceted nature of resilience and adaptation among pregnant women in conflict zones. They underscore the importance of considering both the immediate and long-term impacts of conflict on maternal and child health, and the critical role of social support and tailored interventions in promoting resilience and positive health outcomes.

Collectively, these studies illustrate the multifaceted nature of resilience and adaptation among pregnant women in conflict zones. They underscore the importance of considering both the immediate and long-term impacts of conflict on maternal and child health, and the critical role of social support and tailored interventions in promoting resilience and positive health outcomes.

Understanding and supporting these resilience mechanisms are crucial for developing effective health interventions and policies aimed at improving maternal and neonatal health outcomes in conflict-affected areas.

The theoretical framework of this research is illustrated in Figure 2.4.

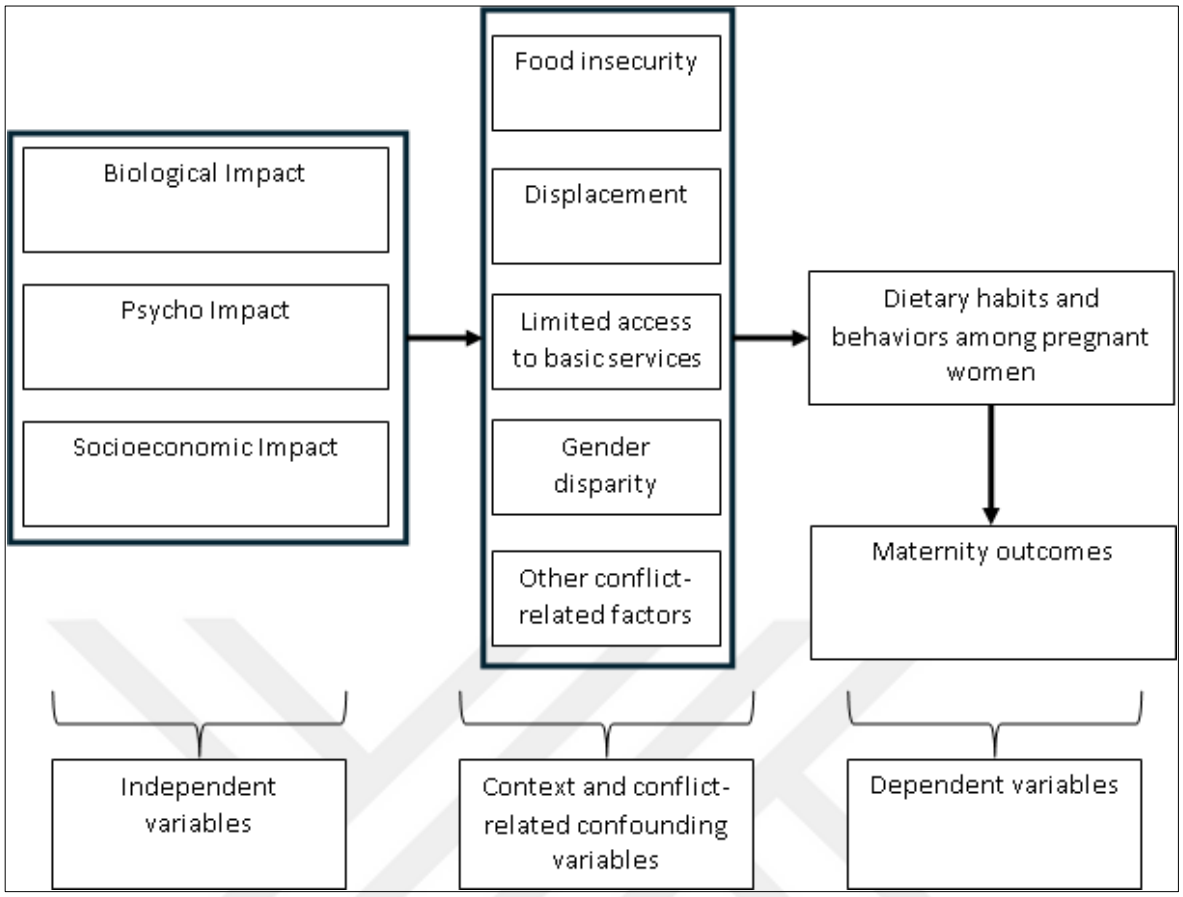


Figure 2.4. Theoretical framework of the research illustrates the Biopsychosocial Approach confounded by context and conflict-related factors impacting the dietary behaviors of pregnant women in Northwest Syria, and consequently the maternity outcomes

2.4. Existing Policies Related to Nutrition and Food Security in Crisis

The research and implementation of nutrition and food security policies in conflict areas, along with the associated ethical considerations, are complex and multifaceted issues. Conflict directly affects food security by reducing the availability of production inputs and income, increasing reliance on less preferred foods, and limiting dietary diversity. The situation in the West Bank and Gaza Strip exemplifies how different conflict-related factors, like political violence or restrictions on movement, can variably impact agricultural hardship, economic hardship, and dietary diversity (108). A comprehensive understanding of food insecurity in conflict settings requires analyzing how political, economic, and agricultural factors interplay. For instance, in the occupied Palestinian territory, the study found that different geopolitical enclaves faced varying levels of deprivation and conflict, impacting food security differently (108–111).

Ethical considerations in disaster and humanitarian research encompass a broad range of issues, including the dynamics of unequal relationships in research settings, the well-being of both participants and researchers, and the application of western methodologies and theoretical frameworks. In these contexts, it is crucial to engage in ongoing reflection and to adopt flexible research processes to uphold ethical standards. Research conducted in disaster-stricken areas necessitates a heightened awareness of safety and security risks, aspects that are frequently underemphasized in conventional ethical protocols (112–114). Furthermore, ethical concerns extend to the methodologies employed for data collection. This is particularly relevant in remote research situations where traditional face-to-face interaction may not be viable. The conduct of research can profoundly affect the lives and sustenance of individuals in conflict-impacted regions, with the potential to intensify their hardship. Therefore, an ethical approach to research demands a conscious recognition and addressing of power imbalances and the colonial underpinnings of humanitarian and disaster management. This approach must be dynamic, involving constant reflection and adjustment, especially given the unpredictable nature of disaster or conflict environments (114).

The integration of ethical considerations in the development and implementation of nutrition-related public health interventions is frequently limited, often leading to challenges both during and post-implementation. The ethical dimensions of such interventions are complex and highly context-specific, necessitating a nuanced understanding of the environments in which they are deployed. Consequently, there is a growing advocacy for the development of comprehensive ethical frameworks in public health interventions. These frameworks ought to encompass fundamental principles, including the promotion of benefits, prevention of harm, respect for individual autonomy, and the safeguarding of vulnerable populations (37).

2.5. Minimum Dietary Diversity for Women

Women of reproductive age (WRA) are often nutritionally vulnerable due to the physiological demands of pregnancy and lactation, which elevate their nutrient requirements beyond those of adult men (115). Inadequate micronutrient intake before and during these stages can adversely affect both the women and the development of their infants, particularly during the critical first 100 days of life (116). In many low-resource settings, WRA frequently

consume monotonous diets dominated by starchy staples, lacking in essential micronutrients (117,118).

For decades, there have been calls to improve women's nutrition and dietary quality, as well as recognition of these nutritional vulnerabilities and micronutrient shortages. A variety of dietary promotion initiatives have been developed because of the multifaceted notion of diet quality, which aims to enhance micronutrient nutrition for WRA and promote sustainable and healthful diets. Consuming a range of food groups and making nutrient-dense foods more widely available and accessible are still universally safe and advised practices, even in the face of other nutrition reform initiatives (119).

The lack of efficient policies and initiatives that promote improved access, quality, and availability of nutrient-dense food is a major obstacle to improving the dietary quality of women in LMICs. More high-quality, reliable, and valid data must be made available and accessible to establish evidence-based policies and customize priorities and activities for WRA. Though they provide useful information about nutrient adequacy for both individuals and populations, quantitative dietary assessment techniques like weighed food records (WFR), food diaries, or open 24-hour quantitative recalls are resource-intensive, requiring trained enumerators and a significant amount of time for preparation and data collection (120). Consequently, LMICs often lack the resources or capacity to regularly employ these methods for national-scale progress tracking (119).

Different dietary diversity scores (DDS) have been proposed, although some are difficult to calculate and gather. Therefore, especially in policy and programs contexts, straightforward yet powerful indicators are essential for assessment, advocacy, and accountability. Additionally, in the context of tracking advancement toward the Sustainable Development Goals (SDGs) pertaining to nutrition, especially SDG 2 (119), there is a noticeable deficit in easily collectible, food-based indicators that specifically address diet quality and target vulnerable populations (121). Incorporating the MDD-W as a food-based indicator to monitor WRA's dietary diversity could bridge this gap and contribute significantly to the fulfillment of SDG 3 and SDG 5 (119).

To address this need, a study using nine dietary consumption datasets from Asia and Africa was conducted. The MDD-W indicator was developed by Martin-Prevail et al. The only standardized dietary variety indicator specifically designed for women of reproductive age

(WRA) is this dichotomous indicator, which is based on a framework of ten food groups. For this population, the MDD-W can be used in a variety of settings and for a range of objectives (118,122).

The MDD-W indicator has a wide range of possible uses, so the data collection process must be straightforward and well chosen. List-based and open recall are two non-quantitative techniques that have been shown to be the most practical and successful for collecting MDD-W data in a low-cost, low-burden manner. Although quantitative dietary data can be utilized to calculate the MDD-W, this method is usually not feasible for the previously stated reasons and is only employed in research-focused studies (119).

Since its launch, the MDD-W indicator has been used more and more for a variety of objectives by organizations such as the Demographic and Health Surveys (DHS) Program, the European Union, GIZ, and United Nations agencies. The technical and operational difficulties with list-based and open-recall approaches have been highlighted by this expansion. Through lobbying campaigns, capacity building workshops, and user surveys, the Food and Agriculture Organization (FAO) has been actively compiling issues. The time has come for these insights to be systematically disseminated (119).

The FAO and its partners carried out studies in three nations in 2020 to evaluate the operationalization and effectiveness of these two approaches in comparison to a reference technique. These results advance a more comprehensive understanding of the best techniques for gathering, analyzing, and presenting data. This study emphasizes the need for harmonized guidance, such as new findings and recommendations on dietary diversity data collection for large-scale surveys, such as those for DHS, the Global Diet Quality Project (GDQP), and the upcoming updated Infant and Young Child Feeding (IYCF) technical guide. The availability of comparable data will be improved by such standardization across different organizations and projects involved in routine, extensive data collection, highlighting its importance in tracking the advancement of Sustainable Development Goal 2 and taking into account the addition of new indicators in the future (123,124).

Additionally, traditional paper-based questions have been replaced with computer-assisted personal interviewing (CAPI) using tablets or mobile phones in many large-scale national surveys, and remote techniques in crisis situations have significantly changed the way

MDD-W data is collected. In light of the growing need for superior diet quality monitoring and assessment instruments, the Guide needs to be revised to reflect these new findings (119).

The MDD-W indicator has been conceptualized as a proxy measure to assess the micronutrient adequacy of women's diets. Although this data is gathered from individual women, MDD-W should not be interpreted as indicative of diet quality at the individual level. This limitation stems from its reliance on a single 24-hour recall period, which fails to capture the daily intake variability of an individual. The appropriate application and interpretation of MDD-W are at the population level, specifically for groups of WRA.

Validation studies concerning MDD-W, such as those by Martin-Prevel et al. have revealed that:

- Micronutrient adequacy is anticipated to be higher in societies where a larger proportion of women consume foods from at least five of the ten food groups than in populations where fewer women fit this description.
- Moreover, WRA groups that consume foods from five or more food groups are more likely to include at least one food derived from animals, as well as pulses, nuts, or seeds, in addition to at least two different fruit or vegetable groups (118,122).

The ten food groups are (119):

1. Plantains, grains, and white tubers and roots
2. Pulses (lentils, beans, and peas)
3. Seeds and nuts
4. Milk and its derivatives
5. Fish, poultry, and meat
6. Eggs
7. Leafy, dark green vegetables
8. Additional fruits and vegetables high in vitamin A
9. Additional veggies
10. Additional fruits

Dietary diversity indicators categorize foods based on their nutritional similarities and/or their roles in the diet, as noted by Rule (125). In the formulation of the MDD-W, various configurations and definitions of food groups were explored. The adoption of the ten groups

outlined in this context was ultimately decided upon. This decision was informed by evidence indicating that these particular groupings demonstrate a more robust correlation with micronutrient adequacy compared to other tested combinations and numbers of food groups, as elucidated by Martin-Prevel et al. (122).

2.6. Maternity Outcomes

2.6.1. Hemoglobin (HB) and Anemia

The relationship between maternal hemoglobin (HB) levels during pregnancy and maternity outcomes is a complex and multifaceted issue, as indicated by several studies (126). Hemoglobin, an essential component of red blood cells, plays a crucial role in oxygen transportation throughout the body (127). During pregnancy, the balance of hemoglobin levels is vital for both the mother's and the fetus's health (128).

A comprehensive systematic review and meta-analysis, as reported in BMC Pregnancy and Childbirth, involved an extensive examination of studies related to maternal hemoglobin concentrations and their association with adverse maternal and infant health outcomes, especially anemia. This meta-analysis included a significant number of studies, highlighting the global interest in understanding these associations (129).

Another systematic review and meta-analysis, published in PubMed, focused on the effects of hemoglobin levels during pregnancy on adverse maternal and infant outcomes. This study aggregated data from various sources, providing a broad overview of the research in this area. It included studies like "Maternal hemoglobin concentrations across pregnancy and maternal and child health" and "Hemoglobin concentrations and adverse birth outcomes in South Asian pregnant women", among others. Collectively, these studies contribute to a better understanding of the impact of hemoglobin levels on pregnancy outcomes (130).

An article in BMC Pregnancy and Childbirth discussed the changes in maternal hemoglobin during pregnancy and their impact on birth outcomes. This study provided insights into how hemoglobin levels fluctuate throughout pregnancy and how these changes correlate with various outcomes, including anemia. For instance, it was found that women who had the least reduction in hemoglobin levels from early to late pregnancy were

more likely to be anemic during early pregnancy but less likely during late pregnancy. This study emphasizes the importance of monitoring hemoglobin levels throughout pregnancy for predicting and managing potential risks (131).

These studies collectively illustrate that both low and high hemoglobin levels can be associated with adverse outcomes for both the mother and the fetus. It is crucial to maintain optimal hemoglobin levels during pregnancy, as deviations from the normal range can lead to complications such as anemia or other health issues. Regular monitoring and appropriate medical interventions, as necessary, are key to ensuring the well-being of both mother and child.

2.6.2. Gestational Diabetes Mellitus

Pregnant women with Gestational Diabetes Mellitus (GDM), a disorder marked by glucose intolerance initially identified during pregnancy, were the subject of several investigations. Obesity, physical inactivity, multiparty, a family history of diabetes mellitus, certain ethnicities, and having a previous macrocosmic kid are risk factors for GDM. The study highlights how crucial it is to screen for people at risk using the oral glucose tolerance test between weeks 24 and 28 of pregnancy in order to avoid negative effects for both the mother and the unborn child (126,132).

A study about GDM among refugee pregnant Syrian women in Jordan explored the prevalence, risk factors, and self-care practices associated with GDM among pregnant women residing in the Za'atari refugee camp. Based on a sample of 40 women, the study reveals that a higher level of diabetes knowledge and self-efficacy significantly enhances GDM self-care practices. This research underscored the importance of tailored health promotion initiatives to enhance self-care and advocates for further investigation into other factors that influence GDM self-care within refugee populations (133). Another study by M. Agarwal (2020) found that GDM prevalence in Arab Gulf countries ranged from 5.1% to 37.7%, which is among the highest globally. Risk factors identified included obesity, advanced maternal age, family history of diabetes, and unhealthy lifestyle changes due to economic affluence. The study highlighted the urgent need for effective screening and management programs to mitigate the impact of GDM in these regions (134).

2.6.3. Hyponatremia in Pregnancy

The relationship between maternity outcomes during pregnancy and hyponatremia (a condition characterized by low sodium levels in the blood) is a complex and significant area of study (135,136). Several studies have explored the implications of hyponatremia during pregnancy, particularly in relation to conditions like preeclampsia.

A study published highlighted that hyponatremia should be considered a marker of severity in preeclampsia cases. In this context, hyponatremia may indicate the need for expedited delivery. Interestingly, hyponatremia tends to recover rapidly post-delivery without specific therapy (137). Another aspect to consider is the effect of hyponatremia on both maternal and neonatal health during labor. Cases of severe maternal hyponatremia complicating preeclampsia have been reported, underscoring the potential risks associated with this electrolyte imbalance (138).

The syndrome of inappropriate antidiuretic hormone secretion is also a concern in pregnant women with preeclampsia, as it can lead to hyponatremia. This condition requires careful monitoring and management due to its complexity and potential impact on both the mother and the fetus. Hyponatremia is closely associated with changes in maternal physiology, particularly in cases of gestational hypertension. The balance of electrolytes, which includes sodium, is crucial during pregnancy, and any imbalance can have significant implications for both the mother and the developing fetus (139).

These studies indicate that hyponatremia during pregnancy, especially in the context of preeclampsia or gestational hypertension, is a significant concern that requires careful management. It highlights the need for antepartum screening and a thorough understanding of maternal physiology to ensure the wellbeing of both mother and child. The recovery of hyponatremia post-delivery without specific therapy is a notable point, suggesting that the condition is closely linked to the physiological changes of pregnancy itself.

2.6.4. Hypokalemia in Pregnancy

The relationship between maternity outcomes during pregnancy and hypokalemia (low potassium levels in the blood) is complex and multifaceted. Recent studies have provided insights into how hypokalemia can influence pregnancy outcomes (140,141).

A nationwide population study conducted in the United States from 2012 to 2014, as detailed in an article published in the International Journal of Nephrology, focused on the prevalence and risk factors of hypokalemia in pregnancy-related hospitalizations. This large-scale study found that hypokalemia occurred in 0.69% of pregnancy-related hospitalizations, which is in line with the previously known incidence of about 1%. The study identified several risk factors for hypokalemia during pregnancy, including younger maternal age, African American race, lower HH income, and certain medical conditions like corticoid-adrenal insufficiency and congestive heart failure. Notably, obstetric complications such as hyperemesis gravid arum (severe morning sickness), post-partum hemorrhage, and gestational hypertension were significantly associated with hypokalemia. The study highlighted the importance of monitoring potassium levels, especially in patients with these risk factors (142).

In terms of prevention and management, maintaining a balanced diet with adequate potassium intake is crucial during pregnancy. Foods rich in potassium include beet greens, sweet potatoes, spinach, avocado, tomato juice, and various fruits and legumes. Optimal prenatal care and maternal health education also play a vital role in preventing potassium insufficiency or deficiency during pregnancy. It's important to manage conditions that can affect potassium levels, such as diabetes and hypertension. While hypokalemia is relatively rare in pregnancy, occurring in about 1% of healthy pregnancies, it can lead to complications like heart arrhythmias, muscle cramps, and abnormal heartbeats. Therefore, prompt diagnosis and treatment of hypokalemia are essential to prevent maternal and fetal complications (143,144).

In summary, while hypokalemia during pregnancy is relatively rare, it's associated with several risk factors and can lead to significant complications if not properly managed. The focus should be on monitoring at-risk patients and ensuring adequate potassium intake through diet and supplements as needed.

2.6.5. Hypocalcemia in Pregnancy

The relationship between maternity outcomes during pregnancy and hypocalcemia, a condition characterized by low levels of calcium in the blood, is a subject of ongoing research. Several studies have investigated the implications of hypocalcemia on pregnancy and maternal health (145,146).

One study emphasized the association of abnormal calcium levels, including hypocalcemia, with unfavorable pregnancy-related outcomes. However, this study primarily provided an exploratory viewpoint, indicating that precise estimates of the incidence and impact of hypocalcemia in pregnancy are still emerging (147).

Another significant study discussed the challenges in diagnosing and managing hypocalcemia during pregnancy. This review noted that hypocalcemia in pregnancy is not frequently reported but can occur in cases like hypoparathyroidism and severe dietary inadequacy. The condition is associated with various maternal and fetal complications, such as hypertensive disorders, preeclampsia, and fetal growth disorders. The study advocated for a multidisciplinary approach, involving endocrinologists and obstetricians, to ensure optimal outcomes (148).

Furthermore, a study conducted in Maiduguri, Nigeria, found that hypocalcemia is relatively common during pregnancy in that region. This cross-sectional study highlighted that pregnant women with hypocalcemia were more likely to have conditions like anemia and anorexia and were often prim gravid (experiencing their first pregnancy). It suggested that educational attainment and routine calcium supplementation during pregnancy and the preconception period could be protective factors against hypocalcemia (149).

These studies collectively underscore the complexity and significance of understanding hypocalcemia in pregnancy. They highlight the need for more research and a comprehensive healthcare approach to manage and mitigate the risks associated with this condition during pregnancy.

2.7. Socioeconomic Factors in Northwest Syria

2.7.1. Household Income

Despite the fluctuations in the value of the local currency between areas controlled by the Government of Syria and the Syrian Interim Government in Northwest Syria, the latter areas still enjoy somewhat acceptable living conditions compared to those under the Government of Syria control. This is despite a relative similarity in monthly expenses for both regions. However, the monthly income in areas of the "temporary government"

remains a lifeline, preventing its inhabitants from drowning in the surge of prices, according to a report issued in March 2021 (150,151).

According to local sources, the average monthly income for workers in areas of Northwest Syria is not less than 1,000 Turkish Lira. This income bracket includes teachers, administrators, police officers, and members of opposition factions. Meanwhile, the income margin increases to 3,500 Turkish Lira, about 500 USD monthly for those working in international organizations active in the region, according to the currency exchange rates during the time of releasing the report.

An examination of the monthly incomes in Northwest Syria reveals a disparity with the salaries of workers in government-controlled regions, where the average is 70,000 Syrian Lira (18 dollars), significantly detached from the frenzy of price hikes and the ongoing depreciation of the Syrian Lira, nearing 4,000 Syrian Lira to the dollar (150).

Reflecting on the monthly incomes of both regions, the Ministry of Economy and Finance in the Syrian Interim Government conducted a study indicating the average expenses of a Syrian family with five children over one month. The ministry estimated that the minimum expenses for families with children under ten years old are about 1,544 Turkish Lira, equivalent to 215 USD, or roughly 7 dollars per day. For families with older children, expenses rise to 1,649 Turkish Lira (230 USD), or about 7.6 USD per day. The ministry's study, conducted last January, defined the "acceptable limit" for total expenses of a Syrian family with children under ten as 2,791 Turkish Lira (388 USD), or around 13 dollars per day. For families with older children, the total monthly expense ceiling is 3,026 Turkish Lira, approximately 421 USD, averaging 14 dollars per day. Nonetheless, the value of the Turkish Lira has experienced significant alterations in recent years, primarily attributable to economic inflation and fluctuations in currency exchange rates within Turkiye.

Currently, the exchange rate stands at 1 USD being equivalent to 28.50 Turkish Lira (152,153). The ministry's study summarized the distribution of Syrian family expenses across food, fuel, water, electricity, transportation, HH items, cleaning supplies, and other services (150).

Comparing the incomes and expenditures of families in liberated areas, it's found that the deficit in Northwest Syria is about a third, while in government-controlled areas, the

deficit is 5-6 times the income. Cities and regions under the government of Syria's control are experiencing a marathon of rising prices for basic goods and daily necessities, especially with the sharp decline in the Syrian Lira against the USD (53,154,155).

Prices of basic goods in many Syrian cities and towns have skyrocketed, as acknowledged by government newspapers and entities in the governmental areas, lamenting the dire living conditions of Syrian families in these regions (156,157).

According to an economic labor report by the Assad-affiliated Workers' Union, a Syrian family needs 600,000 Syrian Lira to cover basic needs, equivalent to 162 USD monthly (6 dollars per day).

These figures emerge at a time when the low-income segment of Syrians, constituting 90% of the population in Assad-controlled areas, earns no more than 50,000 Syrian Lira (13 USD) monthly. This situation has forced many families to send their children to work instead of school and compromise their food intake (150,158,159).

2.7.2. Education and Dietary Habits Among Pregnant Women

Educational levels are an organized classification of educational programs based on the complexity of learning experiences and the knowledge, skills, and competencies they are designed to impart. This classification helps in understanding and comparing educational attainment across different countries and regions (160,161).

The educational system in Syria is structured into various levels, each with its own characteristics and objectives (55,162,163):

- Primary Education: This level includes six years of compulsory education, starting after a period in state-managed kindergartens.
- Middle Education: After primary education, Syrian students undergo three years of compulsory middle education. This stage culminates in a national examination, which determines whether students can proceed to secondary education.
- Secondary Education: Secondary education in Syria lasts three years and is not compulsory. It is divided into general/academic and vocational/technical branches. The general branch prepares students for higher education, with specialization in

either scientific or literary streams. The vocational branch offers training in various technical skills.

- University Education: Higher education in Syria is overseen by the Ministry of Higher Education. It includes both public and private institutions, with most universities following the French model of higher education. The university stages include a License degree (4 to 6 years), postgraduate degree (1 to 2 years), and a doctorate degree (3 to 5 years).

The relationship between educational level and malnutrition or dietary habits among pregnant women is a complex issue, influenced by various factors, including socioeconomic status, cultural practices, and access to health education. Studies in different regions have highlighted key aspects of this relationship (164,165).

A study in Ethiopia focused on the dietary diversity and undernutrition among pregnant women. It defined undernutrition using the Mid-Upper Arm Circumference (MUAC) measurement, with less than 23 cm indicating undernutrition. The study utilized a dietary diversity score (DDS), summing up the different food groups consumed by pregnant women over 24 hours. Inadequate dietary diversity was marked by the consumption of less than five food groups, while adequate diversity involved consuming five or more food groups (166).

Research in Ghana highlighted the eating habits of pregnant adolescents, emphasizing the importance of nutritional education to improve these habits. It was found that the eating habits of adolescent pregnant women were not encouraging, pointing towards the need for intensified efforts in nutritional education and awareness (167).

Another study in Southwest Ethiopia assessed the minimum dietary diversity among pregnant women. It was found that about 51% of the women met the minimum dietary diversity scores, consuming five or more food groups. Factors like women's occupation, nutritional awareness, and age were significantly associated with achieving minimum dietary diversity (168).

The association between maternal food intake and outcomes for both the mother and the newborn was assessed in an Italian study. Newborns were classified as small for gestational age (SGA), appropriate for gestational age (AGA), or large for gestational age (LGA) depending on their weight percentile for gestational age. Additionally, it took into

account the mothers' pre-pregnancy Body Mass Index (BMI) and Gestational Weight Gain (GWG). The results showed that maternal anthropometric measures (pre-pregnancy BMI and GWG) and primary neonatal outcomes (placental weight and infant birth weight percentile) were significantly correlated (169).

These studies collectively suggest a significant impact of dietary habits and nutritional awareness on the health of pregnant women and their babies. They underscore the importance of education and awareness programs to improve nutritional intake and overall health outcomes in pregnant women, particularly in regions with limited resources or high rates of malnutrition.

2.7.3. Employment and Maternal Outcome

In fact, there is a lack of studies and reports addressing the employment rates among women in Syria. However, it is evident that access to the labor market and skilled jobs is limited in Northwest Syria due to the deteriorated socioeconomic conditions, especially for vulnerable groups like women (170–172). A case study of the challenges and acute need for medical humanitarian operations for displaced women and children highlighted that employment and maternal outcomes in Syria were severely impacted by the conflict.

The research found that women and children, particularly pregnant women, faced significant challenges due to inadequate access to maternal and child health services. The prevalence of adverse maternal outcomes, such as higher rates of preterm births and complications, increased due to the disrupted healthcare system (173). Another study that focused on the impact of conflict on maternal outcomes and employment in Syria found that the conflict severely disrupted the healthcare system, leading to significant gaps in the coverage of reproductive, maternal, newborn, child, and adolescent health and nutrition interventions. The researchers concluded that humanitarian organizations had to adapt by implementing remote management strategies and task-shifting to cope with shortages in skilled healthcare workers. Additionally, it was concluded that despite efforts to prioritize maternal and child health, the volatile security situation and limited resources posed ongoing challenges (174).

2.7.4. Household Size and Dietary Habits

The relationship between dietary behaviors among pregnant women and the number of HH members is a complex topic that intertwines various social, economic, and cultural factors (175,176).

In one study, the food habits of pregnant mothers were examined. Age, marital status, religion, family size, occupation, education, and income level were among the many independent variables that were considered in this study. The study emphasized how crucial it is to consider a variety of characteristics, including HHs size, when evaluating the eating habits of expectant mothers. The study employed semi-structured and structured questionnaires to gather information about HH food insecurity status, pregnancy-related variables, and socioeconomic status. A brief food intake assessment and nutrition-behavior checklists were used to gauge pregnant women's dietary behaviors, as well as their attitudes and knowledge around food. This thorough methodology made it possible to analyze in depth how several factors, like as the number of HH members, can affect pregnant women's food habits (177).

Another study explored the factors influencing dietary patterns during pregnancy in a culturally diverse society. This research also underscores the importance of considering various socioeconomic and demographic factors, including family size, when examining dietary practices among pregnant women. The study suggests that a complex interplay of these factors determines dietary patterns during pregnancy, highlighting the need for a multifaceted approach in nutritional counseling and interventions for pregnant women (178).

These studies emphasize that the dietary behaviors of pregnant women are influenced by a range of factors, including the number of HH members. Understanding these relationships is crucial for developing effective nutritional interventions and support systems for pregnant women. These interventions should be tailored to accommodate the varying needs of women in different HH settings, considering the broader socio-economic and demographic context.

A recent assessment by the International Labor Organization in Syria found that the average HH size was five members (179).

2.7.5. Housing Status and Maternity Outcomes

The relationship between housing conditions and maternal outcomes among pregnant women has been extensively studied, revealing significant associations between displacement and unstable housing and various adverse pregnancy outcomes (180).

A study highlighted in the National Low Income Housing Coalition reported a strong correlation between housing instability, including homelessness, and harmful pregnancy outcomes. This includes a higher incidence of preterm birth, low birth weight, neonatal intensive care unit admission, and delivery complications. The study underlined that housing stability is crucial for good maternal health, emphasizing the need for interventions that provide stable housing to pregnant women (181). Another research indicated that homelessness during pregnancy is linked to a range of pregnancy complications. These include increased odds of preterm delivery and a higher risk of neonatal intensive care unit admission. This suggests that homelessness and displacement is a significant risk factor that contributes to poor perinatal outcomes (182).

A retrospective cohort study analyzed the impact of unstable housing on obstetric outcomes and healthcare utilization post-birth. Women with unstable housing were found to have higher odds of preterm birth, preterm labor, longer hospital stays, and increased emergency department visits within three months and one year after delivery. This study underscores the need for housing and income support as potential interventions to prevent preterm birth and reduce healthcare utilization (183).

These findings collectively illustrate that unstable housing conditions, including living as IDPs or in inadequate housing, significantly impact maternal health. They highlight the importance of stable, dignified housing as a key determinant of maternal and neonatal health. Ensuring stable housing could be a critical intervention for improving maternal outcomes and reducing the strain on healthcare systems. This points to a broader understanding of health that includes social determinants like housing as essential components of maternal and child health strategies.

3. METHODOLOGY

This chapter presents details of the methods and materials used in this research, site selection, the target population, sampling strategy, the instruments used for data collection, and data collection and analysis.

3.1. Study Design

The study design relied on direct observational and data collection from the target group following a proper sampling strategy to ensure representative and generalizable findings (184). Data collection lasted for eight months between December 2022 and July 2023. It differs from other types of longitudinal studies by not following subjects over a period of time (185). In this study, the researcher aimed to observe and measure the variables of interest without manipulating the study environment (186).

For this research on dietary habits and nutritional behaviors in Northwest Syria, a cross-sectional study is suitable because it allows for the assessment of the current nutritional status and dietary patterns of pregnant women in the context of an ongoing conflict. This type of study is efficient for gathering data at a single point in time, which is practical in conflict zones where long-term follow-up might be challenging (187). It provides a snapshot that can reveal important correlations and insights into the impact of the conflict on dietary habits and maternal health, which is crucial for developing immediate and effective interventions.

3.2. Study Area

Geographical Location: The study is focused on Northwest Syria, a region significantly affected by the ongoing conflict. Northwest Syria encompasses rural regions in the northern part of Aleppo governorate and certain areas within Idleb governorate, including Idleb City (3,188).

3.3. Background of Population

The humanitarian crisis in Northwest Syria continues to be dire, particularly for the female population. Of the region's 4.5 million inhabitants, approximately 4.1 million are in

critical need of humanitarian assistance. Among them, 2.9 million are internally displaced persons (IDPs), the largest number for any country globally. Out of the total population, around half are women and girls, including 4.2 million women of reproductive age. In Northwest Syria, 3.3 million face food insecurity, according to a report published by UNFPA as of June 2023. The dependency on humanitarian aid for survival has intensified, especially in the aftermath of the devastating earthquakes in February (189,190). The conflict involved various factions, including pro-government militias, opposition rebels, ISIS, Kurdish autonomous forces, and Turkish-backed fighters. Before the current war, the agricultural sector was a significant employment source, accounting for 29% of Syrian jobs (191). Before the Syrian crisis in 2011, Syria had made significant progress in closing the gender gap in education. The literacy rate for females was 77% and for males 90%. Female enrollment in secondary education reached 51% in 2005-2006, with females comprising 52% of those completing pre-university education by 2006. Since the war's onset, many young people have been unable to pursue education due to instability, loss of teachers, displacement, and destruction of educational infrastructure. In 2012, higher education enrollment rates were 12% for females and 17% for males. By 2016, overall tertiary education participation had dropped to 5% in Northwest Syria (192).

3.4. Study Sites

Specific areas within Northwest Syria where health facilities are operational despite the conflict. These sites were chosen based on certain factors, including accessibility, the type of health services provided through these health centers (maternity and reproductive health care), the prevalence of pregnant women, and the severity of the conflict's impact. The goal is to ensure a representative sample that captures diverse experiences within the region. Four health facilities in three sub-districts in Aleppo and Idleb governorates have been targeted for data collection. These facilities were selected by the researcher because they were reachable, ensuring that data collection could be conducted safely and effectively. Besides, these facilities deliver specialized maternity and reproductive health services, including normal deliveries and anti-natal care. These facilities recorded high numbers of patients which allowed sufficient number of cases for the research. Based on the researcher knowledge, these facilities maintain quality services and apply Electronic Medical Records for patient's registry, which allowed the author to extract the required information of the cases without invasive medical intervention for data collection.

3.5. Ethical Approval

In the study on dietary habits and nutritional behaviors among pregnant women in Northwest Syria, ethical clearance was a paramount consideration. The research team obtained approval from the Health Sciences Ethics Committee at Ankara Yıldırım Beyazıt University, under the reference number 2022/601. This approval signified that the study's design met the ethical standards required for research involving human subjects, particularly in sensitive contexts like a conflict zone. The process involved a thorough review of the research proposal, ensuring that the study adhered to ethical principles such as: **informed consent** ((Informed consent for participation in the study was obtained through a specially designed form that outlines the purpose of the research. The form provides a comprehensive explanation of the questionnaire used, emphasizing the importance of privacy and confidentiality while adhering to ethical standards. It also indicates the expected duration for completing the questionnaire and clarifies the rights of participants during the survey process. Furthermore, the form assures participants that their decision to accept or decline participation in the questionnaire will in no way affect the healthcare services they will receive. It underscores the voluntary nature of the research, ensuring that participants understand their freedom to withdraw at any stage without any repercussions on their access to health services)), **confidentiality**, **participant safety**, **cultural sensitivity**, and **data security**. This ethical clearance was not merely a procedural formality but a crucial step in ensuring the integrity and ethical soundness of the research, reflecting a commitment to upholding the highest standards of ethical conduct in a challenging research environment.

3.6. Data Collection

Data collection was undertaken by a team of four individuals who had undergone specialized training. The initial draft of the questionnaire was crafted and subsequently circulated among prominent humanitarian and academic stakeholders in Northwest Syria and Turkiye. This collaborative approach was aimed at refining the quality of the questionnaire, ensuring its alignment with the research objectives, and securing its relevance to the actual context in Northwest Syria. Prior to the commencement of data gathering, the researcher provided comprehensive training to the data collectors to facilitate the process effectively. Data collection personnel utilized smart tablets, onto

which the questionnaire was uploaded via the Kobo Toolbox application. The questionnaire facilitated the gathering of demographic, psychosocial, and dietary habit information. For the purpose of maintaining anonymity in the raw data, each case was assigned a unique identification code. Biological data, on the other hand, were initially collected in hard copy from health facilities following authorization from the managing NGOs. Subsequently, these data were digitized into the software application, with a validation process cross-referencing each case's unique ID code against their personal details. To guarantee the accuracy and validity of the data, the verification procedure was meticulously conducted twice by the researcher.

3.7. Data Analysis

The data was analyzed using the Statistical Package for Social Sciences (SPSS) v.22. The applied tests to investigate significant differences between the categorical variables were the Chi-square test (χ^2) and Fisher exact test (F). Additionally, for statistical analysis of relationship and correlation, we used binary logistic regression and multinomial logistic regression analysis for dichotomous and more than two groups of categorical data, respectively.

A significant P-value of 0.05, Confidence Interval (CI) level of 95%, and standard error (α) of 0.01 were used in all statistical analyses.

3.8. Sampling Strategy

3.8.1. Sampling Design

In our research that focuses on dietary habits and nutritional behaviors among pregnant women in Northwest Syria, the sampling design is crucial in ensuring the study accurately captures the experiences and needs of this specific population. The use of purposive sampling is particularly justified in this context.

Purposive sampling allows for the deliberate selection of pregnant women who represent various experiences and conditions in the conflict zone (193). This approach is essential for gaining in-depth insights into the complex issue of dietary habits under the stress of conflict (194). The choice to recruit participants from certain healthcare facilities

(maternity and pediatrics hospitals and health centers) is strategic, as these locations are likely points of contact for pregnant women seeking prenatal care. These facilities provide a feasible and effective way to identify and engage with the target population, ensuring that the study includes women not only in different stages of pregnancy but also actively seeking healthcare. This methodological choice enhances the potential for gathering rich, detailed data, which is critical for understanding the unique nutritional challenges and behaviors of pregnant women in a conflict-affected setting like Northwest Syria.

3.8.2. Inclusion and Exclusion Criteria

3.8.2.1. Inclusion Criteria

- Pregnant women regularly visit the target health facilities for ANC.
- Residents of the study areas.
- Willing to participate and able to give informed consent.
- Able to communicate and interact using the local language.

3.8.2.2. Exclusion Criteria

- Non-pregnant women.
- Women with medical conditions affecting dietary habits independently of pregnancy (e.g., pre-existing diabetes).
- Inability to provide informed consent:
- Lack of capacity to give informed consent.
- Incapacity to understand and agree to participate in the study.
- Inability to communicate and interact:
- Difficulty in effectively communicating or engaging in dialogue.
- Challenges in verbal communication and interaction.
- Participants who did not complete the questionnaire.

3.8.3. Sample size

Purposive sampling was used in this research, and the sample was drawn from four health facilities spread across three sub-districts in Idleb and Aleppo areas of Northwest

Syria (Afrin and Raju in Afrin district – Aleppo governorate, and Dana in Harim district – Idleb governorate). Statistical data obtained from the designated sites indicate that maternity and reproductive health services are actively provided to new and revisiting patients requiring ANC and maternity care. Due to resource constraints and the ongoing crisis implication on access to health facilities, the researcher chose to use data on new ANC cases reported for a period of six months in the target health facilities in 2023. The size of the sample, therefore, was determined based on the number of new ANC cases visiting the target health facilities during the period December 2022 to July 2023. This data was used because it was the most recent. The demographic, psychosocial, and dietary behaviors data was obtained through direct interviews with the selected participants. The biological data, including blood test results, were obtained through the information management database of the selected health facilities. Data for the referenced period showed that during the eight months, a total of 2250 new ANC patients were reported in the target health facilities. Out of these, 1,575 met the inclusion criteria and, therefore, were included in the preliminary selection. Thus, the sample size was calculated based on the total number of ANC visits to the target health facilities, which was 1,575.

In order to determine the sample size for this study, the sample size calculation was done using Yamane's formula (195).

$$n = \frac{N}{1+N(e)^2}$$

Where:

n: the sample size.
N = 1600: the total population of the study.
e = 0.05: the margin error in the calculation.
Applying the equation (1), we found that n = 315.

Thus, a sample size of 315 ANC cases was surveyed through face-to-face interviews.

3.8.4. Recruitment and Consenting

Recruitment is initiated at the selected healthcare facilities, where medical professionals, trusted by the community, first introduce the study to potential participants.

This approach leverages the existing relationship between healthcare providers and patients, creating a comfortable and trustworthy environment for initiating contact.

Upon introduction, the trained research data collectors then engage with interested pregnant women. These data collectors were thoroughly trained to handle sensitive discussions with empathy and understanding, considering the challenging circumstances the participants are living in. Additionally, the data collection team received training on administering the applied questionnaire. The data collection team was comprised of four female members, a decision made in consideration of local cultural norms and gender sensitivity. This composition was aimed at fostering an environment conducive to active engagement from the target participants.

The informed consent process is central to this recruitment phase. Staff provide a detailed explanation of the study's aims, procedures, potential risks, and benefits in a language and manner that is easily understood by the participants. The use of simple, non-technical language, and the availability of consent forms in the local language, ensures clarity and comprehension.

Emphasizing that participation is voluntary is crucial. Women are informed that their decision to participate or not will in no way impact the quality of care they receive. This reassurance is vital in a setting where power dynamics can be easily misconstrued.

A key element in this process is the consideration of ethical issues. Given the conflict-affected nature of the area, ensuring the privacy and confidentiality of participant information is paramount. The research team (the researcher and data collectors) was also acutely aware of the need to ensure that participation in the study does not inadvertently increase the risks or burdens for the women.

Lastly, cultural sensitivity plays a significant role in the recruitment and consenting process. The approach is carefully tailored to respect local cultural norms and values, ensuring women feel respected and understood. Subjects consented to participate in the study had to sign a consent form. All consent forms are securely stored in a confidential location, accessible solely to the researcher. These forms will be disposed of following the submission and discussion of this research.

3.9. Research Variables and Questionnaire

In this study, the primary independent variable was identified as the dietary behaviors of pregnant women, while the dependent variables encompassed the biopsychosocial factors, which were influenced by several confounding elements such as conflict, limited access to food, and displacement. The selection and definition of these variables were consistent with the biopsychosocial model of health, taking into account the contextual factors that shape dietary practices within the studied population. Tables 1 & 2 show the coding of dependent and independent variables.

The methodology for data collection on nutritional behaviors and habits among pregnant women adhered to the INDIKIT guidelines, which outline the minimum dietary diversity necessary for women. Developed by the NGO People in Need, INDIKIT serves as a comprehensive monitoring instrument covering various sectors, including the nutrition of women of reproductive age. Within this tool, the Minimum Dietary Diversity for Women (MDD-W) is a specific measure employed to assess the variety in food intake. It utilizes a specialized instrument to determine the percentage of the target population consuming a diet that is adequately diverse. According to this tool, people must have a minimum of five different food groups as categorized by this tool. The MDD-W has been validated as an effective proxy at the population level for assessing micronutrient adequacy. The methodology for collecting indicator data is suggested to be either through a list-based approach or via open recall (196).

3.9.1. Socioeconomic Status

The economic and social position of the women could influence their access to food and healthcare (197). The following variables were considered as socioeconomic determinants (198,199):

- Age: the female participants were categorized into three distinct age groups corresponding to their stages of reproduction: the early reproductive phase (below 25 years of age), the mid-reproductive phase (25 to 34 years of age), and the advanced reproductive phase (above 35 years of age) (200).
- Governorate of residence: including Idleb and Aleppo governorates and the communities in which the participants reside.

- Housing Conditions: The living conditions that can reflect overall economic status and access to facilities. This variable is categorized into IDP and host population (or formal residency) status.
- Ethnicity: There are two main ethnicities in Northwest Syria, Arab and a minority group of Kurdish people living in Afrin district and some communities in Al Bab and Jarablus districts (201).
- HH income Level: The financial resources available to women which can influence their ability to access nutritious food. This variable represents the total income of HH. Based on the results published by the Syrian Interim Government in Northwest Syria, the average income must be at least 11,058 Turkish Lira (equal to 388 USD according to the current exchange rates).
- Education Level of the patients and their husbands: The level of formal education attained can affect knowledge about nutrition and health. This variable is categorized into illiterate, primary education, secondary education, and institute or university education.
- Employment Status of the patients and their husbands: Whether and where the woman is employed impacts income and food security. The employment status is categorized as employed or unemployed.

HH size: According to the reviewed literature, this variable was categorized as normal size (five or fewer members per HH) and crowded (more than five members per HH).

3.9.2. Dietary Habits

An independent variable refers to the regular eating patterns, food choices, and dietary preferences of the pregnant women in the study (202). Data on food consumption among pregnant women were obtained during the interview process, wherein participants were queried about levels of their consumption quantities of various food items over the past month in adherence to the MDD-W questionnaire guidelines (203). For this research, we invented a systematic scale to calculate and estimate the monthly cumulative food consumption, which represents the sum of food consumption of all the food groups. The scale ranges from 0 to 21 (the lowest and highest possible values of the sum of the food groups consumption rates). The scale is divided into three categories:

- Low consumption: 7 – 10 points.
- Moderate consumption: 11 - 15 points.
- Sufficient consumption: 16 – 21 points.

This scale represents the diversity and access of individuals to food items in the seven food groups. The comprehensive list of food items under each food group is detailed in Annex1.

3.9.3. Maternal Health Diseases

This group of diseases refers to the physical health consequences experienced by pregnant women, which could include pregnancy-related complications and overall well-being (204). In this study, the following specific variables were considered to reflect maternal health outcomes based on the participants' answers:

The group of specific variables under this category refers to dependent variables affected by the changes in dietary and nutritional habits among pregnant women.

- Anemia: this disease is a significant public health challenge, particularly in developing nations like Syria, and is linked to unfavorable outcomes during pregnancy. WHO categorizes pregnancy-related anemia as an average hemoglobin (Hg) concentration below 10.5 g/dL (205,206).
- Gestational Diabetes Mellitus among pregnant women: This disease is a metabolic disorder sparked by insulin resistance and dysfunction of the β cells. WHO criteria to diagnose Diabetes Mellitus was applied to confirm the diagnosis of Diabetes Mellitus, which is a fasting plasma glucose level of ≥ 95 mg/dL confirms the diagnosis (207,208).
- Hyponatremia in pregnancy: a normal pregnancy is characterized by a state of positive sodium and water balance. It is noteworthy that during pregnancy, the concentration of sodium in the blood typically ranges between 130–140 mmol/L, indicating a lower level compared to non-pregnant states. Hyponatremia refers to low levels of Sodium during pregnancy that are below the average levels (135 mmol/L) (209,210).
- Hypokalemia in pregnancy: In pregnant women exhibiting typical health parameters, the average serum potassium concentration was determined to be 5.65

mmol/L. According to WHO, hypokalemia refers to the potassium level in blood below the mentioned average (211,212).

- Hypocalcemia in pregnancy: In healthy individuals, the standard concentration range for total serum calcium is typically between 8.8 and 10.4 mg/dl. Women who will have calcium levels less than 8.5 mg/dl will be considered to have hypocalcemia (213).

Table 3.1. Codes for dependent variables: maternal outcomes

Dependent variables		
Variable	**Coding**	**References**
Anemia	0: Normal. 1: Diagnosed with anemia	WHO
Gestational Diabetes Mellitus	0: normal 1: Diagnosed with Gestational Diabetes Mellitus	WHO
Hyponatremia	0: Normal 1: Diagnosed with hyponatremia	WHO
Hypokalemia	0: Normal 1: diagnosed with hypokalemia	WHO
Hypocalcemia	0: Normal 1: Diagnosed with hypocalcemia	Literature

Table 3.2. Codes for independent variables: socioeconomic and dietary intake

Independent variables		
Variable	**Coding**	**References**
Age	1: Early reproductive age group. 2: Mid-reproductive age group. 3: advanced reproductive age group	Literature
Ethnicity	1: Arab 2: Kurdish	Literature
Housing condition	1: IDP lives in informal shelter like tents or collective centers 2: Host population lives in formal residency settings	Literature
Education level of the patient	1: Illiterate 2: Primary school education 3: Intermediate or secondary school education. 4: High education (intermediate institute or university)	Syrian Ministry of Education
Education level of the patient's husband	1: illiterate 2: primary school education 3: intermediate or secondary school education. 4: High education (intermediate institute or university)	Syrian Ministry of Education
The HH income level	1: the HH monthly income is less than the average expenditure 2: the HH monthly income is within or higher than the average expenditure	Syrian Interim Government in Northwest Syria
HH size	1: Within the average size of 5 members 2: Crowded = HH size of more than 5 members	International Labor Organization
Group 01 to Group 07 (7 variables)	Frequency of eating one of the food items in each group per month: 1: Less than three times a month. 2: Three times a month. 3: More than three times a month.	Indi Kit: Minimum Dietary Diversity Women
Overall food uptake	The cumulative frequency of food uptake from the seven food groups: 1: Low monthly food consumption. 2: Moderate monthly food consumption. 3: Sufficient monthly food consumption	

4. RESULTS

4.1. Descriptive and Statistical Analy

4.1.1. Sociodemographic Analysis

In this section, we presented the descriptive statistical figures of the socioeconomic variables and then explored potential statistically significant differences between them.

For this poll, 315 expected mothers in all were enlisted. The participants were 26 years old on average. 48.6% of the participants were women in the early reproductive age range of 14–25 years from the beginning. 35.2% of the population was in the mid-reproductive age range (25–34 years), and 16.2% was in the advanced reproductive age range (35–45 years). A slightly higher proportion of participants reside in Aleppo (53.3%) compared to Idleb (46.7%). A significant majority of the participants were IDPs, making up 87.3%, while 12.7% had formal residency. Almost all participants were married (99.7%), with a very small percentage being divorced (0.3%). About 24.4% of the women were illiterate, 64.1% had primary school education, 7.0% had intermediate or secondary school education, and 4.4% had higher education. Additionally, among the husbands, 27.3% were illiterate, 65.7% had primary school education, and 4.1% had intermediate or secondary school education. The vast majority of the participants were unemployed (95.2%), with only 4.4% having paid jobs. Besides, around 59.4% of the husbands were employed, while 40.6% were unemployed. Furthermore, 39.0% of the HHs had neither the woman nor her husband employed, 57.8% had one person employed, and only 2.9% had both employed. The HH sizes ranged widely, from 1 to 32 members, with the most common size being five members. Normal HH sizes (those that are not crowded) constituted 53% of the total HHs, while crowded HHs made up 47%. A significant majority (84.1%) of the HHs had an income less than the average, with only 15.6% having an income within or higher than the average. The majority of the participants were Arab (91.1%), with a smaller proportion being Kurdish (8.9%). The table below depicts the overall sociodemographic characteristics of the sample. Table 4.1 below presents the analysis of sociodemographic variables.

Table 4.1. Sociodemographic characteristics of the participants

Variables		Frequency	Percent (%)	Valid Percent	Cumulative Percent
Age group	**Early reproductive age 14 – 25 y**	153	48.6	48.6	48.6
	Mid-reproductive age 25 – 34 y	111	35.2	35.2	83.8
	Advanced reproductive age 35 – 45 y	51	16.2	16.2	100.0
Governorate of residence	**Aleppo**	168	53.3	53.3	53.3
	Idleb	147	46.7	46.7	100.0
Residence status	**IDP**	275	87.3	87.3	87.3
	Formal residency	40	12.7	12.7	100.0
Marital status	**Divorced**	1	0.3	0.3	0.3
	Married	314	99.7	99.7	100
The education attainment level of the patient	**Illiterate**	77	24.4	24.4	24.4
	Primary school	202	64.1	64.1	88.6
	Intermediate or secondary school	22	7.0	7.0	95.6
	High education	14	4.4	4.4	100.0
The education attainment level of the husband	**Illiterate**	86	27.3	28.1	28.1
	Primary school	207	65.7	67.6	95.8
	Intermediate or secondary school	13	4.1	4.2	100.0
	High education	0	0	0	100.0
The employment status of the patient	**Unemployed**	300	95.2	95.5	95.5
	Paid job	14	4.4	4.5	100.0
The employment status of the husband	**Unemployed**	128	40.6	40.6	40.6
	Paid job	187	59.4	59.4	100.0
The employment status of the patient and husband	**None of them is employed**	123	39.0	39.2	39.2
	One of them is employed	182	57.8	58.0	97.1
	Both are employed	9	2.9	2.9	100.0
HH size	**Normal HH**	167	53.0	53.0	53.0
	Crowded HH	148	47.0	47.0	100.0
HH monthly income	**HH monthly income is less than the average**	265	84.1	84.4	84.4
	HH monthly income is less than the average	49	15.6	15.6	100.0
Ethnicity	**Arab**	287	91.1	91.1	91.1
	Kurd	28	8.9	8.9	100.0

4.1.1.1. Age

A total of 315 pregnant women consented to participate in this study. The minimum age of participants was 14 years, and the maximum age was 45 years. The average and median of the participants' ages were 26 and 25 years, respectively. A total of 19 participants were below the age of 18 (6%). Additionally, the majority of participants were from the early reproductive phase group (ages between 14 and <25 years) (48.6%), followed by the mid-reproductive age group (ages between 25 and <35 years) (35.2%), and lastly the advanced reproductive phase group (ages between 35 and <45 years) (16.2%). The data suggests that a remarkable proportion of patients from both Aleppo and Idleb are in the *e*arly *r*eproductive *age* (14-25 years). Specifically, 42.3% of patients from Aleppo and 55.8% from Idleb fall into this age group, indicating a higher concentration of younger patients in Idleb compared to Aleppo. In the Mid-Reproductive Phase (25-34 years), Aleppo has a slightly higher percentage (37.5%) compared to Idleb (32.7%). This suggests a relatively equal distribution of patients in this age group across both locations, with Aleppo having a slightly higher proportion. For the *a*dvanced *r*eproductive *age* (35-45 years), Aleppo also has a higher percentage (20.2%) compared to Idleb (11.6%). This shows that Aleppo

has a more balanced distribution of patients across all reproductive age groups, while Idleb has a stronger bias towards the younger demographic.

In general, the combined data showed a predominance of younger patients (14-25 years) in both locations, accounting for 48.6% of the total sample. Mid-reproductive patients constitute 35.2% of the population, and those in the advanced reproductive age group make up the smallest group at 16.2%. Table 4.2 depicts the distribution of participants across the location of residence and reproductive age groups.

Table 4.2. The distribution of participants disaggregated by government of residence

			Age groups			
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	Total
The address of the patient	Aleppo	N	71	63	34	168
		%	42.3%	37.5%	20.2%	100.0%
	Idleb	N	82	48	17	147
		%	55.8%	32.7%	11.6%	100.0%
Total		N	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

The patients were equally selected from the four health facilities that are distributed in four communities, Afrin and Raju in Aleppo governorate and Qah and Dana in Idleb governorate, as shown in Table 4.3.

Table 4.3. Distribution of participants across governorates and location of health facilities and reproductive age groups

Address			Age groups			Total
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	
Afrin	Aleppo	N	37	32	16	85
		%	43.5%	37.6%	18.8%	100.0%
	Total	N	37	32	16	85
		%	43.5%	37.6%	18.8%	100.0%
Raju	Aleppo	N	34	31	18	83
		%	41.0%	37.3%	21.7%	100.0%
	Total	N	34	31	18	83
		%	41.0%	37.3%	21.7%	100.0%
Dana	Idleb	N	39	22	11	72
		%	54.2%	30.6%	15.3%	100.0%
	Total	N	39	22	11	72
		%	54.2%	30.6%	15.3%	100.0%
Qah	Idleb	N	43	26	6	75
		%	57.3%	34.7%	8.0%	100.0%
	Total	N	43	26	6	75
		%	57.3%	34.7%	8.0%	100.0%
Total	Aleppo	N	71	63	34	168
		%	42.3%	37.5%	20.2%	100.0%
	Idleb	N	82	48	17	147
		%	55.8%	32.7%	11.6%	100.0%
	Total	N	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

When combining the data by governorate, Idleb shows a higher proportion of women in the early reproductive phase (55.8%) compared to Aleppo (42.3%). Conversely, Aleppo has a higher proportion of women in the advanced reproductive age (20.2%) than Idleb (11.6%).

4.1.1.2. Governorate of Residence

The data analysis showed that the patients were equally distributed between the two governorates, with 53.3% of them from Aleppo and 46.7% from Idleb. In fact, all the Kurdish participants were from Aleppo governorate. The patients were selected from four health facilities located in the four mentioned communities in the two governorates, as shown in Table 4.4 below.

Table 4.4. The distribution of patients according to the location of health facilities

		Frequency	Percent (%)
Community	**Afrin – Aleppo**	85	27.0
	Dana – Idleb	72	22.9
	Qah – Idleb	75	23.8
	Raju – Aleppo	83	26.3
	Total	315	100.0

4.1.1.3. Residency Status

The data show that the majority of participants (275 participants = 87.3%) were IDPs living in informal residential settings such as tents and collective centers. Table 4.5 below shows a table of age groups and residency status of the participants.

Table 4.5. A cross-tabulation of reproductive age groups and residency status

			Age groups				X^2 p value
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	Total	1,924 3,82
The residency status of the patient	**IDP**	**N**	133	100	42	275	
		%	48.4	36.4	15.3	100.0	
	formal residency	**N**	20	11	9	40	
		%	50.0%	27.5%	22.5%	100.0%	
Total		**N**	153	111	51	315	
		%	48.6%	35.2%	16.2%	100.0%	

The distribution of participants across residential settings and age groups shows that the majority of patients in both residency status groups fall into the early reproductive

phase, with 48.4% of IDPs and 50% of those with formal residency. The mid-reproductive age group constitutes the second-largest portion, comprising 36.4% of IDPs and 27.5% of those with formal residency. The smallest group is the advanced reproductive age group (35-45 years), with 15.3% of IDPs and 22.5% of those with formal residency. The data provides valuable insights into the age distribution among patients according to their residency status. It is notable that both groups exhibit a greater concentration of younger individuals in the early reproductive age. However, it is observed that the IDP group demonstrates a larger absolute count but a lower percentage in the advanced reproductive age group when compared to the formal residency group. However, the χ^2 tests confirmed that there is no significant difference between residency status and age groups ($P > 0.05$), indicating that age distribution among patients is similar regardless of whether they are IDPs or have formal residency.

4.1.1.4. Ethnicity

The study on the distribution of participants by age group and ethnicity reveals that among the Arab participants, a total of 287, the majority (49.1%) are in the early reproductive phase. This is followed by 35.5% in the mid-reproductive age group (25-34 years old) and the smallest proportion (15.3%) in the advanced reproductive age group (35-45 years old). Similarly, the Kurdish participants also have a large proportion in the early reproductive age, accounting for 42.9% of their group. However, there is a noticeable difference in the distribution of the remaining age groups. Among the Kurdish participants, 32.1% fall within the mid-reproductive age group, while a higher percentage (25%) are in the advanced reproductive age group compared to their Arab counterparts. The total number of Kurdish participants is 28 (Table 4.6).

Table 4.6. Cross-tabulation of the participants across ethnicity and reproductive age group variables

			Age groups			
			Early reproductive phase 14 – 25 y	**Mid-reproductive age 25 – 34 y**	**Advanced reproductive age 35 – 45 y**	Total
The ethnicity of the participants	**Arab**	**N**	141	102	44	287
		%	49.1%	35.5%	15.3%	100.0%
	Kurdish	**N**	12	9	7	28
		%	42.9%	32.1%	25.0%	100.0%
Total		**N**	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

The statistical analysis of the correlation between ethnicity and age group variables (Table 4.7) shows that while there are variations in the age distribution within each ethnic group, these differences are not statistically significant.

Table 4.7. Chi-square test of the relationship between ethnicity and age group variables

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.763	2	.414
Likelihood Ratio	1.583	2	.453
Linear-by-Linear Association	1.191	1	.275
N of Valid Cases	315		

4.1.1.5. Education Attainment of the Patients

In terms of education, among illiterate patients, the largest proportion is found in the early reproductive age group, accounting for 42.9%, followed by the mid-reproductive age group at 31.2% and the advanced reproductive age group at 26.0%. This indicates that illiteracy is more prevalent among younger patients compared to their older counterparts.

When examining primary school education, 52.0% of patients fall into the early reproductive age group. The mid-reproductive age group represents 35.1%, while the advanced reproductive age group constitutes 12.9%. This suggests that primary education is more common among younger patients, though a noticeable portion is also seen in the mid-reproductive age group.

For those with intermediate or secondary school education, the highest percentage is found in the mid-reproductive age group at 59.1%, followed by 36.4% in the early reproductive age group, with only 4.5% in the advanced reproductive age group. This indicates a critical concentration of patients with intermediate or secondary education in the mid-reproductive age group.

Patients with higher education levels show a relatively balanced but low distribution overall. In the early reproductive age group, 50.0% have higher education, while the advanced reproductive age group accounts for 28.6%, and the mid-reproductive age group has 21.4%. This suggests that higher education levels are not predominantly skewed towards any particular age group but are less common across all groups (Table 4.8).

Table 4.8. The distribution of participants across education attainment and reproductive age group variables

			Age groups				
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	Total	P
The education level of the patient	Illiterate	N	33	24	20	77	0,017
		%	42.9%	31.2%	26.0%	100.0%	
	Primary school	N	105	71S	26	202	
		%	52.0%	35.1%	12.9%	100.0%	
	intermediate or secondary school	N	8	13	1	22	
		%	36.4%	59.1%	4.5%	100.0%	
	high education	N	7	3	4	14	
		%	50.0%	21.4%	28.6%	100.0%	
Total		N	153	111	51	315	
		%	48.6%	35.2%	16.2%	100.0%	

The cross tabulation and χ^2 test reveal a significant difference between the education levels of patients and their age groups ($p = 0.017$). Illiteracy and primary school education are more prevalent among younger patients, while intermediate or secondary education is concentrated in the mid-reproductive age group. Higher education levels are uniformly low across all age groups (Table 4.9).

Table 4.9. Chi-square test of the relationship between education attainment and reproductive age group variables

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.449	6	.017
Likelihood Ratio	14.942	6	.021
Linear-by-Linear Association	.919	1	.338
N of Valid Cases	315		

The analysis of the participants' educational attainment in relation to their residency status (host and IDPs), as shown in (Table 4.10), reveals a prevailing trend of primary school education among both groups, with a noticeably higher percentage among formal residents. This may indicate that formal residents have better access to primary education compared to IDPs. The slight increase in higher education among IDPs could be indicative of targeted educational interventions or scholarships for displaced individuals.

Table 4.10. The distribution of the participants across education attainment and residency status variables

			The residency status of the patient			
			IDP	formal residency	Total	P
The education level of the patient	Illiterate	N	69	8	77	0,795
		%	89.6%	10.4%	100.0%	
	Primary school	N	174	28	202	
		%	86.1%	13.9%	100.0%	
	intermediate or secondary school	N	19	3	22	
		%	86.4%	13.6%	100.0%	
	high education	N	13	1	14	
		%	92.9%	7.1%	100.0%	
Total		N	275	40	315	
		%	87.3%	12.7%	100.0%	

Table 4.11 below shows the result of the Pearson χ^2 test (p = 0.795), which suggests that there is no statistically significant difference between the patients' residency status and their education level, given that the p-value is higher than the conventional threshold of 0.05. This fact is supported by the Likelihood Ratio and Linear-by-Linear Association tests, with p-values of 0.777 and 0.917, respectively. Additionally, the analysis highlights that 25.0% of the cells have an expected count of less than 5, with the lowest expected count being 1.78. This low expected count could potentially impact the reliability of the χ^2 test.

Table 4.11. Chi-square test of the relationship between education attainment and residency status variables

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.024	3	.795
Likelihood Ratio	1.102	3	.777
Linear-by-Linear Association	.011	1	.917
N of Valid Cases	315		

When studying the data related to education levels and governorate of residence, we found a significantly higher proportion of patients are illiterate in Aleppo, with 64.9% compared to 35.1% in Idleb. This disparity indicates that Aleppo has a larger population of patients who lack literacy skills. Regarding primary school education, patients are more evenly distributed, with 52.5% in Aleppo and 47.5% in Idleb. This suggests a relatively balanced presence of individuals with primary school education in both locations. Patients with intermediate or secondary school education are equally distributed between Aleppo and Idleb, with each location accounting for 50% (Figure 6). This equality suggests no particular preference for one location over the other among patients with this level of education.

However, there is a remarkable contrast in the distribution of patients with higher education.

In Idleb, 92.9% of patients have higher education, whereas only 7.1% of patients in Aleppo fall into this category. This significant disparity highlights that Idleb has a much higher proportion of highly educated patients compared to Aleppo.

The χ^2 test revealed a significant difference between the education level of patients and their residential addresses in Aleppo and Idleb (p = 0.001). Specifically, Aleppo has a

higher proportion of illiterate patients, while Idleb has a remarkably higher proportion of patients with higher education.

In addition, the data reveals that Arabs are remarkably more represented across all education levels compared to Kurds. This inequality is particularly evident at the higher education level, where no Kurdish patients are accounted for. Nevertheless, the χ^2 tests indicate that the difference between education level and ethnicity is statistically insignificant ($p > 0.05$). Consequently, although there seems to be a tendency in the distribution of education levels among ethnic groups, this pattern is insignificant.

When analyzing the education data of husbands, we found noticeable disparities in the distribution of husbands' educational attainment levels between the two areas. Specifically, a greater percentage of husbands in Aleppo were without formal education, whereas Idleb demonstrates a considerably higher proportion of husbands with intermediate or secondary education. Conversely, the distribution of husbands with primary school education appears to be relatively equitable across both regions.

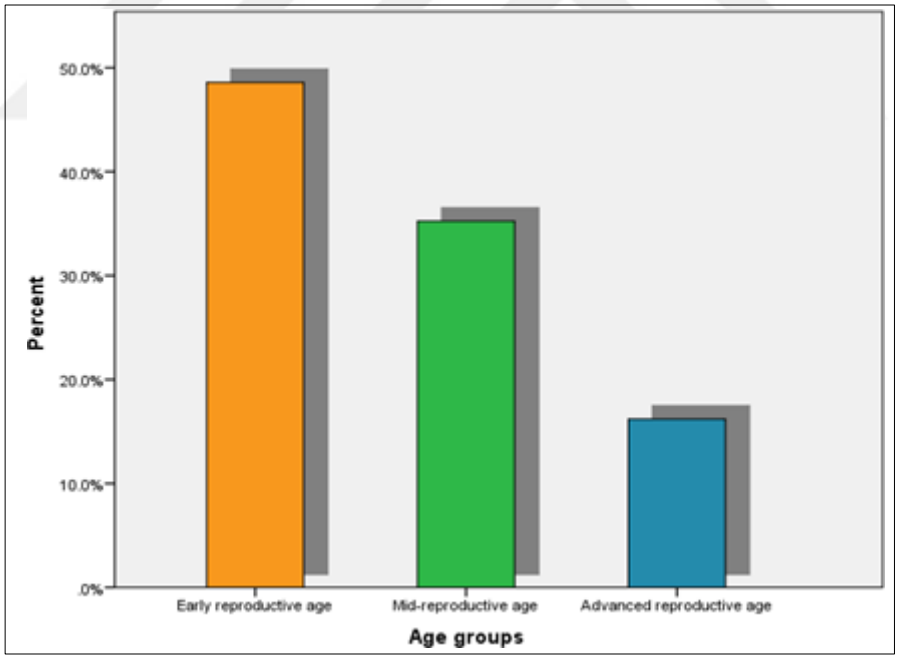


Figure 4.1. Distribution of reproductive age groups of participants

4.1.1.6. Education Attainment of Spouses

In a sample of 315 cases, 86 individuals (27.3%) are illiterate, indicating that more than a quarter of the population has no formal education, which could impact their

socioeconomic status and opportunities. The majority, 207 individuals (65.7%), have completed primary school, represented the largest category and suggested that most of the population has attained at least a basic level of education. Only 13 individuals (4.1%) have completed intermediate or secondary school. The smallest category, with just 9 individuals (2.9%), consists of those who have completed university education or higher, highlighting the very limited portion of the population with advanced education (Figure 4.2).

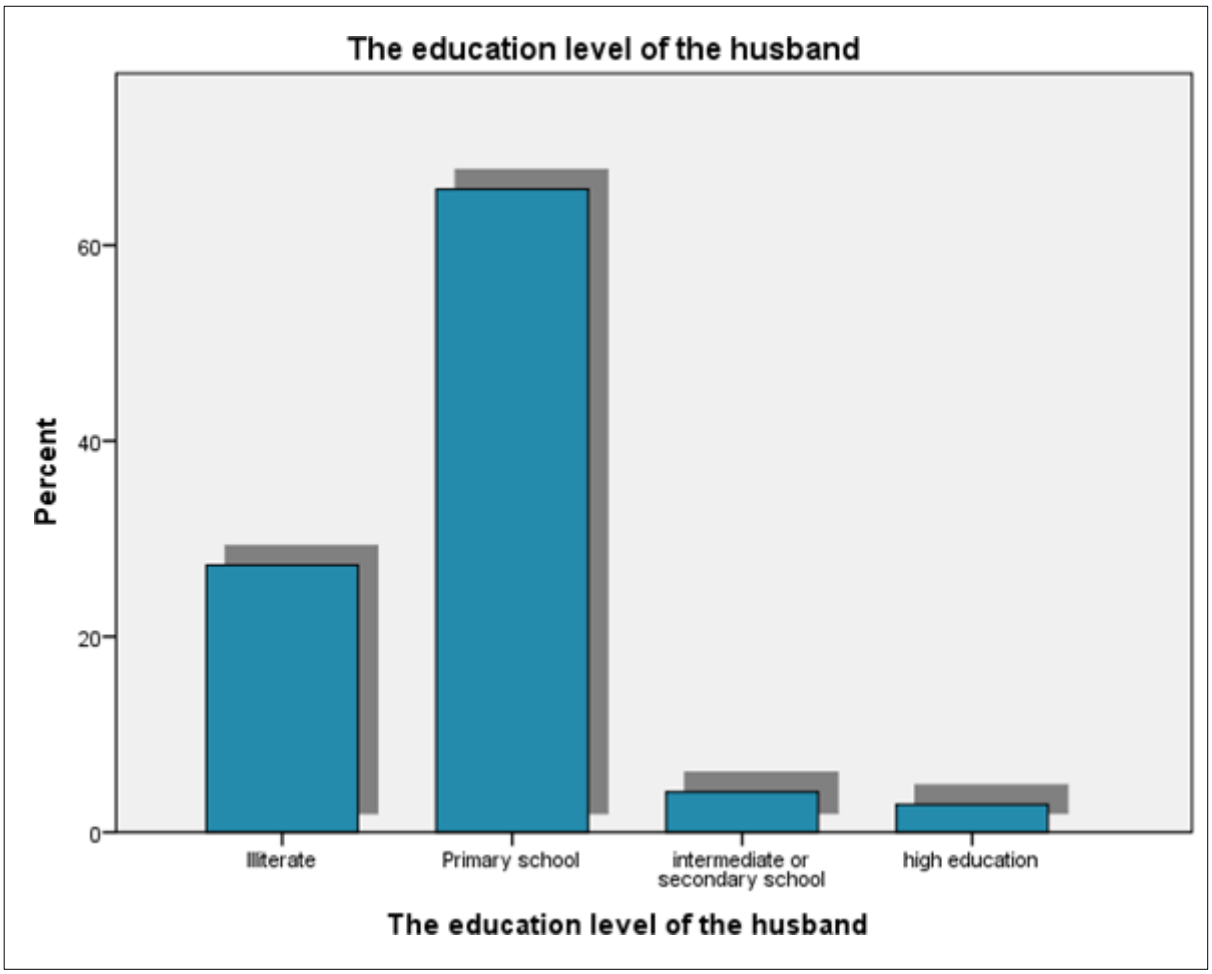


Figure 4.2. The distribution of the patient

Additionally, we found that in Aleppo, a higher proportion of both patients and their husbands are illiterate compared to Idleb. Specifically, 64.9% of patients and 59.3% of their husbands in Aleppo are illiterate, indicating that illiteracy might be more prevalent among female patients (Figure 4.3).

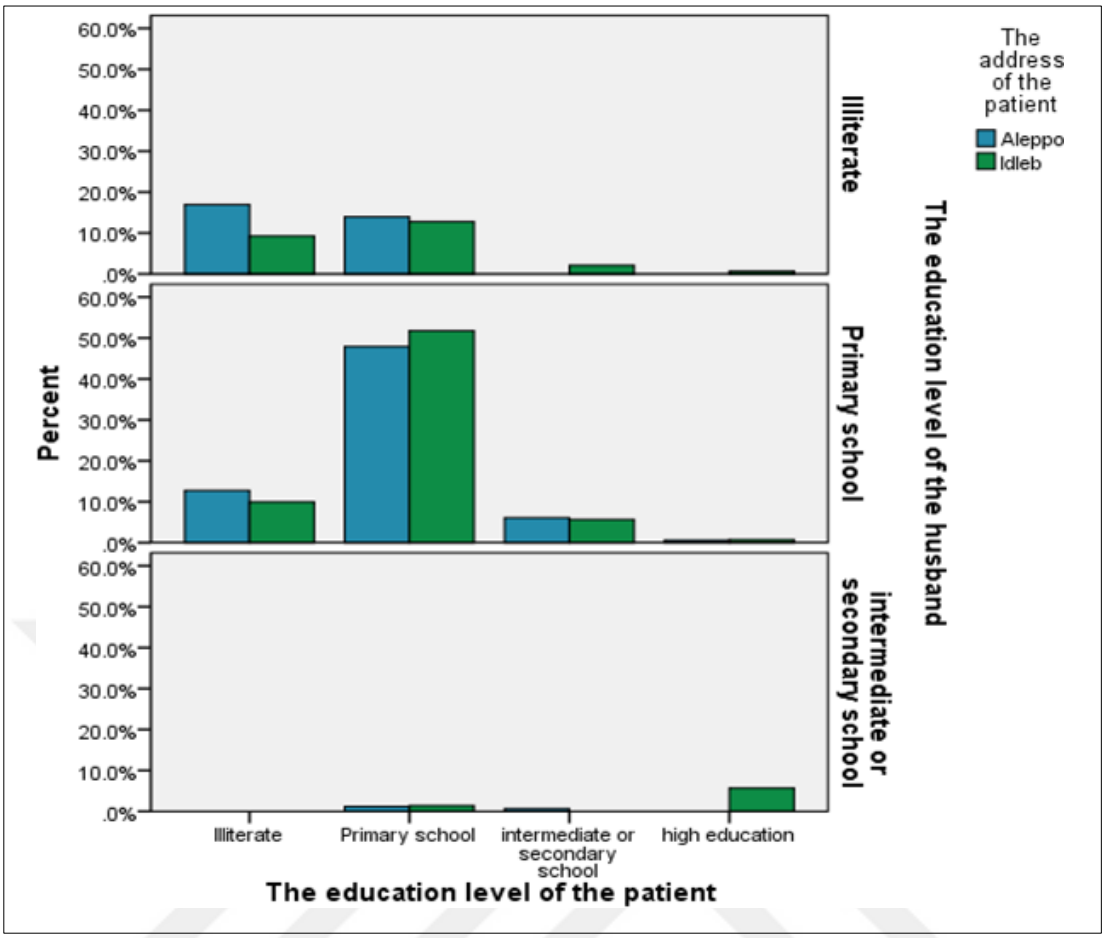


Figure 4.3. The education level of the patient

The distribution of primary school education is very similar for both patients and their husbands, with an almost even split between Aleppo and Idleb. This consistency suggests that primary education levels are relatively uniform between genders and locations.

For intermediate or secondary school education, patients are equally distributed between Aleppo and Idleb, with each location accounting for 50%. However, there is a notable difference among their husbands: 76.9% of those in Idleb have attained this education level, compared to only 23.1% in Aleppo. This indicates that men in Idleb are more likely to achieve secondary education than those in Aleppo, while women show an equal distribution between the two locations.

Higher education among patients is predominantly found in Idleb, with 92.9% of those with higher education residing there. Although data for husbands is not provided for this category, the significant skew towards Idleb for female patients with higher education is noteworthy.

4.1.1.7. Employment Status

The employment and unemployment rates among the participants were very concerning and referred to high levels of lack of resources and income in both regions. In Aleppo, out of a total of 168 patients, there were 166 individuals without paid employment, constituting a striking 98.8% of the patient population. Only 1.2% of the patients were employed. In Idleb, while the situation is comparatively better, it remains a cause for concern. Out of 146 patients, there were 134 individuals, accounting for 91.8% of the patient cohort, are unemployed. Conversely, there were 12 patients, or 8.2%, who held paid jobs. A comprehensive analysis of the aggregated data from both regions showed that 300 patients were unemployed, representing 95.5% of the overall patient population (Table 4.12).

Table 4.12. The distribution of the patients according to governorate and occupation

			The address of the patient		
			Aleppo	**Idleb**	**Total**
The employment status of the patient	**Unemployed**	**N**	166	134	300
		%	55.3%	44.7%	100.0%
	Paid job	**N**	2	12	14
		%	14.3%	85.7%	100.0%
Total		**N**	168	146	314
		%	53.5%	46.5%	100.0%

4.1.1.8. Household Size

Among HHs with monthly incomes below the average, 60.4% are located in Aleppo, while 39.6% are in Idleb (Figure 4.4). These figures suggest that a larger proportion of low-income HHs are in Aleppo. Conversely, for HHs with monthly incomes at or above the average, 14.3% are in Aleppo, whereas 85.7% are in Idleb, indicating that higher-income HHs are predominantly in Idleb. The χ^2 test results in (Table 4.13) indicate a statistically significant difference between the monthly income level of HHs and their geographical location. The very low p-values (<0.05) across multiple tests suggest that the observed association is not due to chance.

Table 4.13. Chi-square test of the relationship between governorate of residence and monthly income variables

	Value	**Df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	5.284	1	.000		
Continuity Correction	3.457	1	.000		
Likelihood Ratio	7.961	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	35.172	1	.000		

N of Valid Cases	314

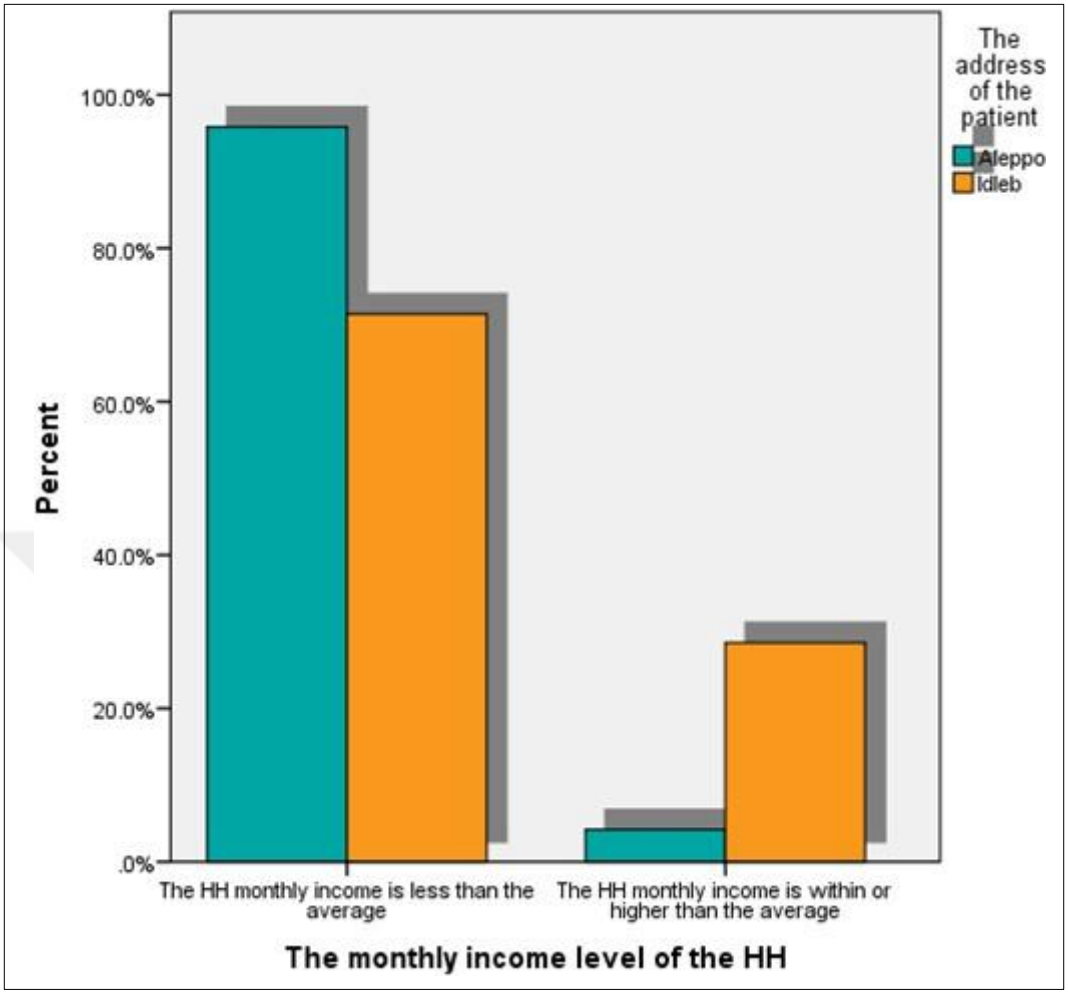


Figure 4.4. The distribution of the participants' HHs according to the level of monthly income and governorates

Nevertheless, the difference between the monthly income level of the HH and residency status was insignificant, as shown in Table 4.14 ($p > 0.05$).

Table 4.14. Chi-square test of the correlation between HH income level and residency status

	Value	D	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.672	1	.412		
Continuity Correction	.344	1	.557		
Likelihood Ratio	.634	1	.426		
Fisher's Exact Test				.483	.270
Linear-by-Linear Association	.670	1	.413		

4.1.1.9. Household Income

The relationship between the monthly income level of HH and the residency status of participants is shown in table 17. Among the HHs with a monthly income less than the average, 265 HHs were analyzed. Of these, 233 patients (87.9%) are IDPs, while 32 patients (12.1%) have formal residency. This indicates that the majority of HHs with a lower monthly income are more likely to include IDPs. For HHs with a monthly income within or higher than the average, 49 HHs were considered. Among these, 41 patients (83.7%) are IDPs, and 8 patients (16.3%) have formal residency. While the majority of HHs in this income bracket are still IDPs, there is a slightly higher percentage of formal residents compared to HHs with income below the average. However, the statistical analysis reveals that there is no significant difference between the monthly income level of HHs and the residency status of patients.

Table 4.15. The distribution of HH monthly income level and the patients' residency status variables

			The residency status of the patient		
			IDP	**formal residency**	**Total**
The monthly income level of the HH	**The HH monthly income is less than the average**	**N**	233	32	265
		%	87.9%	12.1%	100.0%
	The HH monthly income is within or higher than the average	**N**	41	8	49
		%	83.7%	16.3%	100.0%
Total		**N**	274	40	314
		%	87.3%	12.7%	100.0%

A significant difference was found between the two variables when studying the relationship between the education attainment level and the monthly income level of the HH, as shown in Table4.18. Among HHs with a monthly income less than the average, the majority of cases have only a primary school education. Specifically, 177 patients (66.8%) fall into this category. A smaller group, 69 patients (26.0%), are illiterate, while 15 patients (5.7%) have attained an intermediate or secondary school level. Only a very small proportion of the subjects (1.5%) have higher education (Table 4.16).

Table 4.16. The distribution of participants according to their education attainment level and HH monthly income variables

			The education level of the patient					X^2 p value
			Illiterate	**Primary school**	**intermediate or secondary school**	**high education**	**Total**	**41,477 0,001**
The monthly income level of the HH	**The HH monthly income is less than the average**	N	69	177	15	4	265	
		%	26.0%	66.8%	5.7%	1.5%	100.0%	

	The HH monthly income is within or higher than the average	N	7	25	7	10	49
		%	14.3%	51.0%	14.3%	20.4%	100.0%
Total		N	76	202	22	14	314
		%	24.2%	64.3%	7.0%	4.5%	100.0%

In contrast, among HHs with a monthly income within or higher than the average, there is a notable difference in the educational levels. Only 14.3% of the participants in this group are illiterate. The majority, 25 patients (51.0%), completed primary school, while 14.3% of the participants have reached an intermediate or secondary school level. Additionally, this group also includes a higher proportion of patients with higher education (20.4%).

This analysis, shown in Table 4.17. below, reveals a clear correlation between HH income and educational attainment ($p < 0.05$). HHs with higher incomes tend to have a greater proportion of individuals with higher education, while those with lower incomes are more likely to have only primary school education or be illiterate.

Confounding these variables with the independent variable of the educational attainment level of the husband reveals a noteworthy correlation between the education attainment level of both patients and husbands and their respective monthly income levels. It is observed that higher levels of education are linked to higher income levels, with this relationship being particularly pronounced among individuals in the primary and intermediate or secondary school categories. The p-value below 0.05 refers to a significant difference between these variables (Table 4.17).

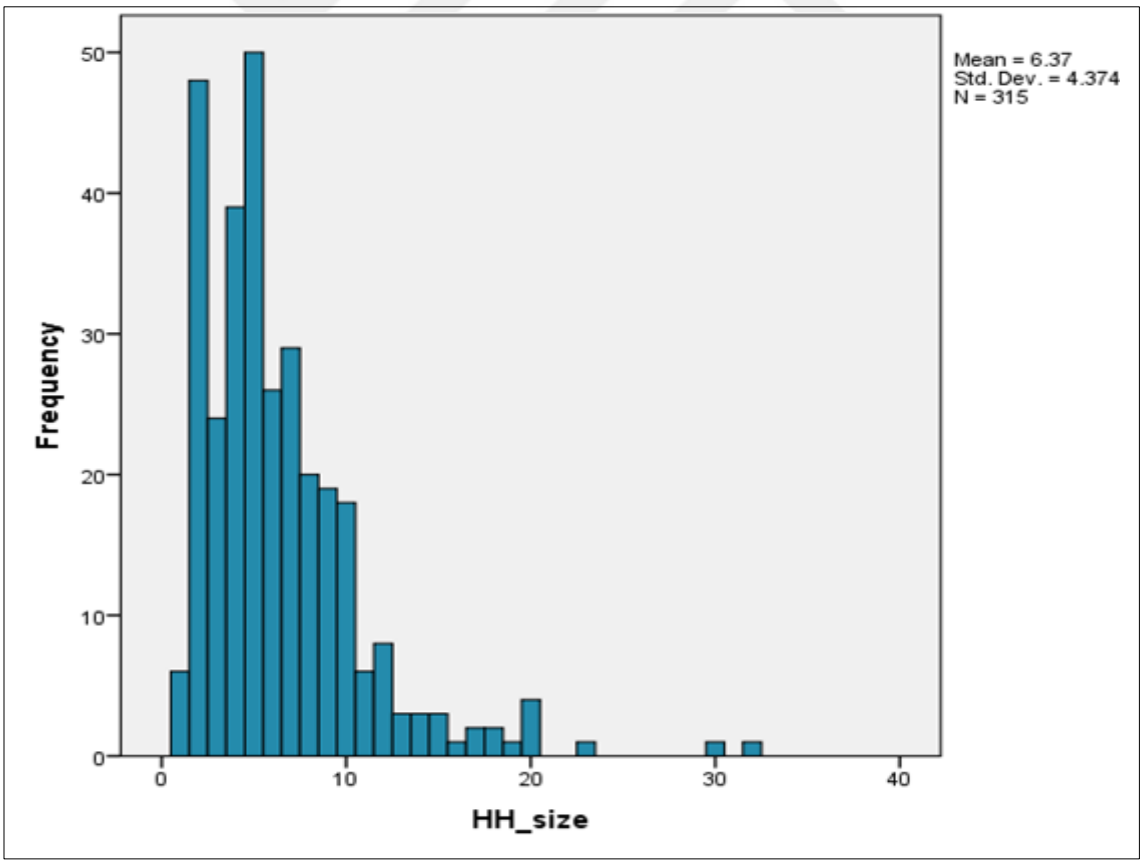
Table 4.17. Chi-square test of the correlation between education attainment level among the participants and their husbands and the monthly HH income level

The education level of the husband		**Value**	**DF**	**Asymp. Sig. (2-sided)**
Illiterate	**Pearson Chi-Square**	2.665	3	.446
	Likelihood Ratio	1.767	3	.622
	Linear-by-Linear Association	.312	1	.576
	N of Valid Cases	85		
Primary school	**Pearson Chi-Square**	16.389	3	.001
	Likelihood Ratio	12.101	3	.007
	Linear-by-Linear Association	8.117	1	.004
	N of Valid Cases	207		
intermediate or secondary school	**Pearson Chi-Square**	9.479	2	.009
	Likelihood Ratio	11.917	2	.003
	Linear-by-Linear Association	8.100	1	.004
	N of Valid Cases	13		
Total	**Pearson Chi-Square**	46.784	3	.000
	Likelihood Ratio	32.240	3	.000

	Linear-by-Linear Associa tion	29.028	1	.000
	N of Valid Cases	305		

The analysis of HH sizes revealed that the average HH comprised 6.37 individuals. The median HH size was 5, indicating that half of the HH have five or fewer members, while the other half have more than five. The most frequently occurring HH size was also 5. HH sizes varied noticeably, ranging from a minimum of 1 to a maximum of 32 members (Figure 4.5), indicating a wide diversity in HH compositions. Normal-sized HHs constituted 53% of the total, with 167 HHs falling under this category. Crowded HHs, on the other hand, represented 47% of the sample, totaling 148 HHs. This distribution showed a nearly balanced split between normal-sized and crowded HHs.

The relationship analysis between the HH size categories and income level variables showed a strong correlation with a p-value < 0.05. Crowded HHs are much more likely to have incomes below the average compared to normal-sized HHs. However, the difference between the HH size categories and ethnicity was insignificant, with a p-value = 0.445.



. Figure 4.5. The frequency of HH size

4.1.2. Anthropometric Measurements

Summary statistics for weight showed that the participants' weights ranged from 46 kg to 108 kg. The most common weight was 55 kg, while the median weight was 64 kg. The mean weight is approximately 65.21 kg, with a standard deviation of SD = 12.05 kg, suggesting moderate variability in the weights of the participants. The frequency distribution showed that 50% of participants weighed between 56 kg and 71 kg, with smaller groups at the extreme ends. The weights showed a gradual distribution with no large spikes, indicating a relatively even spread of weights among the participants. Cumulatively, 10.5% of participants weighed 50 kg or less, about 22.9% weighed 55 kg or less, 52.7% weighed 64 kg or less, 73.7% weighed 70 kg or less, and nearly 85.4% weighed 78 kg or less. The upper 15% of participants weighed more than 78 kg, with the maximum weight being 108 kg (Figure 4.5).

The participants' heights ranged from 137 cm to 178 cm, as depicted in table 3. The most common height was 156 cm, and the median height was 158 cm. The mean height was approximately 158.25 cm, with SD = 6.41 cm, indicating moderate variability in participants' heights. The frequency distribution showed that most participants' heights fell between 154 cm and 163 cm, comprising the central 50% of the data. Fewer participants were at the extreme ends, with very few heights below 145 cm or above 170 cm. The height distribution showed a higher concentration of participants around the mean, indicating a relatively normal distribution with slight variation. Cumulatively, 12.4% of participants were 150 cm or shorter, 28.3% were 154 cm or shorter, 48.6% were 157 cm or shorter, 65.1% were 160 cm or shorter, and approximately 90.2% were 166 cm or shorter. The upper 10% of participants were taller than 166 cm, with the maximum height being 178 cm (Figure 4.6).

Table 4.18. Summary statistics of the participant's height and weight variables

		Weight	Height
N	**Valid**	315	315
	Missing	0	0
Mean		65.2127	158.2508
Median		64.0000	158.0000
Mode		55.00	156.00
Std. Deviation		12.05174	6.41336
Minimum		46.00	137.00
Maximum		108.00	178.00
Sum		20542.00	49849.00
Percentiles	**25**	56.0000	154.0000
	50	64.0000	158.0000

75	71.0000	163.0000

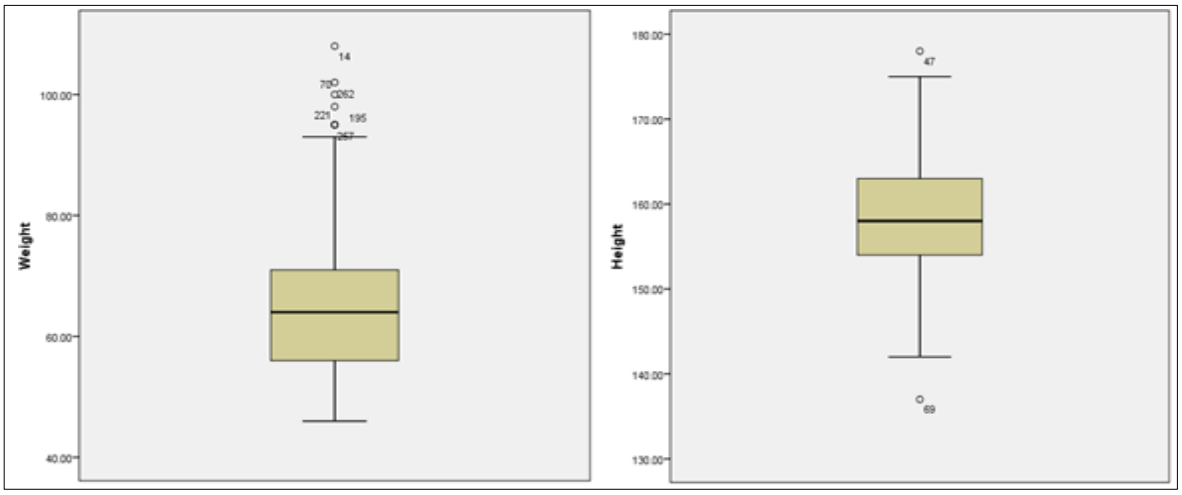


Figure 4.6. Boxplot diagrams of the participants' weight and height with the outlier values

4.1.3. Food Groups and Dietary Habits

In this part of our study, we studied the statistical correlation between these groups and the independent variables using multinomial regression analysis to discover the best-fitting model. Table 4.19 below shows the food groups.

Table 4.19. Food Groups

Group 1 **(**Cereals, wheat**)**	Rice		Corn
	Pasta		Oats
	Bread		other tubers
	Bulgur		
Group 2 Legumes	Beans		Lentils
	Peas		Chickpeas
	fava beans		
Group 3 Nuts and seeds	Pistachios		Hazelnuts
	Sesame		Sesame tahini
	Sunflower		Peanuts
	seeds (watermelon, pumpkin)		Nut
	Almonds		
Group 4 Vegetables and fruits rich in vitamin A	Apricots		Carrots
	Peaches		Pumpkins
	Melons		Peppers
Group5 Dark green leafy vegetables	Spinach		Parsley
	Chard		Mint
	Mulukhiyah		Watercress
	Lettuce		
Group 6 Other types of vegetables and fruits	Apple	Strawberry	Eggplant
	Orange	Fig	Cauliflower
	Banana	Tomato	Cabbage
	Manga	Cucumber	Mushroom
	Pomegranate	Radish	Onions
	Pear	Potatoes	Garlic
	Kiwi	Zucchini	Lemon
	Olive	Black olive	

Group 7 Milk and its derivatives	Cheese	
	Yogurt	
	Dried labne	

4.1.3.1. Food Group 1

The data about this food group reveals that most participants (90.5%) consume food from Group 1 at a moderate frequency of three times a month. This percentage is among the highest three rates compared with other food groups. A minority of participants consume it either less frequently (1%) (less than three times a month) or more frequently (8.6%) (more than three times a month).

4.1.3.2. Food Group 2

The data unveils that the monthly consumption rate of the majority of the participants is more than three times a month (82.2%), which is among the highest rates compared with other food groups. This might indicate an adequacy of the food products of this group in Northwest Syria. A total of 40 participants (12.7%) said they consume food from this group three times a month monthly. The data showed that only 5.1% of the participants consumed food from this group less than three times a month.

4.1.3.3. Food Group 3

The data indicates that almost half of the participants consume food from Group 3 at a moderate frequency of three times per month (55.2%), and 32.7% of the sample consumes this food group less frequently (32.7%) (less than three times per month), while the smallest subset consumes it more regularly (12.1%) (more than three times per month).

4.1.3.4. Food Group 4

The vast majority of participants (75.2%) consume food from Group 4 three times a month, making this the predominant frequency of consumption among the group. Additionally, A smaller portion of participants (20.6%) consume food from Group 4 less than three times a month, and a small portion of participants (4.1%) consume food from Group 4 more than three times a month.

4.1.3.5. Food Group 5

The vast majority of participants (95.9%) consume food from Group 5 three times per month, making it as the prevailing frequency of consumption within the group. However, smaller portions of the sample consume food from this group more or less frequently (3.5% and 0.6%, respectively).

4.1.3.6. Food Group 6

While the monthly consumption of the majority of the sample population from food group 6 was at a moderate frequency (85.7%), a small portion of the participants said they consumed food from group 6 less or more frequently (13.7% and 0.6%, respectively).

4.1.3.7. Food Group 7

Data about the monthly consumption from food group 7 showed that only 14.3% of individuals consume food from Group 7 less than three times a month, which represents the smallest fraction of this group. The majority of the sample said that the monthly consumption of food group 7 was at a moderate level (61.9%), and 23.8% said they consume from this group more than three times a month.

Table 4.20. Frequency and percentages of food group consumption

		less than three times a month	three times a month	more than three times a month
Frequency of eating food from group 1	**N**	3	285	27
	%	1.0%	90.5%	8.6%
Frequency of eating food from group 2	**N**	40	259	16
	%	12.7%	82.2%	5.1%
Frequency of eating food from group 3	**N**	103	174	38
	%	32.7%	55.2%	12.1%
Frequency of eating food from group 4	**N**	65	237	13
	%	20.6%	75.2%	4.1%
Frequency of eating food from group 5	**N**	2	302	11
	%	0.6%	95.9%	3.5%
Frequency of eating food from group 6	**N**	43	270	2
	%	13.7%	85.7%	0.6%
Frequency of eating food from group 7	**N**	45	195	75
	%	14.3%	61.9%	23.8%

4.1.3.8. The Cumulative Food Uptake

A total of 132 out of 315 cases have low food uptake, representing 41.9% of the sample. Additionally, 151 cases fall into the moderate food uptake category, accounting for 47.9% of the sample. This is the largest category, indicating that nearly half of the population has an adequate but not optimal level of food consumption. Only 32 cases have sufficient food uptake, making up 10.2% of the sample, which suggests that a relatively small portion of the population consumes food at a sufficient level (Table 4.21).

Table 4.21. The overall food consumption rates among the participants

		Frequency	Percent	Valid Percent	Cumulative Percent
The overall food uptake	**Low**	132	41.9	41.9	41.9
	Moderate	151	47.9	47.9	89.8
	Sufficient	32	10.2	10.2	100.0
	Total	315	100.0	100.0	

4.2. Multilinear Correlation Model Between the Overall Food Consumption and the Independent Variables

The multinomial regression analysis between overall food consumption and age groups of the participants showed that age groups do not significantly impact overall food consumption. Cross-tabulation results show that among those with low food consumption, 62 (47.0%) are in the early reproductive age, 41(31.1%) are in the mid-reproductive age, and 29 (22.0%) are in the advanced reproductive age. For moderate food consumption, 71 (47.0%) are in the early reproductive age, 62 (41.1%) are in the mid-reproductive age, and 18 (11.9%) are in the advanced reproductive age. Among those with sufficient food consumption, 20 (62.5%) are in the early reproductive age, 8 (25.0%) are in the mid-reproductive age, and 4 (12.5%) are in the advanced reproductive age (Table 4.22).

Table 4.22. The distribution of the participants across the overall food uptake and age group variables

			Age groups				X^2 p value
			Early reproductive phase 14 – 25 y	**Mid-reproductive age 25 – 34 y**	**Advanced reproductive age 35 – 45 y**	**Total**	**3,452**
The overall food uptake	**Low**	**N**	62	41	29	132	**0,178**
		%	47.0%	31.1%	22.0%	100.0%	
	Moderate	**N**	71	62	18	151	
		%	47.0%	41.1%	11.9%	100.0%	
	Sufficient	**N**	20	8	4	32	
		%	62.5%	25.0%	12.5%	100.0%	
Total		**N**	153	111	51	315	
		%	48.6%	35.2%	16.2%	100.0%	

The χ^2 tests indicate a borderline significant association between food uptake categories and age group, with a Pearson χ^2 value of 9.173 and a p-value of 0.057.

We found different figures by removing the age group variable and replacing it with the governorate of residence variable. The distribution of the patients across the two variables showed that among those with low food consumption, 59.1% reside in Aleppo and 40.9% in Idleb. For moderate food consumption, 53.6% reside in Aleppo and 46.4% in Idleb. Among those with sufficient food consumption, 28.1% reside in Aleppo and 71.9% in Idleb (Table 4.23). The χ^2 tests show a significant association between food uptake categories and governorate of residence, with a Pearson value of 9.934 and a P-value of 0.007.

Table 4.23. The distribution of the participants across the overall food uptake and governorate of residence variables

			The address of the patient		Total	X^2 p value
			Aleppo	Idleb		10,126
The overall food uptake	Low	N	78	54	132	
		%	59.1%	40.9%	100.0%	0,006
	Moderate	N	81	70	151	
		%	53.6%	46.4%	100.0%	
	Sufficient	N	9	23	32	
		%	28.1%	71.9%	100.0%	
Total		N	168	147	315	
		%	53.3%	46.7%	100.0%	

The model fitting information showed that the χ^2 value of 10.126 and a p-value of 0.006 indicates that adding the governorate of residence variable significantly improves the model fit. The R-Square (R^2) values of 0.037 indicated that the model explains a modest portion of the variance in overall food consumption (Table 4.23). Besides, the likelihood ratio tests revealed that the governorate of residence is a significant predictor of food consumption categories.

Parameter estimates showed that for low food consumption, the intercept has a B value of 3.465 and a p-value less than 0.05, indicating a significant effect. The coefficient for the governorate of residence variable is -1.306 (Exp(B) = 0.271, 95% CI (0.116 – 0.631), p = 0.002), indicating that residents of Idleb are significantly less likely to have low food consumption compared to residents of Aleppo. For moderate food consumption, the intercept is significant, with a B value of 3.281 and a p-value < 0.05. The coefficient for the governorate of residence variable is -1.084 (Exp(B) = 0.338, 95% CI (0.147 – 0.779), p = 0.011), indicating that residents of Idleb are significantly less likely to have moderate food consumption compared to residents of Aleppo (Table 4.24)

Table 4.24. Multinomial regression analysis of the correlation model between the overall food uptake and governorate of residence. Reference group: Sufficient

The categorical scale of food uptake		B	Std. Error	Wald	DF	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Low	Intercept	3.465	.747	21.533	1	.000			
	Gov of residence	-1.306	.431	9.174	1	.002	.271	.116	.631
Moderate	Intercept	3.281	.743	19.522	1	.000			
	Gov of residence	-1.084	.426	6.487	1	.011	.338	.147	.779

Adding the residency status variable to the model significantly increased the correlation between the overall food uptake dependent variable and the governorate of residency and residency status independent variables. The data showed that among those with low food consumption, 93.9% were IDPs and 6.1% had formal residency. For moderate food consumption, 86.1% were IDPs and 13.9% had formal residency. Among those with sufficient food consumption, 65.6% were IDPs and 34.4% had formal residency (Table 4.25). The χ^2 tests indicated a significant association between food uptake categories and residency status, with a Pearson value of 19.008 and a p-value < 0.05.

Table 4.25. Chi-square test of the correlation between the overall food uptake and residency status variables

			The residency status of the patient		Total	X2
			formal residency	IDP		p value
The overall food uptake	Low	N	8	124	132	35,273
		%	6.1%	93.9%	100.0%	
	Moderate	N	21	130	151	0,322
		%	13.9%	86.1%	100.0%	
	Sufficient	N	11	21	32	
		%	34.4%	65.6%	100.0%	
Total		N	40	275	315	
		%	12.7%	87.3%	100.0%	

The χ^2 value of 35.273 and a p-value less than 0.05 indicated that adding the governorate of residency and residency status variables significantly improved the model fit. The goodness-of-fit tests (p = 0.322) suggested that the model fits the data significantly. The R^2 value of 0.125 indicated that the model explains a modest portion of the variance in overall food consumption.

Cross-tabulation results of the case distribution across the overall food consumption and education attainment level showed that among those with low food consumption, 27.3% were illiterate, 66.7% had primary education, 3.8% had intermediate or secondary education, and 2.3% had higher education. For moderate food consumption, 25.2% were illiterate, 63.6% had

primary education, 9.3% had intermediate or secondary education, and 2.0% had higher education. Among those with sufficient food consumption, 9.4% were illiterate, 56.3% had primary education, 9.4% had intermediate or secondary education, and 25.0% had higher education (Table 4.26). The χ^2 tests indicated a significant association between food uptake categories and education level, with a Pearson χ^2 value of 41.086 and a p-value less than 0.05.

Table 4.26. Chi-square test of the correlation between the overall food uptake and education attainment variables

			The education level of the patient				Total	X^2 p value
			Illiterate	Primary school	intermediate or secondary school	high education		52,552
The overall food uptake	Low	N	36	88	5	3	132	0,001
		%	27.3%	66.7%	3.8%	2.3%	100.0%	
	Moderate	N	38	96	14	3	151	
		%	25.2%	63.6%	9.3%	2.0%	100.0%	
	Sufficient	N	3	18	3	8	32	
		%	9.4%	56.3%	9.4%	25.0%	100.0%	
Total		N	77	202	22	14	315	
		%	24.4%	64.1%	7.0%	4.4%	100.0%	

Regarding the model fitting information, the χ^2 value of 52.552 and a p-value less than 0.05 indicated that adding the education attainment variable to the previous variables in the correlation model significantly improved the model fit. The goodness-of-fit tests suggested that the model fits the data significantly. The R^2 value of 0.181 indicated that the model explains a modest portion of the variance in overall food consumption.

In the last model, the likelihood ratio tests, shown in Table 4.27, revealed that the governorate of residence ($\chi^2 = 11.400$, $p = 0.003$), residency status ($\chi^2 = 25.175$, $p < 0.05$), and education attainment ($\chi^2 = 17.279$, $p < 0.05$) were significant predictors of food consumption categories.

Table 4.27. The likelihood ratio tests of the model fitting between the overall food uptake dependent variable and the governorate of residency, residency status, and education attainment level independent variables

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	86.576	6.851	2	.033
Gov of residency	91.125	11.400	2	.003
Residency status	104.901	25.175	2	.000
Education attainment	97.004	17.279	2	.000

Parameter estimates show that for low food consumption, the intercept has a B value of 1.079 and a p-value of .361, indicating no significant effect. Additionally, the coefficient for the

education attainment variable was -1.148 (Exp(B) = 0.317, 95% CI (0.180 – 0.560), $p < 0.05$), indicating that higher education attainment is associated with lower odds of having low food consumption. For moderate food consumption, the coefficient for the education attainment variable was -1.001 (Exp(B) = 0.367, 95% CI (0.215 – 0.628), $p < 0.05$), indicating that higher education attainment is associated with lower odds of having moderate food consumption (Table 4.28).

Table 4.28. Multinomial regression analysis of the correlation model between the overall food uptake dependent variable and governorate of residency, residency status, and education attainment independent variables. Reference group: Sufficient

The overall food uptake		B	Std. Error	Wald	DF	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Low	Intercept	1.079	1.181	.835	1	.361			
	Gov of residency	-1.682	.537	9.797	1	.002	.186	.065	.533
	Residency status	2.990	.625	22.906	1	.000	19.879	5.844	67.626
	Patient's education attainment	-1.148	.290	15.715	1	.000	.317	.180	.560
Moderate	Intercept	2.456	1.024	5.747	1	.017			
	Gov of residency	-1.364	.523	6.796	1	.009	.256	.092	.713
	Residency status	1.955	.546	12.839	1	.000	7.066	2.425	20.591
	Patient's education attainment	-1.001	.273	13.412	1	.000	.367	.215	.628

The goodness-of-fit tests suggested that the model fit the data well. The increase in R^2 value from 0.125 in the previous model to 0.181 in the last model values referred to more completeness of the model, which explained a greater portion of the variance in overall food consumption.

Later, we added the education attainment level of the spouse to the model after analyzing their distribution according to this variable and the overall food uptake of the patients, as shown in Table 4.29 below.

Table 4.29. The distribution of the spouses according to their education attainment level and the overall food consumption of the patients

			The education level of the husband				Total	X^2 p value
			Illiterate	Primary school	intermediate or secondary school	high education		24,600 0,001
The overall food uptake	Low	N	36	88	3	5	132	
		%	27.3%	66.7%	2.3%	3.8%	100.0%	
	Moderate	N	46	99	4	2	151	
		%	30.5%	65.6%	2.6%	1.3%	100.0%	
	Sufficient	N	4	20	6	2	32	
		%	12.5%	62.5%	18.8%	6.3%	100.0%	

Total	**N**	86	207	13	9	315
	%	27.3%	65.7%	4.1%	2.9%	100.0%

The table above shows that among those with low food consumption, 27.3% of the spouses were illiterate, 66.7% had primary education, 2.3% had intermediate or secondary education, and 3.8% had higher education. For moderate food consumption, 30.5% of the spouses were illiterate, 65.6% had primary education, 2.6% had intermediate or secondary education, and 1.3% had higher education. Among those with sufficient food consumption, 12.5% of the spouses were illiterate, 62.5% had primary education, 18.8% had intermediate or secondary education, and 6.3% had higher education. The χ^2 tests indicated a significant association between food uptake categories and the education level of the husband, with a Pearson value of 24.600 and a p-value less than 0.05.

Nevertheless, the likelihood ratio tests revealed that while the previous indicators were significant predictors of food consumption categories, the education level of the spouse was not a significant predictor (χ^2 = 3.537, p = 0.171). Additionally, parameter estimates shown in Table 4.30 indicated that for low food consumption, the intercept had a B value of 1.250 and a p-value of 0.307, indicating no significant correlation.

Table 4.30. Multinomial regression analysis of the correlation model between the overall food uptake dependent variable and governorate of residency, residency status, and education attainment of the patients' and spouses' independent variables. Reference group: Sufficient

The overall food uptake		**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
Low	**Intercept**	1.250	1.223	1.044	1	.307			
	Gov of residency	-1.624	.536	9.180	1	.002	.197	.069	.564
	Residency status	2.977	.623	22.861	1	.000	19.636	5.794	66.541
	Education attainment (patient)	-1.035	.324	10.231	1	.001	.355	.188	.670
	Education attainment (spouse)	-.247	.366	.456	1	.499	.781	.381	1.600
Moderate	**Intercept**	2.938	1.080	7.407	1	.006			
	Gov of residency	-1.297	.523	6.154	1	.013	.273	.098	.762
	Residency status	1.962	.546	12.932	1	.000	7.116	2.442	20.734
	Education attainment (patient)	-.784	.309	6.434	1	.011	.456	.249	.837
	Education attainment (spouse)	-.557	.361	2.374	1	.123	.573	.282	1.164

We incorporated the employment status of the patient into the model upon excluding the educational attainment level of the spouse. The data revealed that within the group of low food consumption, 95.5% were unemployed, while 4.5% held paid employment. Regarding moderate food consumption, 97.3% were unemployed and 2.7% had paid

employment. As for those with sufficient food consumption, 87.5% were unemployed, while 12.5% held paid employment (Table 4.31).

Table 4.31. The distribution of the spouses according to their education attainment level and the overall food consumption of the patients

			The employment status of the patient		Total
			Unemployed	paid job	
The overall food uptake	Low	N	126	6	132
		%	95.5%	4.5%	100.0%
	Moderate	N	146	4	150
		%	97.3%	2.7%	100.0%
	Sufficient	N	28	4	32
		%	87.5%	12.5%	100.0%
Total		N	300	14	314
		%	95.5%	4.5%	100.0%

The χ^2 tests indicate a borderline significant association between food uptake categories and employment status, with a Pearson value of 5.991 and a p-value of 0.05. However, the likelihood ratio tests revealed that the employment status variable (χ^2 = 1.624, p = 0.444) was not a significant predictor in the model (Table 4.32). In fact, the coefficient for the employment status variable was 0.600 (Exp(B) = 1.822, 95% CI (0.341 – 9.726), p = .483, which is not significant Table 4.33.

Table 4.32. The likelihood ratio tests of the model fitting between the overall food uptake dependent variable and the governorate of residency, residency status, education attainment level of the patient, and employment status of the patient independent variables.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	98.382	6.036	2	.049
Gov of residency	103.873	11.527	2	.003
Residency status	117.507	25.161	2	.000
Education attainment	108.045	15.699	2	.000
Employment status	93.969	1.624	2	.444

Table 4.33. Multinomial regression analysis of the correlation model between the overall food uptake dependent variable and governorate of residency, residency status, education attainment of the patients, and employment status of the patients' independent variables. Reference group: sufficient

The overall food uptake		B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Low	Intercept	1.213	1.218	.993	1	.319			
	Gov of residency	-1.698	.540	9.895	1	.002	.183	.064	.527
	Residency status	2.989	.624	22.925	1	.000	19.864	5.844	67.521
	Education attainment	-1.218	.321	14.440	1	.000	.296	.158	.554
	Employment status	.600	.855	.493	1	.483	1.822	.341	9.726
Moderate	Intercept	2.434	1.066	5.212	1	.022			
	Gov of residency	-1.365	.525	6.744	1	.009	.255	.091	.716

Residency status	1.953	.546	12.798	1	.000	7.049	2.418	20.550
Education attainment	-.984	.303	10.521	1	.001	.374	.206	.677
Employment status	-.275	.858	.103	1	.748	.759	.141	4.081

Adding the employment status of the patient and spouse to the model did not show a significant improvement in the model ($p > 0.05$). Furthermore, the R^2 value of the new model decreased from the last value to 0.182. The χ^2 tests did not show a significant correlation between the employment status of the patient and spouse variable and the overall food consumption variable (Table 4.34).

Table 4.34. Chi-square tests of the correlation between the employment status of the patient and spouse and overall food uptake variables

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	6.149	4	.188
Likelihood Ratio	6.255	4	.181
Linear-by-Linear Association	3.575	1	.059
N of Valid Cases	314		

Later, we added the HH size variable to the model with the variables of the governorate of residence, residency status, and education attainment of the patient. The data showed that among individuals with low food consumption, 18.2% were in HHs of normal size, while 81.8% resided in crowded HHs. For patients with moderate food consumption, 73.5% resided in HHs of normal size, whereas 26.5% were in crowded HHs. Conspicuously, it was found that among individuals with sufficient food consumption, none of them were in crowded HHs (Table 4.35).

Table 4.35. The distribution of the spouses according to their education attainment level and the overall food consumption of the patients

			The HH size		**Total**	**X^2**
			Normal HH size	**Crowded HH**		**p value**
						189,568
The overall food uptake	**Low**	**N**	24	108	132	0.002
		%	18.2%	81.8%	100.0%	
	Moderate	**N**	111	40	151	
		%	73.5%	26.5%	100.0%	
	Sufficient	**N**	32	0	32	
		%	100.0%	0.0%	100.0%	
Total		**N**	167	148	315	
		%	53.0%	47.0%	100.0%	

The χ^2 tests indicated a significant association between the food uptake category and HH size, with a Pearson χ^2 value of 118.122 and a p-value < 0.05. Besides, the χ^2 value of the model fitting was 189.568, and the p-value was less than 0.05. These values indicated

that adding the governorate of residence, residency status, education attainment, and HH size variables significantly improved the model fit.

The goodness-of-fit tests, including Pearson χ^2 (39.279, p = 0.412), revealed that the model fits the data significantly. The R^2 value of 0.532 indicated that the model explains a substantial portion of the variance in overall food consumption. Additionally, the likelihood ratio tests reveal that the governorate of residence (χ^2= 7.892, p = 0.019), residency status (χ^2 = 36.126, p < 0.05), education attainment (χ^2 = 12.563, p = 0.002), and HH size (χ^2 = 137.016, p < 0.05) are significant predictors of food consumption categories (Table 4.36).

Table 4.36. The likelihood ratio tests of the model fitting between the overall food uptake dependent variable and the go verso rate of residency status, education attainment level of the patient, and HH size variables

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	144.845	49.366	2	.000
Gov of residency	103.371	7.892	2	.019
Residency status	131.604	36.126	2	.000
Education attainment	108.042	12.563	2	.002
HH size	232.494	137.016	2	.000

The coefficient for the HH size variable for low food consumption was 19.710 (Exp(B) = 362953801.926, 95% CI (1.9 X 108 – 6.6 X 108) p < 0.05), indicating that having a crowded HH size was significantly associated with higher odds of low food consumption. For moderate food consumption, the coefficient value for the HH size variable was not shown in the analytical test because there were some sub-categories with zero values, as mentioned before (Table 4.37).

Table 4.37. Multinomial regression analysis of the correlation model between the overall food uptake dependent variable and governorate of residency, residency status, education attainment of the patients, and HH size independent variables. Reference group: sufficient

The overall food uptake		B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Low	Intercept	-23.661	1.672	200.371	1	.000			
	Gov of residency	-1.577	.646	5.955	1	.015	.207	.058	.733
	Residency status	4.487	.818	30.067	1	.000	88.834	17.868	441.656
	Education attainment	-1.007	.344	8.546	1	.003	.365	.186	.718
	HH size	19.710	.310	4046.785	1	.000	3.6×10^8	1.9×10^8	6.6×10^8

	Intercept	-16.155	1.162	193.402	1	.000			
	Gov of residency	-1.470	.592	6.161	1	.013	.230	.072	.734
Moderate	**Residency status**	2.689	.667	16.264	1	.000	14.716	3.983	54.366
	Education attainment	-.938	.282	11.090	1	.001	.391	.225	.680
	HH size	16.972	.000	.	1	.	2.3×10^8	2.3×10^8	2.3×10^8

The increased value o R^2 (0.532) indicated that the expanded model explained a substantial portion of the variance in overall food consumption compared to the last model.

In order to further explore the quantitative figures related to the absence of cases with sufficient food consumption living in crowded HHs, we conducted a cross-tabulation analysis (Table 4.38), and we found that all the cases living in crowded HHs, regardless of other variables, have limited access to sufficient food.

Table 4.38. Cross-tabulation of the cases according to the overall food uptake, governorate of residence, residency status, and HH size

Variables						**The overall food uptake**		
						Low	**Moderate**	**Sufficient**
The HH size	**Normal HH size**	**The residency status of the patient**	**host**	**Gov of residence**	**Aleppo**	0	8	6
					Idleb	0	1	5
			IDP	**Gov of residence**	**Aleppo**	14	45	3
					Idleb	10	57	18
	Crowded HH	**The residency status of the patient**	**host**	**Gov of residence**	**Aleppo**	6	11	0
					Idleb	2	1	0
			IDP	**Gov of residence**	**Aleppo**	58	17	0
					Idleb	42	11	0

In the subsequent phase, the HH income variable was incorporated into the model, revealing that individuals with low food consumption accounted for 4.5% having a monthly income at or above the average, while 95.5% had a monthly income below the average. For individuals with moderate food consumption, 11.9% possessed a monthly income at or above the average, compared to 88.1% with a monthly income below the average. Among those with sufficient food consumption, it was observed that 78.1% had a monthly income at or above the average, whereas 21.9% had a monthly income below the average (Table 4.39).

Table 4.39. The distribution of cases across the overall food consumption and HH monthly income variables

			The monthly income level of the HH		**Total**	**X^2** p value
			The HH monthly income is within or higher than the average	**The HH monthly income is less than the average**		228,061 0,001
The overall food uptake	**Low**	**N**	6	126	132	
		%	4.5%	95.5%	100.0%	
	Moderate	**N**	18	133	151	
		%	11.9%	88.1%	100.0%	
	Sufficient	**N**	25	7	32	

	%	78.1%	21.9%	100.0%
Total	**N**	49	266	315
	%	15.6%	84.4%	100.0%

The χ^2 tests indicate a significant association between food uptake categories and HH income, with a Pearson value of 109.072 and a P-value < 0.05. The χ^2 value of 228.671 and a p-value less than 0.05 indicated that adding the governorate of residence, residency status, education attainment, HH size, and HH income variables significantly improves the model fit.

The goodness-of-fit tests, including Pearson χ^2 (104.858, p = 0.001), suggested that the model fits the data significantly. The R^2 value of 0.607 indicates an improved model completeness compared to the previous one. As a result, it can be inferred that the model explains a significant portion of the variance in overall food consumption. Nevertheless, adding the HH monthly income variable changed the significance of the governorate of residency and education attainment variables, meaning that the HH monthly income variable negatively impacted the model's efficiency (Table 4.40).

Table 4.40. The likelihood ratio tests of the model fitting between the overall food uptake dependent variable and the governorate of residency, residency status, education attainment level of the patient, HH size, and HH monthly income independent variables

Effect	**Model Fitting Criteria**	**Likelihood Ratio Tests**		
	-2 Log Likelihood of Reduced Model	**Chi-Square**	**DF**	**Sig.**
Intercept	186.556	64.288	2	.000
Gov of residency	122.430	.162	2	.922
Residency status	153.367	31.099	2	.000
Education attainment	123.972	1.704	2	.427
HH size	246.018	123.750	2	.000
HH income level	161.371	39.103	2	.000

4.2. Binary Logistic Correlation Model Between the Maternity Outcomes and the Independent Variables

This section presents a descriptive analysis of the variables affecting maternity outcomes. Later, we conducted a binary logistic regression analysis between these variables and independent variables.

4.2.1. Descriptive Analysis of Maternity Outcome Variables

The Hg levels ranged from 6.70 g/dL to 15.10 g/dL, with the most common level being 12.00 g/dL, observed in 28 participants. The median Hg level was 11.70 g/dL. The

mean Hg level was 11.40 g/dL with SD = 1.53 g/dL, suggesting moderate variability in Hg levels. The frequency distribution showed a gradual spread of Hg levels with higher concentrations around the median. Cumulatively, 25% of participants had Hg levels below 10.30 g/dL, 50% had levels below 11.70 g/dL, and 75% had levels below 12.90 g/dL.

For glucose levels, the range spanned from 52 mg/dL to 173 mg/dL. The most common glucose level was 90 mg/dL, and the median was 84 mg/dL. The mean glucose level was approximately 83.73 mg/dL, with SD = 18.58 mg/dL, indicating substantial variability among the participants. The glucose levels showed a significant spread with notable peaks around 70 mg/dL to 100 mg/dL. Cumulatively, 25% of participants had glucose levels below 72 mg/dL, 50% below 84 mg/dL, and 75% below 95 mg/dL, highlighting the central tendency and variation within the dataset.

For iron (Fe) levels, the distribution ranged from 31 μg/dL to 232 μg/dL. The most frequently observed iron level was 53 μg/dL, and the median was 60 μg/dL. The mean iron level was approximately 68.02 μg/dL with an SD of 25.11 μg/dL, showing considerable variability. The frequency distribution indicated a concentration of iron levels between 50 μg/dL and 70 μg/dL. Cumulatively, 25% of participants had iron levels below 53 μg/dL, 50% below 60 μg/dL, and 75% below 80 μg/dL.

For sodium (Na) levels, the data showed a range from 124 mmol/L to 158 mmol/L. The most common sodium level was 138 mmol/L, followed by 139 mmol/L. The median sodium level was 137 mmol/L, the mean level was 137.75 mmol/L and SD = 3.49 mmol/L. The distribution indicated a higher frequency of sodium levels around the median, with cumulative percentages showing that 25% of participants had sodium levels below 135 mmol/L, 50% below 137 mmol/L, and 75% below 140 mmol/L, indicating a relatively narrow range around the central tendency.

The potassium (K) levels ranged from 1.14 mmol/L to 13.90 mmol/L, with the most common level being 3.90 mmol/L. The median potassium level was 3.90 mmol/L, and the mean level was 4.00 mmol/L with an SD value of 0.51 mmol/L. The frequency distribution showed a significant concentration around the median, with cumulative percentages indicating that 25% of participants had potassium levels below 3.70 mmol/L, 50% below 3.90 mmol/L, and 75% below 4.10 mmol/L, suggesting a relatively tight distribution around the median. Calcium (Ca) levels ranged from 6.20 mg/dL to 85.00 mg/dL, with the

most common level being 9.50 mg/dL. The median calcium level was 9.10 mg/dL, and the mean level was 9.18 mg/dL, with an SD = 1.19 mg/dL. The distribution showed a concentration of calcium levels around the median, with cumulative percentages indicating that 25% of participants had calcium levels below 8.50 mg/dL, 50% below 9.10 mg/dL, and 75% below 9.70 mg/dL, highlighting a consistent spread around the central tendency. The descriptive analysis of serologic tests is shown in Table 4.41.

With respect to these figures, the analysis of Hg levels below 10.5 g/dL among the participants showed that 259 individuals, accounting for 82.2% of the sample, had normal Hg levels. Conversely, 56 participants, or 17.8%, were classified as having anemia. This indicated that a significant majority of the population maintained normal Hg levels, with a smaller subset experiencing anemia.

For GDM with glucose levels above 95 mg/dL, 209 participants (66.3%) fell within the normal range, while 106 participants (33.7%) were diagnosed with GDM, referring to a considerable proportion being affected by GDM.

Regarding sodium levels below 135 mmol/L, 269 participants (85.4%) were within the normal range, whereas 46 participants (14.6%) were diagnosed with hyponatremia. This distribution indicated that most participants had adequate sodium levels, but a notable minority was affected by hyponatremia.

For potassium levels below 5.65 mmol/L, the data showed that 277 participants (87.9%) had hypokalemia, with only 38 participants (12.1%) maintaining normal potassium levels. This suggested a high prevalence of hypokalemia among the participants.

Analyzing calcium levels below 8.5 mg/dL, 226 participants (71.7%) had normal calcium levels, while 89 participants (28.3%) suffered from hypocalcemia. This distribution indicated that while most participants had normal calcium levels, a significant minority experienced hypocalcemia. The previous figures are depicted in Table 4.41 below.

Table 4.41. The distribution of the cases according to the maternity outcomes

Variable	Diagnosis	N	Frequency
Hg level below 10.5 g/Dl	Normal	259	82.2
	Anemia	56	17.8
Gestational Diabetes Mellitus > 95	Normal	209	66.3
	GDM	106	33.7

Sodium level below 135 mmol/L	Normal	269	85.4
	Hyponatremia	46	14.6
Potassium level below 5.65 mmol/L	Normal	38	12.1
	Hypokalemia	277	87.9
Calcium level below 8.5 mg/dL	Normal	226	71.7

4.2.2. Correlation Model Between Maternity Outcome and the Independent Variables

4.2.2.1. Anemia

Table 4.42 below shows that among the early reproductive age group (14-25 years), 128 individuals had normal hemoglobin levels, and 25 had anemia. In the mid-reproductive age group (25-34 years), 90 individuals had normal levels, and 21 had anemia. In the advanced reproductive age group (35-45 years), 41 individuals had normal levels, and 10 had anemia.

Table 4.42. The distribution of cases across anemia and age group variables

		Age groups				X^2 p value
		Early reproductive phase 14 – 25 y	**Mid-reproductive age 25 – 34 y**	**Advanced reproductive age 35 – 45 y**	**Total**	0,432 0,806
Anemia	**Normal**	128	90	41	259	
	Anemia	25	21	10	56	
Total		153	111	51	315	

The omnibus tests of model coefficients also show no significant effect of age groups on anemia, with a χ^2 value of 0.432 and a significance level P of 0.806 > 0.05. Therefore, the model does not effectively predict anemia based on age groups.

Table 4.43 revealed that among those diagnosed with anemia, 131 (50.6%) individuals were living in Aleppo and 128 (49.4%) in Idleb, and among those with normal hemoglobin levels, 37 (66.1%) individuals were from Aleppo and 19 (33.9%) were from Idleb.

Table 4.43. The distribution of patients across Anemia and governorate of residence variables

			The address of the patient		**Total**	X^2 p value
			Aleppo	**Idleb**		4,523
Anemia	**Normal**	**N**	131	128	259	0,033
		%	50.6%	49.4%	100.0%	

	Anemia	**N**	37	19	56
		%	66.1%	33.9%	100.0%
Total		**N**	168	147	315
		%	53.3%	46.7%	100.0%

The model summary presented an R^2 value of 0.023, suggesting that the model explained only a small portion of the variance in anemia occurrence based on the governorate of residence. The Hosmer and Lemeshow test indicated a good fit of the model. The variables in the equation Table (4.44) showed that the governorate of residence significantly predicted anemia. The odds ratio (Exp(B)) for the governorate variable was 0.526, 95% CI (0.287 – 0.962), p = 0.037. This indicated that residents of Idleb had lower odds of anemia than those of Aleppo.

Table 4.44. Binary logistic model of the correlation between Anemia and the governorate of residence variable. Reference group: Aleppo

		B	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% C.I.for EXP(B)**	
								Lower	**Upper**
Step 1	**Gov of residence**	-.643	.308	4.352	1	.037	.526	.287	.962
	Constant	-.621	.446	1.937	1	.164	.537		

As a next step, we added the residency status to the model. Table 4.45 showed that among anemia cases, 8 (14.3%) were living in formal residency settings, and 48 (85.7%) were IDPs. Additionally, among those who had normal Hg levels, 32 (12.4%) were from the host population, and 227 (87.6%) were IDPs.

Table 4.45. The distribution of patients based on Anemia and residency status variables

			The residency status of the patient		**Total**
			formal residency	**IDP**	
Anemia	**Normal**	**N**	32	227	259
		%	12.4%	87.6%	100.0%
	Anemia	**N**	8	48	56
		%	14.3%	85.7%	100.0%
Total		**N**	40	275	315
		%	12.7%	87.3%	100.0%

The omnibus tests of model coefficients indicated that the model with both the governorate of residence and residency status variables did not significantly improve the fit compared to the null model, with a χ^2 value of 4.523 and p = 0.104 > 0.05. This suggested that the addition of the residency status variable did not contribute significantly to the model's predictive power. Therefore, this variable was removed from the model.

Next, we added the patient's education attainment variable to the model, and we found that among individuals with normal hemoglobin levels, 25.9% were illiterate, 62.2% had primary education, 7.3% had intermediate or secondary education, and 4.6% had high education. Among those with anemia, 17.9% were illiterate, 73.2% had primary education, 5.4% had intermediate or secondary education, and 3.6% had high education (Table 4.46).

Table 4.46. The distribution of cases according to Anemia and education attainment variables

			The education level of the patient				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
Anemia	Normal	N	67	161	19	12	259
		%	25.9%	62.2%	7.3%	4.6%	100.0%
	Anemia	N	10	41	3	2	56
		%	17.9%	73.2%	5.4%	3.6%	100.0%
Total		N	77	202	22	14	315
		%	24.4%	64.1%	7.0%	4.4%	100.0%

The omnibus test of model coefficients indicated that the model, adding the governorate of residence and education attainment variables, was not statistically significant, with a χ^2 value of 5.259, P = 0.27 > 0.05, which suggested that the inclusion of the education attainment level did not significantly improve the fit of the model.

While the governorate of residence remained a significant predictor of anemia in the model (p = 0.027), the education attainment variable was not a significant predictor, with an odds ratio Exp(B) = 1.208, 95% CI (0.787 – 1.854), p value = 0.387, indicating no strong association between education level and anemia (Table 4.47). Thus, this variable was removed from the model equation.

Table 4.47. Binary logistic model of the correlation between Anemia dependent variable and the governorate of residence and patient's education attainment variables. Reference group: Aleppo and illiterate

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residence	-.703	.318	4.894	1	.027	.495	.266	.923
	Education attainment	.189	.219	.748	1	.387	1.208	.787	1.854
	Constant	-.901	.551	2.678	1	.102	.406		

Adding the education attainment level of the husbands to the equation did not show a significant correlation with the outcome variable. The distribution of the cases across

anemia and husband's education level showed that among individuals with normal hemoglobin levels, 29.0% of their spouses were illiterate, 64.9% had primary education, 3.9% had intermediate or secondary education, and 2.3% had high education. Among those with anemia, 19.6% of their spouses were illiterate, 69.6% had primary education, 5.4% had intermediate or secondary education, and 5.4% had high education (Table 4.48).

Table 4.48. The distribution of cases based on the anemia and spouse education attainment variables

			The education level of the husband				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
Anemia	Normal	N	75	168	10	6	259
		%	29.0%	64.9%	3.9%	2.3%	100.0%
	Anemia	N	11	39	3	3	56
		%	19.6%	69.6%	5.4%	5.4%	100.0%
Total		N	86	207	13	9	315
		%	27.3%	65.7%	4.1%	2.9%	100.0%

The χ^2 tests indicated that the correlation between anemia and the spouse's education level was not statistically significant, with a Pearson χ^2 value of 3.363 and a significance level of 0.339. This suggested that the education level of the spouse alone did not significantly impact the occurrence of anemia. The omnibus tests of model coefficients, however, indicated that the overall model was significant, with a χ^2 value of 8.975 and $p = 0.011$. The significance of the overall model suggests that the spouse's education level, while not directly associated with anemia on its own, may interact with other variables in a manner that contributes to elucidating the variance in anemia. Thus, this variable was removed from the model.

On the other hand, the employment status of the patients was not significantly correlated with the diagnosis of anemia. The distribution analysis of the cases (Table 4.49) showed that the majority of patients were unemployed, with 95.3% of those without anemia and 96.4% of those with anemia being unemployed. Only a small fraction had paid jobs (4.7% of non-anemic patients and 3.6% of anemic patients). The χ^2 test for the relationship between anemia and employment status yielded a Pearson χ^2 value of 0.126 with a p-value of 0.723, indicating no significant association between anemia and employment status.

Table 4.49. The distribution of the cases based on the anemia and employment status variables

			The employment status of the patient		Total	X^2 p value
			unemployed	Paid job		4,409
Anemia	Normal	N	246	12	258	0,11
		%	95.3%	4.7%	100.0%	
	Anemia	N	54	2	56	
		%	96.4%	3.6%	100.0%	
Total		N	300	14	314	
		%	95.5%	4.5%	100.0%	

Additionally, The Omnibus Tests of Model Coefficients presented a χ^2 value of 4.409 and p=0.110> 0.05, meaning that the model with the included variables (governorate of residence and employment status) did not significantly improve the prediction of anemia compared to a model with no predictors.

Replacing this variable with the patient's and spouse's employment status did not show different results. The cross-tabulation between the outcome variable and the patient's and spouse's employment status showed that among the patients with normal Hg levels, 40.7% had neither themselves nor their spouse employed, 56.2% had one employed, and 3.1% had both employed. Among anemic patients, 32.1% had neither employed, 66.1% had one employed, and 1.8% had both employed (Table 4.50). The χ^2 test revealed a Pearson value of 1.911 and p = 0.385 > 0.05, indicating no significant association between anemia and the combined employment status of the patient and their spouse.

Table 4.50. The distribution of the cases based on anemia and employment status of the patient and spouse variables

			The employment status of the participants and their husbands			Total
			None of them is employed	one of them is employed	both are employed	
Anemia	Normal	N	105	145	8	258
		%	40.7%	56.2%	3.1%	100.0%
	Anemia	N	18	37	1	56
		%	32.1%	66.1%	1.8%	100.0%
Total		N	123	182	9	314
		%	39.2%	58.0%	2.9%	100.0%

The Omnibus Tests of Model Coefficients yielded a χ^2 = 5.426 and P = 0.066. These findings indicated that the model incorporating the governorate of residence and combined employment status variables did not approach statistical significance and did not significantly enhance the prediction of anemia when compared to the last significant model (anemia and governorate of residence).

The cross-tabulation of anemia status by HH size revealed that among the patients with normal Hg levels, 52.9% lived in normal-sized HHs, while 47.1% lived in crowded HHs. Among the anemic patients, 53.6% lived in normal-sized HHs, and 46.4% lived in crowded HHs (Table 4.51). The χ^2 test showed a Pearson value of 0.008 and p = 0.927, indicating no significant association between anemia status and HH size.

Table 4.51. The distribution of the patients according to anemia and HH size variables

			The HH size		Total
			Normal HH size	Crowded HH	
Anemia	Normal	N	137	122	259
		%	52.9%	47.1%	100.0%
	Anemia	N	30	26	56
		%	53.6%	46.4%	100.0%
Total		N	167	148	315
		%	53.0%	47.0%	100.0%

The Omnibus Tests of Model Coefficients yielded a χ^2 value of 4.727 and a p value of 0.094. These results indicate that the inclusion of variables such as governorate of residence and HH size did not significantly predict anemia compared to the significant correlation model between anemia and the governorate of residency.

When studying the distribution of the cases based on anemia and the average monthly HH income, it was found that among patients with normal Hg levels, 17.8% had HH incomes within or higher than the average, while 82.2% had incomes less than the average. Among the anemic patients, 5.4% had HH incomes within or higher than the average, and 94.6% had incomes less than the average (Table 4.52). The χ^2 test showed a Pearson value of 5.393 with p = 0.020 < 0.05, referring to a significant association between anemia status and HH income level.

Table 4.52. The distribution of the cases based on anemia and the monthly HH income

			The monthly income level of the HH		
			The HH monthly income is within or higher than the average	The HH monthly income is less than the average	Total
Anemia	Normal	N	46	213	259
		%	17.8%	82.2%	100.0%
	Anemia	N	3	53	56
		%	5.4%	94.6%	100.0%
Total		N	49	266	315
		%	15.6%	84.4%	100.0%

The omnibus tests of model coefficients produced a χ^2 value of 8.575 and P = 0.014, suggesting that the model with the included variables (governorate of residence and HH income level) significantly improved the prediction of anemia compared to the last model. The R^2 value

of 0.027 was also higher than the previous model (0.023), which means that this model explains a slightly larger portion of the variability in anemia status. The Hosmer and Lemeshow Test resulted in an χ^2 value of 0.858 and a p value of 0.651 > 0.05, indicating a good fit for the model.

The HH income level variable showed a B value of 1.132 and p = 0.014 < 0.05, suggesting a significant impact of this variable on the correlation model. The Exp(B) = 3.102, 95 % CI (0.895 – 10.753), indicated that HH with incomes lower than the average had higher odds of having anemia (Table 4.53).

Table 4.53. Binary logistic model of the correlation between Anemia dependent variable and the governorate of residence and the average monthly HH income independent variables. Reference group: Aleppo and income is within or more than the average

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residence	-.442	.320	1.909	1	.016	.643	.344	1.203
	HH income	1.132	.634	3.186	1	.014	3.102	.895	10.753
	Constant	-3.053	1.406	4.717	1	.030	.047		

Adding the ethnicity variable to the model did not contribute to a significant prediction of anemia. The distribution of cases based on anemia status and ethnicity showed that among patients with normal Hg levels, 91.9% were Arab, and 8.1% were Kurdish. Among patients with anemia, 87.5% were Arab, and 12.5% were Kurdish (Table 4.54). The χ^2 test revealed a Pearson value of 1.097 and p = 0.295 > 0.05, indicating no significant association between anemia status and ethnicity.

Table 4.54. The distribution of cases based on anemia and ethnicity variables

			The ethnicity of the participants		Total
			Arab	Kurdish	
Anemia	Normal	N	238	21	259
		%	91.9%	8.1%	100.0%
	Anemia	N	49	7	56
		%	87.5%	12.5%	100.0%
Total		N	287	28	315
		%	91.1%	8.9%	100.0%

The ethnicity of the participants variable had a B value of 0.232 and a p value of 0.632, indicating it was not a significant predictor. The Exp(B) for Ethnicity Num was 1.261, 95% CI (0.488 – 3.260), and p > 0.05 (Table 4.55).

Table 4.55. Binary logistic model of the correlation between Anemia dependent variable and the governorate of residence, the average monthly HH income, and the patient's ethnicity independent variables. Reference group: Aleppo, income is within or more than the average, and Arab

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residence	-.401	.332	1.458	1	.227	.670	.349	1.284
	HH income	1.139	.634	3.225	1	.073	3.124	.901	10.828
	Ethnicity	.232	.485	.229	1	.632	1.261	.488	3.260
	Constant	-3.380	1.567	4.654	1	.031	.034		

4.2.2.2. Gestational Diabetes Mellitus

The distribution of cases to GDM status by age group showed that among patients without GDM, 50.2% were in the early reproductive age group, 36.4% were in the mid-reproductive age group, and 13.4% were in the advanced reproductive age group. Among patients with GDM, 45.3% were in the early reproductive age group, 33.0% were in the mid-reproductive age group, and 21.7% were in the advanced reproductive age group (Table 4.56). The χ^2 test revealed a Pearson value of 3.572 with a p value of 0.168 > 0.05, indicating no significant association between GDM status and age groups.

Table 4.56. The distribution of cases based on GDM and age group variables

			Age groups			Total	X^2 p value
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y		3,449 0,178
GDM	Normal	N	105	76	28	209	
		%	50.2%	36.4%	13.4%	100.0%	
	GDM	N	48	35	23	106	
		%	45.3%	33.0%	21.7%	100.0%	
Total		N	153	111	51	315	
		%	48.6%	35.2%	16.2%	100.0%	

The Omnibus Tests of Model Coefficients produced a χ^2 value of 3.449 with a p value of 0.178 > 0.05, suggesting that the model of correlation between GDM and age groups did not significantly contribute to the prediction of GDM among the patients.

Considering the governorate of residence variable, it was found that among patients without GDM, 45.9% resided in Aleppo and 54.1% in Idleb. Conversely, among patients with GDM, 67.9% resided in Aleppo and 32.1% in Idleb (Table 4.57).

Table 4.57. The distribution of the patients based on GDM and governorate of residency variables

			The Gov of residency		Total	X^2 p value
			Aleppo	Idleb		13.666
GDM	Normal	N	96	113	209	0,001
		%	45.9%	54.1%	100.0%	
	GDM	N	72	34	106	
		%	67.9%	32.1%	100.0%	
Total		N	168	147	315	
		%	53.3%	46.7%	100.0%	

The p value of the χ^2 test was 0.001 < 0.05, which indicated a significant association between GDM status and the governorate of residency.

The Omnibus Tests of Model Coefficients showed a χ^2 value of 13.914 and p < 0.05 with a p-value of less than 0.001, suggesting that the model of the correlation between GDM and the governorate of residency significantly improved the prediction of GDM status. The value of R^2 = 0.043 indicated that the model explained about 4.3% of the variability in GDM status.

Regarding the Variables in the Equation, the governorate of residency significantly impacted GDM status. The governorate of residency variable showed a B value of -0.913 with an Exp(B) of 0.401 (95% CI: 0.246 to 0.655), p < 0.05. This indicated that residing in Aleppo was associated with a lower likelihood of having GDM compared to residing in Idleb (Table 4.58).

Table 4.58. Binary logistic model of the correlation between GDM and the governorate of residency. Reference group: Aleppo

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.913	.250	13.333	1	.000	.401	.246	.655
	Constant	-.288	.156	3.405	1	.065	.750		

We added the residency status to the model and found that among patients without GDM, 87.6% were IDPs, and 12.4% had a formal residency, and among patients with GDM, 86.8% were IDPs, and 13.2% had formal residency (Table 4.59). Besides, the association between GDM status and residency status was not significant, as indicated by a Pearson χ^2 value of 0.037 and a p value of 0.847 > 0.05.

Table 4.59. The distribution of the patients depending on GDM and residency status variables

			The residency status of the patient		Total
			formal residency	IDP	
GDM	Normal	N	26	183	209
		%	12.4%	87.6%	100.0%
	GDM	N	14	92	106
		%	13.2%	86.8%	100.0%
Total		N	40	275	315
		%	12.7%	87.3%	100.0%

The Omnibus Tests of Model Coefficients showed a χ^2 value of 14.159 and $p < 0.05$, suggesting that the model, including both the governorate of residency and the residency status significantly improved the prediction of GDM status compared to a model with no predictors. The R^2 value of the model was 0.044, which is slightly higher than its value in the previous model (0.043).

The Residency status variable showed a B value of 0.181 with a p value of 0.622 and an Exp(B) of 1.198 (95% CI: 0.584 to 2.458), indicating that residency status did not significantly impact the likelihood of having GDM (Table 4.60).

Table 4.60. Binary logistic model of the correlation between GDM and the governorate of residency. Reference group: Aleppo and host

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.936	.254	13.536	1	.000	.392	.238	.646
	Residency status	.181	.367	.243	1	.622	1.198	.584	2.458
	Constant	-.435	.339	1.652	1	.199	.647		

In essence, the overall model, which incorporates both the governorate of residency and residency status as predictors, demonstrates a significantly enhanced ability to predict the status of GDM compared to the previous model. However, the residency status variable alone does not make a significant contribution towards the prediction of GDM. This disparity highlights that the improvement in model fit is primarily driven by the governorate of residency variable rather than the residency status variable. Consequently, it implies that the geographical location (governorate) in which the participants reside plays a more substantial role in explaining the variation in GDM status compared to their formal residency status or whether they are internally displaced.

In the next step, we removed the residency status variable and replaced it with the patient's education attainment variable. The distribution Table (4.61) of GDM status by education level revealed that among patients without GDM, 23.9% were illiterate, 65.1%

had primary school education, 6.2% had intermediate or secondary school education, and 4.8% had higher education. Among patients with GDM, 25.5% were illiterate, 62.3% had primary school education, 8.5% had intermediate or secondary school education, and 3.8% had higher education.

Table 4.61. The distribution of cases based on GDM and patient's education level variables

			The education level of the patient				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
GDM	Normal	N	50	136	13	10	209
		%	23.9%	65.1%	6.2%	4.8%	100.0%
	GDM	N	27	66	9	4	106
		%	25.5%	62.3%	8.5%	3.8%	100.0%
Total		N	77	202	22	14	315
		%	24.4%	64.1%	7.0%	4.4%	100.0%

The χ^2 tests indicated no significant association between GDM status and the patient's education attainment level, with a Pearson value of 0.836 and a p value of 0.841. The Omnibus Tests of Model Coefficients showed a $\chi^2 = 14.767$ and $p = 0.005$, suggesting that the model of correlation between GDM and the governorate of residency and the patient's education attainment variables significantly improved the prediction of GDM status compared to the previous model. Nevertheless, in the model equation, the patient's education level variable did not show significant effects on GDM status with p values > 0.05 for all the education categories, and CI ranges that cross the value of 1 (Table 4.62).

Table 4.62. Binary logistic model of the correlation between GDM outcome variable and the governorate of residency and patient's education level independent variables. Reference group: Aleppo and illiterate

		B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% C.I.for EXP(B)**	
								Lower	**Upper**
Step 1	**Gov of residency**	-.943	.259	13.277	1	.000	.389	.235	.647
	Patient education (illiterate)			.869	3	.833			
	Patient education (primary education)	.005	.290	.000	1	.986	1.005	.570	1.773
	Patient education (intermediate or secondary education)	.402	.510	.623	1	.430	1.495	.551	4.061
	Patient education (university education)	.269	.665	.163	1	.686	1.308	.355	4.814
	Constant	-.319	.254	1.579	1	.209	.727		

Adding the spouse's education attainment to the model did not show a significant correlation with the GDM variable. The cross-tabulation of GDM status by the spouse's

education level revealed that among patients without GDM, 28.2% had spouses who were illiterate, 65.1% had spouses with primary school education, 3.8% had spouses with intermediate or secondary school education, and 2.9% had spouses with higher education. Among patients with GDM, 25.5% had spouses who were illiterate, 67.0% had spouses with primary school education, 4.7% had spouses with intermediate or secondary school education, and 2.8% had spouses with higher education (Table 4.63).

Table 4.63. The distribution of patients based on the diagnosis of GDM and spouse education attainment variables

			The education level of the husband				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
GDM	Normal	N	59	136	8	6	209
		%	28.2%	65.1%	3.8%	2.9%	100.0%
	GDM	N	27	71	5	3	106
		%	25.5%	67.0%	4.7%	2.8%	100.0%
Total		N	86	207	13	9	315
		%	27.3%	65.7%	4.1%	2.9%	100.0%

The χ^2 tests indicated no significant association between GDM status and the spouse's education attainment level, with a Pearson χ^2 value of 0.370 and a p value of 0.946 > 0.05. Regarding the variables in the equation, the spouse's education level did not show significant effects on GDM status, with p values of 0.494, 0.279, and 0.647 for illiterate, primary, and intermediate or secondary education levels, respectively (Table 4.64).

Table 4.64. Binary logistic model of the correlation between GDM outcome variable and the governorate of residency and spouse's education level independent variables. Reference group: Aleppo and illiterate

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.961	.255	14.153	1	.000	.383	.232	.631
	Spouse education level (illiterate)			1.352	3	.717			
	Spouse education level (primary)	.192	.281	.467	1	.494	1.212	.698	2.105
	Spouse education level (intermediate and secondary)	.691	.638	1.171	1	.279	1.995	.571	6.973
	Spouse education level (university and higher)	.351	.766	.210	1	.647	1.421	.316	6.378
	Constant	-.434	.251	3.002	1	.083	.648		

Adding the employment status of the patient to the model did not show a significant correlation either. The distribution Table 4.65 of the cases reveals that, among patients

without GDM, 95.2% were unemployed while 4.8% held paid employment. Besides, among patients with GDM, 96.2% were unemployed while 3.8% had a paid job.

Table 4.65. The distribution of cases based on GDM and employment status variables

			The employment status of the patient		Total
			Unemployed	Paid job	
GDM	Normal	N	199	10	209
		%	95.2%	4.8%	100.0%
	GDM	N	101	4	105
		%	96.2%	3.8%	100.0%
Total		N	300	14	314
		%	95.5%	4.5%	100.0%

The χ^2 tests indicated no significant association between GDM status and the patient's employment status, with a Pearson value of 0.156 and a p value of 0.693. The patient's employment status did not have a significant effect on GDM status in the model equation. The model equation table below shows a p value of 0.782 for the patient's employment status variable (Table 4.66).

Table 4.66. Binary logistic model of the correlation between GDM outcome variable and the governorate of residency and spouse's education level independent variables. Reference group: Aleppo and unemployed

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.956	.257	13.889	1	.000	.384	.233	.636
	The employment status of the patient	.173	.624	.077	1	.782	1.189	.350	4.039
	Constant	-.290	.156	3.446	1	.063	.748		

The results did not change when studying the correlation between GDM and the employment status of the patients and spouses. The contingency Table 4.67 below shows that among patients without gestational diabetes mellitus (GDM), 38.3% were found to have neither the patient nor their husband employed, while 59.3% had one of them employed, and 2.4% had both employed. In contrast, among patients with GDM, 41.0% were found to have neither employed, 55.2% had one employed, and 3.8% had both employed.

Table 4.67. The distribution table of the cases based on the GDM diagnosis and employment status of the patients and spouses

	The employment status of the participants and their husbands			Total
	None of them is employed	one of them is employed	both are employed	

GDM	**Normal**	**N**	80	124	5	209
		%	38.3%	59.3%	2.4%	100.0%
	GDM	**N**	43	58	4	105
		%	41.0%	55.2%	3.8%	100.0%
Total		**N**	123	182	9	314
		%	39.2%	58.0%	2.9%	100.0%

The χ^2 tests indicated no significant association between GDM variable and the combined employment status ($p = 0.664 > 0.05$). Regarding the variables in the equation, the combined employment variable did not have a significant effect on GDM status, with p values of 0.531 for one of them being employed and 0.301 for both employed (Table 4.68).

Table 4.68. Binary logistic model of the correlation between GDM outcome variable and the governorate of residency and spouse's education level independent variables. Reference group: Aleppo and none is employed

		B	**S.E.**	**Wald**	**DF**	**Sig.**	**Exp(B)**	**95% C.I.for EXP(B)**	
								Lower	**Upper**
Step 1	**Gov of residency**	-.985	.256	14.818	1	.000	.374	.226	.617
	Employment status of the patient and husband (none is employed)			1.798	2	.407			
	Employment status of the patient and husband (one is employed)	-.159	.254	.393	1	.531	.853	.519	1.402
	Employment status of the patient and husband (both are employed)	.743	.719	1.068	1	.301	2.103	.514	8.607
	Constant	-.202	.218	.865	1	.352	.817		

Similarly, the HH size did not show a significant correlation in the equation model. The cases distribution Table 4.69 showed that among patients without GDM, 53.6% were living in a normal HH size, and 46.4% were living in a crowded HH. For patients with GDM, 51.9% were living in a normal HH size, and 48.1% were living in a crowded HH. The χ^2 tests indicated no significant association between GDM status and HH size, with a Pearson of 0.082 and a p value of $0.775 > 0.05$.

Table 4.69. The distribution table of the cases based on GDM and HH size variables

			The HH size		**Total**
			Normal HH size	**Crowded HH**	
GDM	**Normal**	**N**	112	97	209
		%	53.6%	46.4%	100.0%
	GDM	**N**	55	51	106
		%	51.9%	48.1%	100.0%
Total		**N**	167	148	315
		%	53.0%	47.0%	100.0%

Furthermore, The HH size variable did not show a significant effect on GDM status in the model equation ($P = 0.733$, $Exp(B) = 0.919$, 95% CI: 0.565 – 1.493).

Nevertheless, adding the average HH monthly income to the model revealed different findings. The contingency table of the HH monthly income and GDM showed that among patients without GDM, 15.8% were living in HHs with monthly income within or higher than the average, while 84.2% were in HHs with monthly income less than the average. Among patients with GDM, 15.1% used to live in HHs with a monthly income within or higher than the average, and 84.9% were in HHs with a monthly income less than the average (Table 4.70).

Table 4.70. The contingency table of the GDM and HH monthly income variables

			The monthly income level of the HH			X^2 p value
			The HH monthly income is within or higher than the average	The HH monthly income is less than the average	Total	13,256 0,001
GDM	Normal	N	33	176	209	
		%	15.8%	84.2%	100.0%	
	GDM	N	16	90	106	
		%	15.1%	84.9%	100.0%	
Total		N	49	266	315	
		%	15.6%	84.4%	100.0%	

The χ^2 tests revealed a significant association between GDM status and HH monthly income, with a Pearson χ^2 value of 13.256 and a p value of $0.001 < 0.05$.

Moreover, the Omnibus Tests of Model Coefficients showed a χ^2 value of 15.421 with a p value < 0.05, indicating that the model, which included both the governorate of residency and the HH monthly income, significantly improved the prediction of GDM status compared to a model with the governorate of residency variable alone as a predictor. Additionally, the R^2 value increased from 0.043 in the last significant model to 0.066 in the current model, which means that the new model contributed to a more complete model.

The Hosmer and Lemeshow Test showed a χ^2 value of 0.010 with a p value of 0.919, indicating that the model's fit was significant. Regarding the model equation, the HH income variable showed a significant effect on GDM status (Exp(B) = 0.635, $p < 0.001$, 95% CI: 0.310 – 0.703). These results suggested that living in a HH with a monthly income within or higher than the average was associated with a lower likelihood of GDM (Table 4.71).

Table 4.71. Binary logistic model of the correlation between GDM outcome variable and the governorate of residency and HH monthly income level independent variables. Reference group: Aleppo and HH within or higher than the average

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)

								95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-1.035	.273	14.394	1	.000	.355	.208	.606
	HH monthly income	-.454	.367	1.532	1	.001	.635	.310	.703
	Constant	.147	.384	.146	1	.702	1.158		

The patient's ethnicity did not show a significant correlation with the diagnosis of GDM ($p > 0.05$). Additionally, the model equation showed that the patient's ethnicity has no significant impact on the diagnosis of GDM (Exp(B) = 0.795, $p > 0,05$, 95% CI: 0.301 – 1.622).

4.2.2.3. Hyponatremia

The age groups did not show a significant correlation with hyponatremia. Based on the case distribution table, it was observed that among individuals with normal sodium levels, 48.3% were in the early reproductive age group, 34.9% were in the mid-reproductive age group, and 16.7% were in the advanced reproductive age group. For those with hyponatremia, 50.0% were in the early reproductive age group, 37.0% were in the mid-reproductive age group, and 13.0% were in the advanced reproductive age group (Table 4.72).

Table 4.72. The distribution of cases based on hyponatremia and age group variables

			Age groups			
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	Total
Hyponatremia	Normal	N	130	94	45	269
		%	48.3%	34.9%	16.7%	100.0%
	Hyponatremia	N	23	17	6	46
		%	50.0%	37.0%	13.0%	100.0%
Total		N	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

The χ^2 tests confirmed the lack of a significant correlation with a $p = 0.820 > 0.05$. Additionally, in the variables in the equation (table below 4.73), neither of the age group categories showed a significant effect on hyponatremia. The coefficient for the early reproductive age group was 0.022 with a p-value of 0.950, and for the mid-reproductive age group, it was -0.283 with a p-value of 0.564. The constant term had a significant negative coefficient, indicating that the baseline log odds of hyponatremia were low.

Table 4.73. Binary logistic model of the correlation between hyponatremia outcome variable and age group independent variable. Reference group: early reproductive age group

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Age groups			.395	2	.821			
	Mid-	.022	.347	.004	1	.950	1.022	.517	2.019

	reproductive age group							
	Advanced reproductive age group	-.283	.490	.333	1	.564	.754	.288	1.969
	Constant	-1.732	.226	58.627	1	.000	.177		

The cross-tabulation data of the hyponatremia and governorate of residency variables showed that among individuals with normal sodium levels, 60.2% were from Aleppo, and 39.8% were from Idleb. In contrast, among those with hyponatremia, only 13.0% were from Aleppo, while a significant 87.0% were from Idleb (Table 4.74). The χ^2 tests supported this observation with strong statistical significance. The Pearson χ^2 value was 35.132 with a p value of less than 0.001, indicating a significant association between the governorate of residency and hyponatremia.

Table 4.74. The distribution of cases based on hyponatremia and governorate of residency variables

			The address of the patient		**Total**	**X^2** **p value**
			Aleppo	**Idleb**		38,070
Hyponatremia	**Normal**	**N**	162	107	269	0,001
		%	60.2%	39.8%	100.0%	
	Hyponatremia	**N**	6	40	46	
		%	13.0%	87.0%	100.0%	
Total		**N**	168	147	315	
		%	53.3%	46.7%	100.0%	

The omnibus tests of model coefficients indicated that adding the governorate of residency variable significantly improved the model's predictive power (χ^2 value of 38.070, p value less than 0.001). Besides, the R2 value of 0.202 indicated that the governorate of residency explained approximately 20.2% of the variability in hyponatremia status.

The Variables in the Equation table showed that the governorate of residency had a significant effect on hyponatremia. The coefficient for residing in Idleb (relative to Aleppo) was 2.312 with a p-value of less than 0.001, indicating that patients residing in Idleb had significantly higher odds (Exp(B) = 10.093) of having hyponatremia compared to those in Aleppo. The confidence interval for this odds ratio was 4.136 to 24.631, further confirming the robustness of this finding.

We added the residency status variable to the model. We found that 13.8% were from the host population, whereas 86.2% were IDPs, and among those with hyponatremia, only 6.5% were from the host population, while a notable 93.5% were IDPs (Table 4.75). The χ^2 tests, however, did not show a statistically significant association between

hyponatremia and residency status. The Pearson χ^2 value was 1.854 with a p value of 0.173 > 0.05, indicating that the association between hyponatremia and residency status was not statistically significant.

Table 4.75. The distribution of cases based on hyponatremia and residency status variables

			The residency status of the patient		Total
			Host	IDP	
Hyponatremia	Normal	N	37	232	269
		%	13.8%	86.2%	100.0%
	Hyponatremia	N	3	43	46
		%	6.5%	93.5%	100.0%
Total		N	40	275	315
		%	12.7%	87.3%	100.0%

The residency status variable in the model equation did not show a significant effect, with a coefficient B of 0.231 and a p value of 0.728, indicating that being an IDP or from a host population did not significantly impact the likelihood of hyponatremia (Table 4.76).

Table 4.76. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and residency status independent variables. Reference group: Aleppo and IDP

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.286	.460	24.703	1	.000	9.838	3.994	24.235
	Residency status	.231	.664	.121	1	.728	1.260	.343	4.633
	Constant	-3.488	.699	24.903	1	.000	.031		

We removed the residency status variable from the model and replaced it with the patient's education attainment variable. The contingency (Table 4.77) below showed that among individuals with normal sodium levels, 25.7% were illiterate, 63.2% had completed primary school, 7.4% had completed intermediate or secondary school, and 3.7% had high education. Among those with hyponatremia, 17.4% were illiterate, 69.6% had completed primary school, 4.3% had completed intermediate or secondary school, and 8.7% had high education. The χ^2 tests did not show a statistically significant association between hyponatremia and education level ($p > 0.05$).

Table 4.77. The distribution of cases based on the hyponatremia diagnosis and patient's education level variables

			The education level of the patient				
			Illiterate	Primary school	intermediate or secondary school	high education	Total
Hyponatremia	Normal	N	69	170	20	10	269

		%	25.7%	63.2%	7.4%	3.7%	100.0%
	Hyponatremia	**N**	8	32	2	4	46
		%	17.4%	69.6%	4.3%	8.7%	100.0%
Total		**N**	77	202	22	14	315
		%	24.4%	64.1%	7.0%	4.4%	100.0%

The education level variable in the model equation did not show significant effects, with coefficients for different education levels having P values greater than 0.05, indicating that education level did not significantly impact the likelihood of hyponatremia.

Similar findings in terms of the lack of significant association were revealed when we studied the correlation between hyponatremia and spouse's education attainment level. The contingency table showed that among individuals with normal sodium levels, 28.3% of their spouses were illiterate, 65.8% had completed primary school, 3.7% had completed intermediate or secondary school, and 2.2% had high education. Among those with hyponatremia, 21.7% of their spouses were illiterate, 65.2% had completed primary school, 6.5% had completed intermediate or secondary school, and 6.5% had high education (Table 4.78). The χ^2 tests did not show a statistically significant association between hyponatremia and the spouse's education level. The Pearson χ^2 value was 3.893 with a p value of 0.273 > 0.05, indicating that the association between hyponatremia and the spouse's education level was not statistically significant.

Table 4.77. The contingency table of cases disaggregated by hyponatremia and spouse's education attainment level variables

			The education level of the husband				
			Illiterate	**Primary school**	**intermediate or secondary school**	**high education**	**Total**
Hyponatremia	**Normal**	**N**	76	177	10	6	269
		%	28.3%	65.8%	3.7%	2.2%	100.0%
	Hyponatremia	**N**	10	30	3	3	46
		%	21.7%	65.2%	6.5%	6.5%	100.0%
Total		**N**	86	207	13	9	315
		%	27.3%	65.7%	4.1%	2.9%	100.0%

The spouse's education level variable did not show significant effects in the correlation model, with a coefficient having a p value > 0.05, indicating that the spouse's education level did not significantly impact the likelihood of hyponatremia (Table 4.79).

Table 4.78. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and patient's education attainment independent variables. Reference group: Aleppo and illiterate

	B	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% C.I.for EXP(B)**

								Lower	Upper
Step 1	Gov of residency	2.274	.457	24.795	1	.000	9.721	3.971	23.794
	Spouse's education level	.256	.249	1.053	1	.305	1.291	.793	2.103
	Constant	-3.753	.617	36.972	1	.000	.023		

The distribution of cases based on the diagnosis of hyponatremia and the patient's employment status showed that among individuals with normal sodium levels, 95.9% were unemployed, and 4.1% had paid jobs. Additionally, among those with hyponatremia, 93.5% were unemployed, and 6.5% had paid jobs (Table 4.80). The Pearson χ^2 value was 0.539 with a p value of 0.463 > 0.05, indicating that the association between hyponatremia and employment status was not statistically significant.

Table 4.79. The distribution of cases based on hyponatremia and employment status variables

			The employment status of the patient		Total
			Unemployed	Paid job	
Hyponatremia	Normal	N	257	11	268
		%	95.9%	4.1%	100.0%
	Hyponatremia	N	43	3	46
		%	93.5%	6.5%	100.0%
Total		N	300	14	314
		%	95.5%	4.5%	100.0%

The Variables in the Equation table revealed that the patient's employment status variable did not show significant effects on the sodium level of the patient (p > 0.05), indicating that the employment status did not significantly impact the likelihood of hyponatremia (Table 4.81).

Table 4.80. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and patient's employment status independent variables. Reference group: Aleppo and unemployed

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.333	.458	25.986	1	.000	10.304	4.203	25.263
	The employment status of the patient	-.164	.689	.057	1	.811	.848	.220	3.272
	Constant	-3.294	.416	62.760	1	.000	.037		

The cross-tabulation data of the cases according to hyponatremia and patient and spouse employment status indicated that among individuals without hyponatremia, 39.2% were from HHs where neither the patient nor the spouse was employed, 57.8% were from HHs where one of them was employed, and 3.0% were from HHs where both were employed. Among those with hyponatremia, 39.1% were from HHs where neither was employed, 58.7% were from HHs where one was employed, and 2.2% were from HHs where both were employed (Table 4.82).

Table 4.81. The contingency table of cases based on hyponatremia and employment status of the patient and spouse variables

			The employment status of the participants and their husbands			Total
			None of them is employed	one of them is employed	both are employed	
Hyponatremia	Normal	N	105	155	8	268
		%	39.2%	57.8%	3.0%	100.0%
	Hyponatremia	N	18	27	1	46
		%	39.1%	58.7%	2.2%	100.0%
Total		N	123	182	9	314
		%	39.2%	58.0%	2.9%	100.0%

The Pearson χ^2 value was 0.095 with a p value of 0.954 > 0.05, indicating that the association was not statistically significant. Additionally, the Variables in the Equation table revealed that the combined employment status variable did not show significant effects (p > 0.05), indicating that the employment status did not significantly impact the likelihood of hyponatremia (Table 4.83).

Table 4.82. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and spouse and patient's employment status independent variables. Reference group: Aleppo and unemployed

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.349	.456	26.502	1	.000	10.473	4.283	25.613
	Employment status (none is employed)			.679	2	.712			
	Employment status (one is employed)	.046	.351	.018	1	.895	1.048	.527	2.083
	Employment status (both are employed)	-.859	1.110	.599	1	.439	.423	.048	3.731
	Constant	-3.317	.468	50.222	1	.000	.036		

Adding the HH size to the model showed that among individuals with normal sodium levels, 52.4% were from HH with a normal size, and 47.6% were from crowded HH. Additionally, among those with hyponatremia, 56.5% were from normal-sized HHs, while 43.5% were from crowded HHs (Table 4.84).

Table 4.83. The distribution table of the cases based on hyponatremia diagnosis and HH size variables

			The HH size		Total
			Normal HH size	Crowded HH	
Hyponatremia	Normal	N	141	128	269
		%	52.4%	47.6%	100.0%
	Hyponatremia	N	26	20	46
		%	56.5%	43.5%	100.0%
Total		N	167	148	315
		%	53.0%	47.0%	100.0%

The χ^2 test results supported this observation, showing no significant association between hyponatremia and HH size ($p > 0.05$). HH size did not show significant effects in the model equation, with a coefficient having a p value greater than 0.05, indicating that HH size did not significantly impact the likelihood of hyponatremia. The coefficient for crowded HH relative to normal-sized HH was 0.177 (Exp(B) = 1.194, p = 0.609, 95% CI: 0.606 – 2.349), showing no significant effect (Table 4.85).

Table 4.84. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and HH size status independent variables. Reference group: Aleppo and HH size normal

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.343	.460	25.961	1	.000	10.415	4.229	25.653
	HH size (crowded)	.177	.345	.262	1	.609	1.194	.606	2.349
	Constant	-3.396	.463	53.864	1	.000	.033		

We removed the HH size variable from the model and replaced it with the average HH monthly income. The distribution table showed that among individuals with normal sodium levels, 13.4% had a HH monthly income within or higher than the average, while 86.6% had a HH monthly income below the average. Among those with hyponatremia, 28.3% had a HH monthly income within or higher than the average, whereas 71.7% had a HH monthly income below the average (Table 4.86). The Pearson Chi-Square value was 6.620 with a p-value of 0.010.

Table 4.85. The distribution table of the cases based on hyponatremia status and the HH monthly income variables

			The monthly income level of the HH		Total
			The HH monthly income is within or higher than the average	The HH monthly income is less than the average	
Hyponatremia	Normal	N	36	233	269
		%	13.4%	86.6%	100.0%
	Hyponatremia	N	13	33	46
		%	28.3%	71.7%	100.0%
Total		N	49	266	315
		%	15.6%	84.4%	100.0%

The χ^2 tests showed a Pearson χ^2 value of 6.620 and a p value of $0.010 < 0.05$ indicating a significant association between the two variables. Additionally, the omnibus tests of model coefficients showed that the model, which included the governorate of residency and HH income, significantly improved the predictive power of the model ($\chi^2 = 38.349$, $p < 0.05$). The

$R^2 = 0.313$, which is higher than the model with the governorate of residency variable alone (0.202), suggests that the model explains approximately 31.3% of the variance in hyponatremia status. The Hosmer and Lemeshow Test ($\chi^2 = 1.844$, $p = 0.398$) referred to a significant fit of the correlation model with the new variables. Moreover, the HH income variable had a significant effect on hyponatremia as shown in Table 4.87. The coefficient for HHs with an income within or higher than the average was B = -0.210 with a p value < 0.05, indicating that patients from HHs with higher income had significantly lower odds of having hyponatremia (Exp(B) = 9.811, p = 0.005, 95% CI: 3.374 – 21.756).

Table 4.86. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and HH size status independent variables. Reference group: Aleppo and HH income within or more than the average

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.260	.466	23.492	1	.000	9.579	3.841	23.887
	HH income level (less than the average)	-.210	.394	.282	1	.595	.811	.374	1.756
	Constant	-3.096	.560	30.612	1	.000	.045		

We added the ethnicity variable to the last model. The contingency table of the hyponatremia diagnosis and ethnicity variables showed that among individuals with normal sodium levels, 89.6% were Arabs, and 10.4% were Kurds. Among those with hyponatremia, 100% were Arabs, and none were Kurds (Table 4.88). The Pearson χ^2 value was 5.255 with a p value of 0.022 < 0.05, indicating a statistically significant relationship between the two variables.

Table 4.87. The distribution of cases based on hyponatremia and ethnicity variables

			The ethnicity of the participants		Total
			Arab	Kurdish	
Hyponatremia	Normal	N	241	28	269
		%	89.6%	10.4%	100.0%
	Hyponatremia	N	46	0	46
		%	100.0%	0.0%	100.0%
Total		N	287	28	315
		%	91.1%	8.9%	100.0%

Nevertheless, ethnicity also did not show a significant effect on the status of the hyponatremia variable in the model equation. Table 4.89 below shows a coefficient value of the ethnicity variable B = -18.105, Exp(B) < 0.001, p = 0.998, and 95% CI: 0.0001 – 0.001.

Table 4.88. Binary logistic model of the correlation between hyponatremia dependent variable and governorate of residency and HH size status independent variables. Reference group: Aleppo, HH income within or more than the average, and ethnicity variables

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	2.067	.468	19.476	1	.000	7.899	3.155	19.778
	HH's monthly income level	-.216	.395	.299	1	.584	.806	.371	1.748
	Ethnicity	-18.105	7593.731	.000	1	.998	.000	.0001	0.001
	Constant	-2.898	.563	26.484	1	.000	.055		

The overall results regarding this variable suggested that ethnicity did not have a significant impact on hyponatremia in this model.

4.2.2.4. Hypokalemia

The distribution table showed that among individuals with normal potassium levels, 36.8% were in the early reproductive age group, 39.5% were in the mid-reproductive age group, and 23.7% were in the advanced reproductive age group. Among those with hypokalemia, 50.2% were in the early reproductive age group, 34.7% were in the mid-reproductive age group, and 15.2% were in the advanced reproductive age group (Table 4.90). The χ^2 test results indicated no significant association between hypokalemia and age groups. The Pearson χ^2 value was 2.943 with a p value of 0.230 > 0.05.

Table 4.89. The distribution of the cases based on hypokalemia and age group variables

			Age groups			Total
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	
Hypokalemia	Normal	N	14	15	9	38
		%	36.8%	39.5%	23.7%	100.0%
	Hypokalemia	N	139	96	42	277
		%	50.2%	34.7%	15.2%	100.0%
Total		N	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

The age group variable did not significantly impact hypokalemia in the model equation (Table 4.91). The coefficient for the early reproductive age group (relative to the mid-reproductive age group) was B = -0.439, p = 0.266 > 0.05, indicating no significant difference in hypokalemia odds based on this age group (Exp(B) = 0.645, p = 0.266, 95% CI: 0.297 – 1.397). Additionally, the coefficient for the advanced reproductive age group

(relative to the mid-reproductive age group) was B = -0.755 and p > 0.05, indicating an insignificant correlation between this age group and hypokalemia (Exp(B) = 0.470, p = 0.102, 95% CI: 0.190 – 1.163).

Table 4.90. Binary logistic model of the correlation between hypokalemia dependent variable and age group independent variable. Reference group: early reproductive age

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Age groups			2.874	2	.238			
	Age group (mid-reproductive age)	-.439	.395	1.238	1	.266	.645	.297	1.397
	Age group (advanced age group)	-.755	.462	2.669	1	.102	.470	.190	1.163
	Constant	2.295	.280	67.015	1	.000	9.929		

The case distribution showed that among individuals with normal potassium levels, 80.9% were residents of Aleppo and 19.1% were residents of Idleb. Among those with hypokalemia, 48.5% resided in Aleppo and 51.5% resided in Idleb as shown in Table 4.92. The χ^2 test results indicated a significant association between hypokalemia and the governorate of residency. The Pearson χ^2 value was 16.807 with a $p < 0.05$, indicating a statistically significant relationship.

Table 4.91. The distribution of cases based on hypokalemia and governorate of residency variables

			The address of the patient		Total	X^2 p value
			Aleppo	Idleb		18,086
Hypokalemia	Normal	N	38	9	47	0,001
		%	80.9%	19.1%	100.0%	
	Hypokalemia	N	130	138	268	
		%	48.5%	51.5%	100.0%	
Total		N	168	147	315	
		%	53.3%	46.7%	100.0%	

The omnibus tests of model coefficients showed that the model, which included the governorate of residency, significantly improved the predictive power ($\chi^2 = 18.086$, $p < 0.05$). The $R^2 = 0.098$, refers to a significant completion of the model of the correlation between the two variables. Additionally, the governorate of residency variable had a significant impact on hypokalemia as shown in the model equation. The coefficient for residency in Aleppo (relative to Idleb) was B = 1.500 with a p value less than 0.001, indicating a significant difference in hypokalemia odds based on the governorate. The odds ratio (Exp(B) = 4.482) indicated that residents of Aleppo had approximately 4.5 times higher odds of having normal potassium levels compared to residents of Idleb with 95% CI (2.086 – 9.632).

The contingency Table 4.93 of the correlation between hypokalemia and residency status showed that among individuals with normal potassium levels, 19.1% were from host communities and 80.9% were IDPs. Among those with hypokalemia, 11.6% were from the host population and 88.4% were IDPs.

Table 4.92. The distribution table of the cases based on hypokalemia and residency status variables

			The residency status of the patient		Total
			host population	IDP	
Hypokalemia	Normal	N	9	38	47
		%	19.1%	80.9%	100.0%
	Hypokalemia	N	31	237	268
		%	11.6%	88.4%	100.0%
Total		N	40	275	315
		%	12.7%	87.3%	100.0%

The χ^2 test results for the residency status indicated no significant association between hypokalemia and residency status ($p = 0.150 > 0.05$), suggesting that the residency status variable was not a significant predictor of hypokalemia in this model. Besides, the residency status variable was not a significant predictor of hypokalemia in the correlation model (Exp(B) = 1.321, $p = 0.517 > 0.05$, 95% CI: 0.569 – 3.066). Therefore, this variable was removed from the model.

The cases distribution table indicated that among individuals with normal potassium levels, 31.9% were illiterate, 59.6% had primary school education, 6.4% had intermediate or secondary school education, and 2.1% had high education. Among those with hypokalemia, 23.1% were illiterate, 64.9% had primary school education, 7.1% had intermediate or secondary school education, and 4.9% had high education (Table 4.94). In addition, the χ^2 tests showed no significant association between education level and hypokalemia ($p = 0.545 > 0.05$).

Table 4.93. The distribution table of the cases based on hypokalemia and the patient's education attainment variable

			The education level of the patient				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
Hypokalemia	Normal	N	15	28	3	1	47
		%	31.9%	59.6%	6.4%	2.1%	100.0%
	Hypokalemia	N	62	174	19	13	268
		%	23.1%	64.9%	7.1%	4.9%	100.0%
Total		N	77	202	22	14	315
		%	24.4%	64.1%	7.0%	4.4%	100.0%

Besides, the education level of the patient was not a significant predictor of hypokalemia in the correlation model ($p > 0.05$ for all the education categories with 95% CI), as depicted in Table 4.95.

Table 4.94. Binary logistic model of the correlation between hypokalemia dependent variable and governorate of residency and patient's education level independent variable. Reference group: Aleppo and illiterate

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	1.474	.402	13.458	1	.000	4.365	1.986	9.592
	Patient's education level (illiterate)			.560	3	.906			
	Patient's education level (primary school)	.268	.363	.546	1	.460	1.307	.642	2.661
	Patient's education level (intermediate and secondary school)	.254	.704	.130	1	.718	1.289	.325	5.119
	Patient's education level (university and higher)	.229	1.122	.041	1	.839	1.257	.139	11.341
	Constant	1.047	.302	11.995	1	.001	2.849		

In addition, adding the spouse's education attainment variable did not show a significant correlation or impact in the model. The contingency Table 4.96 indicated that among individuals with normal potassium levels, 40.4% had spouses who were illiterate, and 59.6% had spouses with primary school education. There were no individuals with intermediate or secondary school education or high education among those with normal potassium levels. Among those with hypokalemia, 25.0% had spouses who were illiterate, 66.8% had spouses with primary school education, 4.9% had spouses with intermediate or secondary school education, and 3.4% had spouses with high education.

Table 4.95. The distribution table of the cases based on hypokalemia and spouse education level variables

			The education level of the husband				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
Hypokalemia	Normal	N	19	28	0	0	47
		%	40.4%	59.6%	0.0%	0.0%	100.0%
	Hypokalemia	N	67	179	13	9	268
		%	25.0%	66.8%	4.9%	3.4%	100.0%
Total		N	86	207	13	9	315
		%	27.3%	65.7%	4.1%	2.9%	100.0%

The χ^2 tests showed a borderline significant association between the spouse's education level and hypokalemia ($p = 0.054 > 0.05$). However, the spouse's education level was not a significant predictor of hypokalemia in the correlation model (Table 4.97). The p

value was higher than 0.05 for all education categories of the spouses. Thus, this variable was excluded from the model.

Table 4.96. Binary logistic model of the correlation between hypokalemia dependent variable and governorate of residency and spouse education level independent variables. Reference group: Aleppo and illiterate

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	1.408	.393	12.809	1	.000	4.087	1.890	8.834
	Spouse's education level (illiterate)			2.674	3	.445			
	Spouse's education level (primary school)	.555	.339	2.674	1	.102	1.742	.896	3.387
	Spouse's education level (intermediate and secondary school)	19.457	10837.6	.000	1	.999	2.8×10^7	.000	.
	Spouse's education level (university and higher)	19.620	12982.7	.000	1	.999	3.3×10^7	.000	.
	Constant	.820	.282	8.456	1	.004	2.270		

Similarly, the χ^2 tests of the correlation between hypokalemia and patients' employment status showed no significant levels ($p = 0.401 > 0.05$). The distribution Table 4.98 below indicated that among individuals with normal potassium levels, 97.9% were unemployed, and only 2.1% had a paid job. Among those with hypokalemia, 95.1% were unemployed, and 4.9% had a paid job.

Table 4.97. The distribution table of the cases based on hypokalemia and patient's employment status variables

			The employment status of the patient		Total
			Unemployed	Paid job	
Hypokalemia	Normal	N	46	1	47
		%	97.9%	2.1%	100.0%
	Hypokalemia	N	254	13	267
		%	95.1%	4.9%	100.0%
Total		N	300	14	314
		%	95.5%	4.5%	100.0%

The patient's employment status was not a significant predictor of hypokalemia in the correlation model. The coefficient for employment status was 0.210 with a p value of 0.847 (Exp(B) = 1.233), indicating that employment status did not independently predict the likelihood of hypokalemia. Nevertheless, the χ^2 tests of the correlation between hypokalemia and the employment status of patients and their spouses showed significant values ($p = 0.007 < 0.05$). The distribution Table 4.99 below revealed that among individuals with normal potassium levels, 19.1% had neither employed, 78.7% had one

employed, and 2.1% had both employed. Among those with hypokalemia, 42.7% had neither employed, 54.3% had one employed, and 3.0% had both employed.

Table 4.98. The distribution table of the cases based on hypokalemia and combined employment status of the patients and spouses

			The employment status of the participants and their husbands			Total
			None of them is employed	one of them is employed	both are employed	
Hypokalemia	Normal	N	9	37	1	47
		%	19.1%	78.7%	2.1%	100.0%
	Hypokalemia	N	114	145	8	267
		%	42.7%	54.3%	3.0%	100.0%
Total		N	123	182	9	314
		%	39.2%	58.0%	2.9%	100.0%

The omnibus tests of model coefficients indicated that the model significantly improved the predictive power ($\chi^2 = 28.644$, $p < 0.05$). The model completion remarkably increased. The R^2 value of the model increased from 0.098 in the model of correlation between hypokalemia and governorate of residency to 0.153 in the current model, which is a significant improvement in explanatory power. Besides, The Hosmer and Lemeshow Test indicated a good fit with a χ^2 value of 1.593 and a P value of 0.810 > 0.05, showing no evidence of poor fit.

The combined employment status of the patient and their spouse was a significant predictor of hypokalemia as shown in the model equation Table 4.100 below. Specifically, when one was employed, the coefficient was B = -1.213 (Exp(B) = 0.297, p = 0.002, 95% CI: 0.136 – 0.651), indicating that the odds of having hypokalemia were lower compared to the reference category (none was employed). Additionally, the category where both were employed was not a significant predictor with a coefficient of B = -0.995 (Exp(B) = 0.370, P = 0.390 > 0.05, 95% CI: 0.038 – 3.581).

Table 4.99. Binary logistic model of the correlation between hypokalemia dependent variable and governorate of residency and combined employment status independent variables. Reference group: Aleppo and none is employed

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	1.529	.398	14.772	1	.000	4.612	2.115	10.055
	Combined employment (none is employed)			9.189	2	.010			
	Combined employment (one is employed)	-1.213	.400	9.188	1	.002	.297	.136	.651
	Combined employment (both are employed)	-.995	1.158	.737	1	.390	.370	.038	3.581
	Constant	2.059	.359	32.976	1	.000	7.840		

Adding the HH size variable did not show a significant improvement in the prediction power of the model. According to the distribution table, among individuals with normal potassium levels, 61.7% lived in normal-sized HHs, while 38.3% lived in crowded HHs. Among those with hypokalemia, 51.5% lived in normal-sized HHs, and 48.5% lived in crowded HHs (Table 4.101). The χ^2 tests did not show a significant association between HH size and hypokalemia ($p = 0.196 > 0.05$).

Table 4.100. The distribution of the cases based on hypokalemia and HH size variables

			The HH size		Total
			Normal HH size	Crowded HH	
Hypokalemia	Normal	N	29	18	47
		%	61.7%	38.3%	100.0%
	Hypokalemia	N	138	130	268
		%	51.5%	48.5%	100.0%
Total		N	167	148	315
		%	53.0%	47.0%	100.0%

While the governorate of residency and combined employment status were significant predictors of the outcome variable, the HH size variable was a marginal predictor of hypokalemia with a coefficient of B = 0.658 (Exp(B) = 1.930, p = 0.056 > 0.05, 95% CI: 0.984 – 3.785) (Table 4.102).

Table 4.101. Binary logistic model of the correlation between hypokalemia dependent variable and governorate of residency, combined employment status, and HH size independent variables. Reference group: Aleppo, none is employed, and normal size

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	1.628	.403	16.304	1	.000	5.093	2.311	11.225
	Combined employment (none is employed)			8.866	2	.012			
	Combined employment (one is employed)	-1.196	.402	8.859	1	.003	.302	.138	.665
	Combined employment (both are employed)	-1.029	1.171	.772	1	.380	.357	.036	3.546
	HH size	.658	.344	3.661	1	.056	1.930	.984	3.785
	Constant	1.723	.393	19.176	1	.000	5.601		

In the next step, we added the average HH monthly income to the model. The contingency table showed that among individuals with normal potassium levels, 51.1% had a monthly income within or higher than the average, while 48.9% had a monthly income less than the average. Among those with hypokalemia, 16.8% had a monthly income within or higher than the average, and 83.2% had a monthly income less than the average (Table 4.103).

Table 4.102. The distribution table of the cases based on hypokalemia and average HH monthly income variables

			The monthly income level of the HH		Total
			The HH monthly income is within or higher than the average	The HH monthly income is less than the average	
Hypokalemia	Normal	N	24	23	47
		%	51.1%	48.9%	100.0%
	Hypokalemia	N	45	223	268
		%	16.8%	83.2%	100.0%
Total		N	49	266	315
		%	15.6%	84.4%	100.0%

The χ^2 tests indicated a significant association between HH income and hypokalemia (P = 0.001 < 0.05). Besides, the omnibus tests of model coefficients indicated that the overall model significantly improved the predictive power (χ^2 = 28.823, p < 0.001). The value of R^2 increased from 0.153 in the model of correlation between hypokalemia and governorate of residency and combined employment status to 0.274 in the current model. This remarkable increase referred to a significant completion of the model and 27.4% of the hypokalemia cases could be predicted by the current combination of the independent variables. Furthermore, the HH income variable was a significant predictor of hypokalemia with a coefficient of B = 3.254 (Exp(B) = 3.776, p = 0.007 < 0.05, 95% CI: 1.535 – 5.566), meaning that individuals from HHs with a monthly income less than the average had higher odds of hypokalemia compared to those living in HHs with a monthly income within or higher than the average (Table 4.104).

Table 4.103. Binary logistic model of the correlation between hypokalemia dependent variable and governorate of residency, combined employment status, and HH monthly income independent variables. Reference group: Aleppo, none is employed, and income is within or higher than the average

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	1.470	.418	12.348	1	.000	4.350	1.916	9.876
	Combined employment (none is employed)			9.351	2	.009			
	Combined employment (one is employed)	-1.227	.401	9.346	1	.002	.293	.133	.644
	Combined employment (both are employed)	-1.095	1.181	.859	1	.354	.335	.033	3.386
	HH monthly income	3.254	.610	.173	1	.007	3.776	1.535	5.566
	Constant	2.314	.709	10.638	1	.001	10.112		

The contingency table of the cases showed that among individuals with normal potassium levels, 80.9% were Arab, and 19.1% were Kurdish. Among those with hypokalemia, 92.9% were Arab, and 7.1% were Kurdish (Table 4.105). The χ^2 tests

indicated a significant association between ethnicity and hypokalemia (p = 0.007). This suggests that ethnicity is a significant predictor of hypokalemia.

Table 4.104. The distribution table of the cases based on hypokalemia and ethnicity variables

			The ethnicity of the participants		Total
			Arab	Kurdish	
Hypokalemia	Normal	N	38	9	47
		%	80.9%	19.1%	100.0%
	Hypokalemia	N	249	19	268
		%	92.9%	7.1%	100.0%
Total		N	287	28	315
		%	91.1%	8.9%	100.0%

However, the ethnicity variable was also not a significant predictor of hypokalemia with a coefficient B of -0.402 and a p value of 0.391 > 0.05, Exp(B) = 0.669).

4.2.2.5. Hypocalcemia

Among individuals with normal calcium levels, 49.1% were in the early reproductive age group, 35.0% were in the mid-reproductive age group, and 15.9% were in the advanced reproductive age group. Among those with hypocalcemia, 47.2% were in the early reproductive age group, 36.0% were in the mid-reproductive age group, and 16.9% were in the advanced reproductive age group (Table 4.106). The χ^2 tests indicated no significant association between age group and hypocalcemia (p = 0.951 > 0.05).

Table 4.105. The distribution table of the cases based on hypocalcemia and age group variables

			Age groups			Total
			Early reproductive phase 14 – 25 y	Mid-reproductive age 25 – 34 y	Advanced reproductive age 35 – 45 y	
Hypocalcemia	Normal	N	111	79	36	226
		%	49.1%	35.0%	15.9%	100.0%
	Hypocalcemia	N	42	32	15	89
		%	47.2%	36.0%	16.9%	100.0%
Total		N	153	111	51	315
		%	48.6%	35.2%	16.2%	100.0%

The age group variable was not a significant predictor of hypocalcemia. The coefficients for the mid-reproductive age group and the advanced reproductive age group, relative to the early reproductive age group (reference group), were both non-significant. Specifically, the coefficient for the mid-reproductive age group was 0.068 with a p value of

0.806 (Exp B) = 1.071), and the coefficient for the advanced reproductive age group was 0.096 with a P value of 0.787 (Exp(B) = 1.101) (Table 4.107).

Table 4.106. Binary logistic model of the correlation between hypocalcemia dependent variable and age group independent variable. Reference group: early age group

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Age groups			.100	2	.951			
	Age group (mid-reproductive age)	.068	.277	.061	1	.806	1.071	.622	1.842
	Age group (advanced age group)	.096	.357	.073	1	.787	1.101	.547	2.216
	Constant	-.972	.181	28.780	1	.000	.378		

The contingency table of the cases showed the distribution of hypocalcemia across the two governorates, Aleppo and Idleb. Among individuals with normal calcium levels, 48.2% resided in Aleppo and 51.8% in Idleb. Among those with hypocalcemia, 66.3% resided in Aleppo and 33.7% in Idleb (Table 4.108).

Table 4.107. The distribution table of the cases based on hypocalcemia and governorate of residency variables

			The address of the patient		Total	X^2 p value
			Aleppo	Idleb		8,506
Hypocalcemia	Normal	N	109	117	226	0,004
		%	48.2%	51.8%	100.0%	
	Hypocalcemia	N	59	30	89	
		%	66.3%	33.7%	100.0%	
Total		N	168	147	315	
		%	53.3%	46.7%	100.0%	

The χ^2 tests indicated a significant association between governorate of residency and hypocalcemia ($p = 0.004 < 0.05$). Besides, the omnibus tests of model coefficients indicated that the overall model significantly improved the predictive power ($\chi^2 = 8.506$, $p = 0.004 < 0.05$). The R^2 value of 0.038 indicated that the model explained approximately 3.8% of the variance in hypocalcemia status. The governorate of residency was a significant predictor of hypocalcemia in the model equation. The coefficient for residency in Idleb, relative to Aleppo, was B = -0.747 (Exp(B) = 0.474, $p = 0.004 < 0.05$, 95% CI: 0.284 – 0.790). This indicated that individuals residing in Idleb had significantly lower odds (by about 53%) of having hypocalcemia compared to those residing in Aleppo.

By adding the residency status to the model, we found that among individuals with normal calcium levels, 10.6% were from host populations and 89.4% were IDPs. Among those with hypocalcemia, 18.0% were from host populations and 82.0% were IDPs (Table 4.109).

Table 4.108. The contingency table of the cases based on hypocalcemia and residency status variables

			The residency status of the patient		Total
			Host populations	IDP	
Hypocalcemia	Normal	N	24	202	226
		%	10.6%	89.4%	100.0%
	Hypocalcemia	N	16	73	89
		%	18.0%	82.0%	100.0%
Total		N	40	275	315
		%	12.7%	87.3%	100.0%

The χ^2 tests indicated no significant association between residency status and hypocalcemia ($p = 0.077 > 0.05$). Besides, residency status was not a significant predictor of hypocalcemia. The coefficient for being an IDP, relative to having formal residency, was -0.438 with a p-value of 0.222 (Exp(B) = 0.645). Later, we added the patient's education attainment variable to the model after removing the residency status variable, and it was found that Among individuals with normal calcium levels, 22.6% were illiterate, 62.8% had primary school education, 8.4% had intermediate or secondary education, and 6.2% had high education. In addition, among those with hypocalcemia, 29.2% were illiterate, 67.4% had primary school education, 3.4% had intermediate or secondary education, and none had high education (Table 4.110). The χ^2 tests showed a significant association between education level and hypocalcemia ($p = 0.027 < 0.05$).

Table 4.109. The distribution table of cases based on hypocalcemia and patient's education attainment variables

			The education level of the patient				
			Illiterate	Primary school	intermediate or secondary school	high education	Total
Hypocalcemia	Normal	N	51	142	19	14	226
		%	22.6%	62.8%	8.4%	6.2%	100.0%
	Hypocalcemia	N	26	60	3	0	89
		%	29.2%	67.4%	3.4%	0.0%	100.0%
Total		N	77	202	22	14	315
		%	24.4%	64.1%	7.0%	4.4%	100.0%

Education level, however, was not a significant predictor of hypocalcemia. The coefficients for primary school, intermediate/secondary school, and high education were

not statistically significant, indicating that education level did not significantly impact the likelihood of hypocalcemia in this sample (P > 0.05) as shown in Table 4.111 below.

Table 4.110. Binary logistic model of the correlation between hypocalcemia dependent variable and governorate of residency and patient's education attainment independent variables. Reference group: Aleppo and illiterate

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.620	.266	5.455	1	.020	.538	.320	.905
	Patient's education level (illiterate)			2.698	3	.441			
	Patient's education level (primary school)	-.115	.290	.157	1	.692	.891	.505	1.574
	Patient's education level (intermediate and secondary school)	-1.099	.671	2.685	1	.101	.333	.089	1.240
	Patient's education level (university and higher)	-20.166	10714.989	.000	1	.998	.000	.000	.
	Constant	-.471	.256	3.392	1	.066	.624		

Table 4.112 of the cases based on hypocalcemia and spouse's education attainment showed that among individuals with normal calcium levels, 27.0% of their spouses were illiterate, 65.5% had primary school education, 4.4% had intermediate or secondary education, and 3.1% had high education. Additionally, among those with hypocalcemia, 28.1% of their spouses were illiterate, 66.3% had primary school education, 3.4% had intermediate or secondary education, and 2.2% had high education.

Table 4.111. The distribution table of cases based on hypocalcemia and spouse's education attainment level

			The education level of the husband				Total
			Illiterate	Primary school	intermediate or secondary school	high education	
Hypocalcemia	Normal	N	61	148	10	7	226
		%	27.0%	65.5%	4.4%	3.1%	100.0%
	Hypocalcemia	N	25	59	3	2	89
		%	28.1%	66.3%	3.4%	2.2%	100.0%
Total		N	86	207	13	9	315
		%	27.3%	65.7%	4.1%	2.9%	100.0%

The χ^2 tests showed no significant association between the spouse's education level and hypocalcemia (p = 0.947 > 0.05). Besides, the spouse's education level was not a significant predictor of hypocalcemia. The coefficients for primary school, intermediate/secondary school, and high education were not statistically significant (p > 0.05), indicating that the spouse's education level did not significantly impact the likelihood of hypocalcemia.

The contingency table of the case distribution showed that among those with normal calcium levels, 95.1% were unemployed and 4.9% had paid jobs. Among those with hypocalcemia, 96.6% were unemployed and 3.4% had paid jobs (Table 4.113). The χ^2 test results showed no significant association between the patient's employment status and hypocalcemia ($p = 0.557 > 0.05$).

Table 4.112. The distribution table of cases based on hypocalcemia and patient's employment status

			The employment status of the patient		Total
			Unemployed	Paid job	
Hypocalcemia	Normal	N	214	11	225
		%	95.1%	4.9%	100.0%
	Hypocalcemia	N	86	3	89
		%	96.6%	3.4%	100.0%
Total		N	300	14	314
		%	95.5%	4.5%	100.0%

The patient's employment status was not a significant predictor of hypocalcemia. The coefficient for employment status (paid job relative to unemployed) was -0.076 with a p value of $0.911 > 0.05$, (Exp(B) = 0.927), indicating that employment status did not significantly impact the likelihood of hypocalcemia in this sample. The combined employment status of patients and spouses did not show different findings. The case distribution table revealed that among those with normal calcium levels, 40.4% had neither the participant nor their spouse employed, 56.4% had one of them employed, and 3.1% had both employed. Among those with hypocalcemia, 36.0% had neither employed, 61.8% had one employed, and 2.2% had both employed (Table 4.114). The χ^2 test results showed no significant association between the combined employment status and hypocalcemia ($p = 0.667 > 0.05$).

Table 4.113. The distribution table of the cases based on hypocalcemia and combined employment status variables

			The employment status of the participants and their husbands			
			None of them is employed	one of them is employed	both are employed	Total
Hypocalcemia	Normal	N	91	127	7	225
		%	40.4%	56.4%	3.1%	100.0%
	Hypocalcemia	N	32	55	2	89
		%	36.0%	61.8%	2.2%	100.0%
Total		N	123	182	9	314
		%	39.2%	58.0%	2.9%	100.0%

The combined employment status of the participant and their spouse was not a significant predictor of hypocalcemia. The coefficients for having one employed (B =

0.204, p = 0.440, Exp(B) = 1.227, 95% CI: 0.730 – 2.061) and for having both employed (B = 0.030, p = 0.971, Exp(B) = 1.031, 95% CI: 0.198 – 5.354) indicated that employment status did not significantly impact the likelihood of hypocalcemia (Table 4.115).

Table 4.114. Binary logistic model of the correlation between hypocalcemia dependent variable and governorate of residency and combined employment status independent variables. Reference group: Aleppo and none is employed

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.734	.263	7.815	1	.005	.480	.287	.803
	Combined employment status (none is employed)			.609	2	.737			
	Combined employment status (one is employed)	.204	.265	.596	1	.440	1.227	.730	2.061
	Combined employment status (both are employed)	.030	.841	.001	1	.971	1.031	.198	5.354
	Constant	-.737	.230	10.262	1	.001	.478		

The contingency table of the cases showed that among those with normal calcium levels, 58.0% lived in normal-sized HHs, while 42.0% lived in crowded HHs. Among those with hypocalcemia, 40.4% lived in normal-sized HHs, and 59.6% lived in crowded HHs (Table 4.116).

Table 4.115. The contingency table of cases based on hypocalcemia and HH size variables

			The HH size		Total
			Normal HH size	Crowded HH	
Hypocalcemia	Normal	N	131	95	226
		%	58.0%	42.0%	100.0%
	Hypocalcemia	N	36	53	89
		%	40.4%	59.6%	100.0%
Total		N	167	148	315
		%	53.0%	47.0%	100.0%

The χ^2 test results showed a significant association between HH size and hypocalcemia ($p = 0.005 < 0.05$). Additionally, the omnibus tests of model coefficients indicated that the overall model significantly improved the predictive power ($\chi^2 = 14.176$, $p = 0.001 < 0.05$). This suggests that the model, including governorate of residency and HH size as predictors, significantly predicts hypocalcemia. The model summary revealed that the model explained a small portion of the variance in hypocalcemia status, with R^2 increased from 0.038 in the last significant model of correlation (hypocalcemia and governorate of residency) to 0.063. The coefficient for living in a crowded HH was B = 0.614 (Exp(B) = 1.847, p = 0.018 < 0.05, 95% CI: 1.112 – 3.070). This indicates that

individuals living in crowded HHs had significantly higher odds (by about 84.7%) of having hypocalcemia compared to those living in normal-sized HHs (Table 4.117).

Table 4.116. Binary logistic model of the correlation between hypocalcemia dependent variable and governorate of residency and HH size independent variables. Reference group: Aleppo and normal size

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	Gov of residency	-.657	.265	6.138	1	.013	.518	.308	.872
	HH size	.614	.259	5.607	1	.018	1.847	1.112	3.070
	Constant	-.964	.225	18.429	1	.000	.381		

The distribution table of the cases based on hypocalcemia and average HH monthly income showed that among those with normal calcium levels, 18.6% were living in HHs with income within or higher than the average, while 81.4% were from HHs with income less than the average. Among those with hypocalcemia, 7.9% were from HHs with income within or higher than the average, and 92.1% were from HHs with income less than the average (Table 4.118). The χ^2 test results showed a significant association between HH income and hypocalcemia ($p = 0.012 < 0.05$).

Table 4.117. The distribution table of cases based on hypocalcemia and average HH monthly income variables

			The monthly income level of the HH		Total
			The HH monthly income is within or higher than the average	The HH monthly income is less than the average	
Hypocalcemia	Normal	N	42	184	226
		%	18.6%	81.4%	100.0%
	Hypocalcemia	N	7	82	89
		%	7.9%	92.1%	100.0%
Total		N	49	266	315
		%	15.6%	84.4%	100.0%

The omnibus tests of model coefficients indicated that the overall model significantly improved the predictive power ($\chi^2 = 15.644$, $p = 0.001 < 0.05$). This suggests that the model, including governorate of residency, HH size, and HH income as predictors, significantly predicts hypocalcemia. Additionally, the model summary revealed that the model explained a portion of the variance in hypocalcemia status, with an R^2 value of 0.696. This indicated that the predictors included in the model explain a moderate proportion of the variability in hypocalcemia status. The coefficient for having a HH income less than the average was B = 1.537 (Exp(B) = 3.710, $p = 0.002 < 0.05$, 95% CI:

1.696 – 4.203). This indicates that individuals with an HH income less than the average had significantly higher odds (by about 271%) of having hypocalcemia compared to those with a HH income within or higher than the average (Table 4.119).

Table 4.118. Binary logistic model of the correlation between hypocalcemia dependent variable and governorate of residency, HH size, and average HH monthly income independent variables. Reference group: Aleppo, normal size, and The HH monthly income is within or higher than the average

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	**Gov of residency**	-.557	.276	4.066	1	.044	.573	.334	.985
	HH size	.551	.264	4.372	1	.037	1.735	1.035	2.909
	HH monthly income	1.537	.459	1.369	1	.002	3.710	1.696	4.203
	Constant	-1.445	.474	9.307	1	.002	.236		

Adding the ethnicity variable to the model did not show a significant contribution to the prediction of the outcome variable. The contingency table results showed that among those with normal calcium levels, 92.9% were Arab and 7.1% were Kurdish, and among those with hypocalcemia, 86.5% were Arab and 13.5% were Kurdish. The χ^2 test results showed no significant association between ethnicity and hypocalcemia ($p = 0.083 > 0.05$). Besides, the coefficient for being Kurdish was B = 0.453 with an Exp(B) = 1.572, $p = 0.290 > 0.05$, 95% CI: 0.680 – 3.638. This indicated that ethnicity was not a significant predictor of hypocalcemia among pregnant women.

Table 4.120 below depicts the variables that showed significant binary model correlation with each of the maternity outcome variables.

Table 4.119. Binary logistic model correlation between the maternity outcome variables and independent socioeconomic variables

	Anemia	**GDM**	**Hyponatremia**	**Hypokalemia**	**Hypocalcemia**
Age group	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05
Gov of residency	**P < 0.05**	**P < 0.05**	**P < 0.05**	**P < 0.05**	**P < 0.05**
Residency status	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05
Patient's education level	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05
Spouse's education level	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05
Patient's employment status	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05
Combined employment status	P > 0.05	P > 0.05	P > 0.05	**P < 0.05**	P > 0.05
HH size	P > 0.05	P > 0.05	P > 0.05	P > 0.05	**P < 0.05**
Average HH monthly income	**P < 0.05**	**P < 0.05**	P > 0.05	**P < 0.05**	**P < 0.05**
Ethnicity	P > 0.05	P > 0.05	P > 0.05	P > 0.05	P > 0.05

5. DISCUSSION

The aim of this dissertation was to investigate the health and nutritional status of women in a conflict-affected region, Northwest Syria, with a specific focus on maternal health indicators such as anemia, GDM, hyponatremia, hypokalemia, and hypocalcemia. Through a comprehensive analysis of demographic, socioeconomic, and health-related variables, this research sought to identify key factors influencing food diversity and uptake as well as health outcomes among pregnant women and to understand the broader implications of conflict on maternal health. The novelty of this study lies in its specific context, targeting women in war-torn areas, an often-underrepresented population in health research. By examining a range of health indicators and their associations with variables such as residency status, HH size, and income levels, this dissertation contributes to the existing body of knowledge by highlighting the unique challenges faced by women in conflict zones.

5.1. Sociodemographic Factors

The age distribution reveals that a significant proportion of the participants were in the early reproductive phase, accounting for 48.6% of the total sample. This group was followed by the mid-reproductive age group at 35.2%, and the advanced reproductive phase group at 16.2%. This distribution suggests that younger women are more prominently represented in the study. When examining the data by governorate, it becomes evident that Idleb has a higher concentration of younger patients. Specifically, 55.8% of participants from Idleb were in the early reproductive phase, compared to 42.3% from Aleppo. In contrast, Aleppo had a more balanced age distribution with 37.5% of participants in the mid-reproductive age group compared to 32.7% from Idleb, and a notably higher proportion of participants in the advanced reproductive age group (20.2% vs. 11.6% in Idleb). This indicates a demographic shift with a younger population in Idleb and a more evenly spread age distribution in Aleppo. The predominance of younger patients in Idleb might reflect the broader demographic trends in conflict-affected areas, where younger populations are often more mobile and may have different reproductive health needs compared to older populations. Studies in similar contexts, such as Yemen and Iraq, have shown comparable trends, where conflict and displacement disproportionately affect younger women, leading to a higher representation of this demographic in health studies (216,217). These findings underscore the importance of targeted reproductive

health services for younger women in conflict zones to address their unique needs and challenges.

The data analysis demonstrates a balanced distribution of participants between the Aleppo (53.3%) and Idleb (46.7%) governorates. Notably, all Kurdish participants hailed from Aleppo. The allocation across the four health facilities exhibits a relatively uniform spread, thereby ensuring comprehensive coverage throughout the regions. This equitable distribution assumes paramount importance in conflict-affected areas to guarantee fair access to healthcare services. Previous studies conducted in analogous settings have underscored the significant improvements in health outcomes that result from the equitable distribution of healthcare services (218). The majority of the participants (87.3%) were IDPs living in informal settings. This high percentage underscores the impact of the ongoing conflict in Syria, which has displaced millions and severely affected their living conditions. Studies have shown that IDPs face numerous challenges, including limited access to healthcare, which can adversely affect maternal and child health outcomes. The lack of significant differences in age distribution between IDPs and those with formal residency ($P > 0.05$) suggests that the reproductive age profile is similar across these groups, aligning with findings from other conflict zones where displacement affects all demographic groups equally (218,219). Additionally, the analysis indicated no statistically significant differences in the distribution of age groups between Arab and Kurdish participants ($p > 0.05$). This similarity in age distribution across ethnic groups highlights the universal impact of conflict, cutting across ethnic lines.

Education levels among participants indicated significant variations ($p = 0.017$) across different age groups. Illiteracy and primary school education were more prevalent among younger participants, while higher education was consistently low among all age groups. This pattern aligned with findings from other conflict-affected areas, where educational disruptions resulted in reduced educational achievements overall, particularly among younger populations (220). The data also suggested that formal residents had slightly better access to primary education compared to IDPs, likely due to more stable living conditions. The employment data indicated extremely high unemployment rates, particularly in Aleppo (98.8%) compared to Idleb (91.8%). This high unemployment was a direct consequence of the ongoing conflict, which has devastated the local economy and employment opportunities. Such high unemployment rates are common in conflict zones

and severely impact HH income and access to essential services, including healthcare (221). The analysis showed a significant correlation between HH size and income, with crowded HH more likely to have incomes below the average ($p < 0.05$). These findings were consistent with other studies in conflict settings where larger HHs often struggle with lower per capita income, exacerbating poverty and limiting access to resources (222). Additionally, there was a significant disparity in income levels between Aleppo and Idleb, with higher-income HHs predominantly found in Idleb, which might be due to differences in local economic conditions and the impact of the conflict on these regions.

5.2. Anthropometric Measurements

The analysis of the summary statistics for weight and height among the participants yields valuable insights into the physical characteristics of the study population. The participants' weights ranged from 46 kg to 108 kg, with the most prevalent weight being 55 kg and a median weight of 64 kg. The mean weight was approximately 65.21 kg with an SD of 12.05 kg, indicating moderate variability. The distribution of weights was relatively even, with no significant spikes, suggesting a gradual and smooth spread among the participants. The data revealed that 50% of participants weighed between 56 kg and 71 kg, with smaller groups on both extremes. Notably, 10.5% of participants weighed 50 kg or less, about 22.9% weighed 55 kg or less, 52.7% weighed 64 kg or less, 73.7% weighed 70 kg or less, and nearly 85.4% weighed 78 kg or less, indicating that the upper 15% of participants weighed more than 78 kg, with the maximum weight recorded at 108 kg.

Similarly, the heights of participants ranged from 137 cm to 178 cm, with the most common height being 156 cm and a median height of 158 cm. The mean height was approximately 158.25 cm with a standard deviation of 6.41 cm, suggesting moderate variability. Most participants' heights fell between 154 cm and 163 cm, representing the central 50% of the data, with fewer participants at the extreme ends. The distribution showed a higher concentration around the mean, indicating a relatively normal distribution with slight variation. Cumulatively, 12.4% of participants were 150 cm or shorter, 28.3% were 154 cm or shorter, 48.6% were 157 cm or shorter, 65.1% were 160 cm or shorter, and approximately 90.2% were 166 cm or shorter, with the upper 10% taller than 166 cm, and the maximum height recorded at 178 cm.

These findings are consistent with similar studies conducted in conflict-affected and humanitarian contexts. For instance, a study conducted in Syria among pregnant women reported comparable distributions in weight and height, reflecting the impacts of prolonged conflict and displacement on nutritional status and physical health (214). Similar trends were observed in studies conducted in other conflict-affected areas such as Yemen and Iraq, where the variability in physical characteristics was influenced by socioeconomic factors and access to healthcare. The moderate variability in weight and height among participants in this study highlights the diverse nutritional and health status within the population, potentially influenced by factors such as food security, healthcare access, and displacement status (58,215).

5.3. Food Groups and Overall Food Uptake

The majority of participants (90.5%) consumed food from Group 1 at a moderate frequency of three times a month. This high consumption rate reflects the dietary patterns observed in conflict-affected regions, where certain staple foods are more readily available due to aid distributions. Studies conducted in similar contexts, such as Yemen and South Sudan, have demonstrated that staple food groups are often consumed at higher rates due to their availability through humanitarian aid (223,224). However, the small percentage of participants who consumed this group less frequently (1%) or more frequently (8.6%) indicates variability in access and personal preferences.

The data revealed that a significant majority (82.2%) consumed food from Group 2 more than three times a month, suggesting an adequate availability of these food products in Northwest Syria. Similar findings have been reported in other conflict zones, where local markets, despite disruptions, continue to provide certain food items more consistently (88,225). The minority (5.1%) consuming this food group less than three times a month may reflect issues with food insecurity and access disparities within the population. Besides, approximately half of the participants (55.2%) consumed food from Group 3 with a moderate frequency of three times per month. The data suggests that a significant proportion (32.7%) consumed it less frequently, which reflects potential difficulties in accessing a varied diet. These findings are consistent with studies conducted in multiple conflict-affected areas, where food accessibility is greatly affected by ongoing conflicts and economic instability (226,227).

The majority (75.2%) consumed food from Group 4 three times a month, suggesting it is a common part of their diet. However, the data shows a smaller portion (20.6%) consumed it less frequently, indicating possible variability in access or dietary preferences. In addition, an overwhelming majority (95.9%) consumed food from Group 5 three times per month, indicating it is a staple in their diet. This is one of the highest consumption rates among all food groups, reflecting similar patterns seen in other conflict zones where certain food items are prioritized in aid distributions due to their nutritional value and availability (228). Additionally, the data showed that 85.7% of participants consumed food from Group 6 at a moderate frequency. The small portion consuming it less frequently (13.7%) or more frequently (0.6%) highlights the variability in access. Studies in other areas have documented similar patterns, where access to certain food groups can be inconsistent due to the fluctuating supply chains in conflict zones (229). The consumption patterns for food group 7 showed that 61.9% of participants consumed it at a moderate level, while 23.8% consumed it more frequently. The lower consumption rates among 14.3% of participants might reflect limited access or preferences influenced by availability. This mirrors findings in Syria and other Middle Eastern conflict areas, where dietary habits are significantly shaped by the availability of aid and market conditions (5,230,231).

For the overall food uptake, the study findings indicate that out of a total of 315 cases, 132 individuals, representing 41.9% of the sample, exhibited low food uptake. Furthermore, 151 cases, accounting for 47.9% of the sample, fell into the moderate food uptake category, making it the largest group. This suggests that approximately half of the population has an adequate, yet suboptimal, level of food consumption. Conversely, only 32 cases, equivalent to 10.2% of the sample, demonstrated sufficient food uptake, indicating that a relatively small proportion of the population consumes food at an adequate level. These findings are consistent with the existing academic literature on food security in conflict-affected regions. In such regions, food scarcity and insufficient nutrition are widespread due to disruptions in supply chains, economic instability, and mass displacement. For example, a report by the World Food Program (WFP) (2021) on food security in Syria emphasized that a substantial proportion of the population faces food insecurity, relying heavily on humanitarian assistance to fulfill their fundamental nutritional requirements (232). Similarly, a study conducted in Yemen found that ongoing conflict has severely impacted food availability, leading to widespread malnutrition and low food intake among vulnerable populations (233). Furthermore, research in other

conflict-affected areas, such as Africa, has shown that displacement often exacerbates food insecurity, as IDPs face additional barriers to accessing food, including lack of income, limited access to markets, and reliance on external aid (234,235). These patterns are evident in the current study, where a significant portion of participants exhibited low to moderate food intake, underscoring the critical need for sustained humanitarian assistance and interventions to improve food security in these regions.

5.4. Overall Food Consumption and Independent Variables

The multinomial regression analysis revealed that age groups did not significantly impact overall food consumption among the participants. These findings align with studies conducted in similar contexts. For instance, research in conflict-affected areas like Afghanistan and Ethiopia has shown that age alone does not significantly determine food security status; instead, other factors such as HH size and income levels play more critical roles in determining food consumption patterns (236,237). A study by Ricardo León, et al. concluded that in conflict or humanitarian settings, age does not significantly influence food consumption among pregnant women. These finding challenges common assumptions that older pregnant women might face more severe nutritional challenges due to age-related factors. Instead, the study highlights the importance of addressing other socioeconomic and environmental factors that equally impact pregnant women's nutritional status in these settings. The results underscore the need for targeted nutritional interventions that focus on the broader context rather than age-specific strategies to improve maternal health outcomes in conflict-affected areas (238). Several studies on dietary behavior and socio-cultural determinants of dietary diversity among women in conflict and humanitarian settings have emphasized the significant impact of age and other socioeconomic factors on food consumption. In the Amhara region of Ethiopia, pregnant women in the older age group tended to have more diverse diets, influenced by factors such as decision-making autonomy and cultural beliefs (239). Similarly, a systematic review on delivering nutrition interventions to pregnant women and children in conflict settings found that older women and those with higher education levels exhibited better dietary diversity. Sociodemographic barriers, such as limited resources, security concerns, and difficulties in accessing beneficiaries, also affect food consumption (240). In the context of Rohingya women, age was shown to significantly influence dietary diversity, with older women and those with higher dietary diversity levels having better nutritional status (241). Among Syrian refugee mothers in Beirut, Lebanon, age and

socioeconomic factors, such as income and mental health status, were closely linked to dietary diversity and food insecurity (76).

When replacing the age group variable with the governorate of residence variable, the results showed a significant correlation between food consumption categories and the governorate of residence. The distribution of participants indicated that most of the participants with low food consumption were living in Aleppo. Additionally, most of the participants with sufficient food consumption were from Idleb. These findings suggest that residents of Idleb are significantly less likely to have low or moderate food consumption compared to residents of Aleppo. This result is supported by evidence published in 2023 by People in Need NGO stating that the indicators of food security are better than in other areas due to more agriculture and humanitarian aid and better access to local markets, whereas Aleppo has faced more severe disruptions in food supply chains (242).

The addition of the residency status variable to the model significantly enhanced the correlation between overall food consumption and the independent variables of the governorate of residence and residency status. This aligns with findings from other conflict zones where residency status significantly influences food security outcomes. The higher likelihood of low and moderate food consumption among IDPs, as shown by our model, is supported by studies from Syria and neighboring regions. For example, research conducted in Lebanon among Syrian refugees found that displacement status was a significant predictor of food insecurity, with refugees facing higher levels of food insecurity compared to local populations (76). Multiple reports have documented the severe food insecurity challenges faced by IDPs in Syria. IRC (2022) reported that IDPs in Syria had limited access to food markets and humanitarian aid, exacerbating their food insecurity (243). Our findings from Northwest Syria are consistent with literature that emphasizes the critical role of displacement status in determining food security among populations in conflict-affected areas. Studies have shown that displacement has a notable impact on the food consumption and dietary behaviors of pregnant women in various humanitarian settings. This influence is determined by resource limitations, cultural beliefs, and socioeconomic factors. For instance, in Mbale, Uganda, pregnant women are compelled to reduce their food intake and make changes to their diets due to limited resources. This often involves omitting foods that may cause discomfort and incorporating options perceived to be healthier (244). Another study from humanitarian settings showed that displaced Cambodian women demonstrate both positive and negative

dietary practices influenced by the dominant culture (245). In Eastern Ethiopia, factors such as wealth, antenatal care, attitudes toward dietary practices, and consumption of animal-source foods significantly affect the food consumption scores of pregnant women (246). In general, several studies underscore the complementary impact of displacement, cultural norms, and socioeconomic status in shaping the dietary habits and food consumption of pregnant women in humanitarian contexts. The significant differences in food consumption patterns between governorates and host populations and IDPs further emphasize the importance of localized approaches to food security interventions in humanitarian contexts.

The multinomial regression analysis revealed that the addition of the education attainment variable significantly enhanced the correlation model between overall food consumption and the independent variables of the governorate of residence and residency status. Our results demonstrated that individuals with higher education attainment were less likely to have low or moderate food consumption. The significant association between education level and food consumption categories in our study underscores the importance of educational interventions to improve food security in conflict-affected regions. Furthermore, the significant correlation between residency status and food consumption categories reinforces the critical role of displacement in exacerbating food insecurity. Multiple research studies highlighted the significant impact of education and displacement on food consumption and dietary habits among pregnant women in various humanitarian settings. In Jordan, educational interventions targeting Syrian refugees were crucial in addressing nutrition gaps and improving feeding practices among infants and young children (247). In the Kurdistan Region of Iraq, a study demonstrated that pregnant women's nutritional and dietary practices were significantly influenced by their knowledge and attitudes towards nutrition, which were shaped by their educational attainment (248). In Lebanon, educational attainment was found to have a significant impact on the nutritional behaviors of pregnant women, underscoring the need for targeted educational interventions (249). A comparative study between Syrian refugee and Jordanian women also revealed that education influenced dietary practices and pregnancy outcomes (250). Furthermore, in Southwest Ethiopia, community-based nutritional education significantly improved pregnant women's knowledge, attitudes, and compliance with iron-folic acid supplementation (251). These findings collectively underscored the complex interplay between educational attainment and displacement in shaping the food consumption and dietary habits of pregnant women in conflict-affected areas.

The addition of the spouse's education attainment variable to the model did not significantly enhance the correlation between overall food consumption and the independent variables. Although the model fit improved with the inclusion of the spouse's education level, the likelihood ratio tests revealed that the education level of the spouse was not a significant predictor of food consumption categories. A study by Etea et al. (2023) found that while the inclusion of spouses' education improved the model fit, it was not a significant predictor of food consumption categories among pregnant women. The research, conducted in Ethiopia, underscores that women's own education and empowerment play a more critical role in dietary habits than their spouse's education in similar humanitarian settings (252).

The incorporation of employment status into the analysis of food consumption among pregnant women did not show a significant impact on dietary habits in Northwest Syria. Moreover, the lack of significant improvement in the correlation model upon including the employment status variable suggests that while employment is an important factor, it alone is insufficient to fully explain the dietary behaviors in these settings. These findings align with previous studies conducted in similar contexts. Monk, D., & Mundy, J. (2014), for example, argued that international peacebuilding interventions often perpetuated existing neoliberal political and economic conditions rather than improving local living conditions. This research indicated that HH employment status did not significantly alter nutritional outcomes for women in conflict areas in Africa, the Middle East, and Eastern Europe (253).

By incorporating the variable HH size into the model, along with the governorate of residence, residency status, and educational attainment of the patients, significant insights were gained into the food consumption patterns among the study population. The data revealed that individuals living in crowded HHs were overrepresented in the low food consumption category, with 81.8% of those with low food consumption residing in crowded HHs. In contrast, none of the individuals with sufficient food consumption lived in crowded HHs. This distribution emphasizes the crucial impact of HH overcrowding on food consumption and nutritional status. The statistically significant results of the χ^2 test indicate that HH size, among other variables, is a significant predictor of food consumption categories. The multinomial regression analysis further emphasizes the significant contrast between crowded and normal-sized HHs, specifically noting that crowded HHs are strongly associated with increased odds of low food consumption. These findings underscore the notion that living in crowded conditions is likely to worsen food insecurity and restrict access to sufficient nutrition. In real life, these results suggest that

interventions aimed at improving food security in conflict-affected and humanitarian settings should prioritize reducing HH overcrowding. Research studies conducted in conflict-affected regions have shown that HH overcrowding significantly impairs food security and nutritional status among pregnant women in humanitarian contexts. For instance, a study identified a significant relationship between HH food security status and energy and protein intake among pregnant women in the Central Tapanuli Regency. While HH overcrowding was not explicitly addressed, the study emphasized the broader context of HH food security and nutritional intake (254). Another study directly addressed the impact of HH overcrowding in conflict-affected South Sudan, finding that it contributes to increased scarcity and challenges in food distribution, significantly impacting the diets of pregnant women and young children (255).

The inclusion of HH income in the model yielded valuable insights concerning the dietary habits and food diversity of pregnant women in Northwest Syria. The data underscored a significant correlation between HH income and food consumption categories, as a greater proportion of individuals with low and moderate food consumption were from HHs with below-average incomes. More precisely, 95.5% of those with low food consumption and 88.1% of those with moderate food consumption were from HHs of incomes below the average, while 78.1% of those with adequate food consumption reported incomes at or above the average. However, the inclusion of HH income in the model also affected the significance of other variables such as the governorate of residency and education attainment. The previously significant impact of these variables became less pronounced, suggesting that income level may overshadow other factors in determining food security. This outcome underscores the predominant role of economic status in accessing adequate nutrition, particularly in settings marked by conflict and humanitarian crises. The examination of the impact of HH income on food intake and nutrition behaviors among pregnant women in conflict-affected and low-income settings consistently revealed significant associations. Different studies highlighted a clear correlation between income and food intake among pregnant women, particularly in conflict and low-income settings. Lower HH income significantly impacted dietary quality, food security, and dietary diversity, leading to inadequate nutrition. This was evident across various settings, including low-income communities in Kyrgyzstan, urban informal settings in Nairobi, and conflict-affected regions, underscoring the critical role of socioeconomic factors in determining nutritional outcomes (256). Additionally, significant determinants of malnutrition among pregnant and lactating women in Ethiopia included antenatal care attendance, maternal occupation, and family

participation in supplementary feeding programs, emphasizing the need for sustainable interventions and comprehensive nutrition education (257). Reduced dietary diversity was found to predict stunting among children in rural Bangladesh, particularly in those from low socioeconomic backgrounds or with a history of diarrhea, highlighting the importance of diverse diets for improving child nutrition (258).

In general, the multinomial regression analysis between overall food consumption and sociodemographic variables among pregnant women in Northwest Syria demonstrated that while age groups did not significantly impact overall food consumption, other factors such as HH size, income levels, and governorate of residence played critical roles. Residents of Aleppo experienced lower food consumption compared to those in Idleb due to severe disruptions in food supply. Displacement status was a significant predictor of food insecurity, with IDPs facing higher food insecurity levels. Educational attainment improved food consumption outcomes, whereas employment status and spouses' education levels did not significantly affect dietary habits. HH overcrowding and low income were associated with poor nutritional status, highlighting the need for targeted interventions addressing socioeconomic disparities to improve food security in conflict-affected regions.

5.5. Correlation Between Maternity Outcomes and Sociodemographic Variables

5.5.1. Anemia

The results of the serological tests among the sample subjects showed the variability and prevalence of different serologic conditions within the study population. The data highlighted the necessity for continuous monitoring and targeted interventions to address the identified health issues, such as anemia, GDM, hyponatremia, hypokalemia, and hypocalcemia. This comprehensive analysis provides valuable insights into the health status of the participants and establishes a foundation for future research and clinical practice aimed at improving maternal and neonatal outcomes.

Based on the findings of our study, the mean Hg level among pregnant women in Northwest Syria was 11.4 g/dl, which is very close to the results of Hg level among the same group in the Eastern Mediterranean region 11.7 g/dl as of 2011 (259). Additionally, the high prevalence of GDM underscores the critical need for effective screening and management programs to monitor and control glucose levels among pregnant women. This

need is highlighted by several academic research studies. A study conducted at a primary health center found a significant prevalence of GDM, emphasizing the necessity for implementing screening and management initiatives for glucose levels in pregnant women (260). Similarly, research in Egypt revealed the importance of such programs in rural areas where healthcare access may be limited (261).

The literature lacks academic studies about Sodium, potassium, and Calcium serological levels among pregnant women in Syria.

The analysis indicated that age groups did not significantly predict anemia. This finding implies that, within this population, anemia is not heavily influenced by age. Several studies concluded that while age was a significant factor in some settings, it was not the primary determinant of anemia among pregnant women. According to recent studies, in Sana'a, Yemen, and Babylon Governorate, Iraq, younger and middle-aged pregnant women exhibited higher anemia prevalence, influenced by socioeconomic and health factors (262,263). Conversely, the research in Derna City, Libya, indicated that anemia prevalence was higher in the third trimester, particularly among younger and older pregnant women (264). Overall, the available studies in the relevant literature highlighted that anemia's multifactorial causes, including nutritional deficiencies and socio-economic conditions, were more critical than age alone in determining anemia prevalence in humanitarian settings.

The governorate of residence was a significant predictor of anemia, with residents of Idleb having lower odds of anemia compared to those in Aleppo. This finding suggests that regional disparities in living conditions, access to healthcare, nutritional quality, and possibly ongoing conflict impacts may be influencing anemia rates. Research from similar settings often shows that regions with better infrastructure and access to services tend to have better health outcomes, including lower anemia rates. In Syria, where the conflict has drastically affected healthcare systems and living conditions differently across regions, such disparities are expected. Interventions targeting anemia should therefore consider regional differences and focus on improving healthcare access and living conditions in the most affected areas.

The addition of residency status (formal residency vs. IDPs) did not significantly improve the model's predictive power for anemia. This suggests that, within this sample, being an IDP alone was not a strong determinant of anemia. However, it is essential to consider that IDPs generally face numerous health challenges due to displacement, which might not be fully

captured by this variable alone. Comprehensive support systems addressing the multifaceted needs of IDPs might still be necessary. Moreover, the education attainment of the subjects did not significantly predict anemia. This outcome may seem counterintuitive, as higher education levels are often associated with better health literacy and nutritional practices. However, in conflict zones or humanitarian settings, the immediate impact of education may be overshadowed by more pressing issues such as access to food and healthcare services. Studies in similar settings have shown that while education is vital, its benefits might not fully translate into improved health outcomes without concurrent improvements in living conditions and healthcare access. Similarly, the employment status of the patients and their spouses also did not show a significant correlation with anemia. This finding highlights that employment, in isolation, may not be a sufficient indicator of economic stability or nutritional status in crisis settings. Humanitarian research often indicates that even employed individuals may struggle with food insecurity and poor health outcomes in conflict zones due to disrupted markets and high living costs.

While HH size did not significantly impact anemia rates, HH average income significantly contributed to the prediction of the outcome variable besides the governorate of residency. HH with incomes lower than the average had higher odds of anemia. This correlation underscores the role of economic stability in ensuring adequate nutrition and healthcare access. In the urban Hail region of Saudi Arabia, the study concluded that anemia among pregnant women was a moderate public health problem. It was found that low income significantly contributed to the prevalence of anemia. Other factors such as bigger family size, higher parity, longer menstrual cycles, and dietary habits also played a crucial role. These findings highlighted the importance of early detection and management of anemia in pregnant women to improve maternal health outcomes. The study emphasized the need for further research to support and extend these findings to rural areas (265).

The ethnicity of the patients did not significantly predict anemia, indicating that within this sample, anemia was not strongly associated with ethnic background. This finding aligns with some humanitarian studies that suggest the impact of ethnic disparities may be less pronounced in conflict settings where overall living conditions and access to resources are universally affected. Similar findings have been shown by Elmugabil et. al., (2023) in Sudan. The study concluded that ethnicity did not have a significant relationship with anemia among pregnant women in the White Nile State of Sudan. Despite examining various ethnic groups, the prevalence of anemia remained consistent across these

populations. The researchers emphasized that other factors, such as nutritional deficiencies and socioeconomic status, played a more crucial role in influencing anemia rates. As a result, the study suggested focusing on improving nutritional and health conditions to combat anemia rather than targeting specific ethnic groups (266).

The significant predictor of anemia was the governorate of residence and HH income, pointing to the need for targeted regional interventions and economic support programs. These findings suggest that improving living conditions and economic stability in the most affected regions could substantially reduce anemia rates. Public health policies should focus on ensuring equitable access to healthcare and nutrition across different regions and income groups. Moreover, ongoing monitoring and targeted aid in conflict-affected areas can help address the root causes of anemia and improve overall health outcomes.

5.5.2. Gestational Diabetes Mellitus

The results of the study highlighted several notable implications regarding GDM and its association with various demographic and socioeconomic factors. While age group, residency status, education level, employment status, and HH size did not exhibit a significant correlation with GDM status, the governorate of residence and HH monthly income showed meaningful associations.

The study revealed a significant association between GDM among pregnant women status and the governorate of residence. A higher proportion of patients with GDM resided in Aleppo compared to Idleb. This finding suggests that geographical factors, possibly related to healthcare accessibility, socioeconomic conditions, or environmental influences, might contribute to the prevalence of GDM. Previous studies in humanitarian settings have highlighted similar disparities. For instance, research conducted in conflict-affected regions of Syria demonstrated that access to healthcare services and socioeconomic conditions significantly impacted maternal health outcomes, including GDM. This underscores the necessity for targeted public health interventions in regions like Aleppo to address the higher risk of GDM among pregnant women. In fact, several studies reviewed consistently revealed a significant association between GDM among pregnant women and their governorate of residence. In Egypt, Menufia governorate showed notable GDM prevalence, indicating regional health disparities (261). Another study conducted in Nigeria emphasized the influence of prior GDM history, underscoring the importance of regional

healthcare histories (267). In Mansoura, Egypt, the implementation of GDM guidelines highlighted the critical role of localized healthcare interventions (268).

The average HH monthly income was another critical factor significantly associated with GDM status. The study found that living in HHs with a monthly income within or higher than the average was associated with a lower likelihood of developing GDM. This aligns with existing literature from LMICs, where economic stability often correlates with better access to healthcare, improved nutrition, and healthier lifestyle choices. For instance, studies in similar settings have demonstrated that women from higher-income HHs have better access to prenatal care and are more likely to engage in preventive health behaviors, reducing the risk of GDM (269,270). These findings emphasize the importance of socioeconomic support and poverty alleviation programs to improve maternal health outcomes. Actually, there is a lack of studies highlighting the relationship between GDM among pregnant women and HH income varieties. Many studies consistently highlighted various factors associated with GDM among pregnant women, though they did not explicitly examine the relationship with HH monthly income.

Our findings regarding GDM among pregnant women and sociodemographic variables have important public health implications. The significant role of the governorate of residence and HH income in predicting GDM suggests that interventions should be region-specific and socioeconomically targeted. For Aleppo, where GDM prevalence is higher, there is a clear need for enhanced healthcare infrastructure, increased availability of prenatal care services, and targeted educational programs to raise awareness about GDM and its risk factors. Furthermore, the association between lower HH income and higher GDM prevalence highlights the need for economic support programs for pregnant women in these regions. Policies aimed at improving HH income through job creation, financial aid, and social welfare programs could indirectly reduce the incidence of GDM by enabling better access to healthcare and improving overall living conditions.

5.5.3. Hyponatremia

Based on the statistical analysis of the correlation model between hyponatremia and age groups, no significant association was found between the two variables. This finding indicates that age does not appear to be a determining factor for the development of hyponatremia within the reproductive age range of the population under study. Comparable outcomes have

been documented in humanitarian settings, where malnutrition and other health-related conditions did not show significant variations according to age among adults and pregnant women. Several studies reviewed consistently revealed that age was not a determining factor for the development of hyponatremia among pregnant women. Several studies primarily focused on hormonal, renal, and vascular effects influencing hyponatremia, rather than age-specific impacts (271). In diverse settings, including general maternal health contexts and chronic maternal hypotension, age did not emerge as a significant variable (272). A study on gestational hypoxia highlighted broader prenatal health impacts, though not directly linked to age or hyponatremia (273). These findings indicate that age may not be a crucial determinant of hyponatremia outcomes during pregnancy.

The most significant finding was the strong correlation between hyponatremia and the governorate of residency. Individuals residing in Idleb had significantly higher odds of developing hyponatremia compared to those in Aleppo. This discrepancy can be attributed to several factors prevalent in Idleb, such as lower access to clean water and higher rates of displacement and associated stressors. Studies have shown that displaced populations and those living in conflict zones are at greater risk of electrolyte imbalances, including hyponatremia, due to poor living conditions and limited healthcare services. A study by Elasrag (2016) highlighted that challenging living conditions and limited healthcare access among Syrian refugees significantly exacerbated electrolyte imbalances, including hyponatremia (274). Another research emphasized that Syrian refugees in Turkiye experienced various adversities, such as loss of family members, property damage, and financial instability, which contributed to physical and mental health issues, including potential electrolyte imbalances (275). In fact, we could not find studies addressing hyponatremia specifically among pregnant women in humanitarian contexts. While the available literature provides a broader understanding of complications during pregnancy, specific research focusing on hyponatremia risk factors in pregnant women within the Syrian context was not found. Future research may need to address this specific gap in the literature.

The analysis showed that IDPs had a higher prevalence of hyponatremia compared to the host population, Nonetheless, the correlation between the two variables was not statistically significant in the correlation model. Several studies reviewed consistently revealed no significant relationship between age and the development of hyponatremia among pregnant women. Several studies indicated no statistically significant relationship

between the state of IDPs or refugees and hyponatremia among pregnant women. Research spanning from 1992 to 2023, conducted in diverse settings including South Sudan and various LMICs, primarily focused on general maternal health outcomes. Studies highlighted poor pregnancy outcomes, nutritional deficiencies, and healthcare access issues, but did not establish a direct correlation with hyponatremia (272,276,277). The lack of specific data suggests that unstable living conditions might not be a critical factor in the development of hyponatremia during pregnancy in these contexts. Further targeted research may be necessary to explore this relationship comprehensively.

Similarly, education levels and employment status, both of the patients and their spouses, did not show a significant correlation with hyponatremia. This finding is consistent with some studies in LMICs that suggest while education can influence maternity health outcomes, its impact on specific conditions like hyponatremia among pregnant women might be less direct. The available studies in the literature about this topic indicated that while education positively influenced overall maternity health outcomes, its direct relationship with hyponatremia among pregnant women was not established. Research conducted from 2020 to 2022 in settings such as Uganda, Rwanda, and other humanitarian contexts primarily focused on nutritional education and antenatal care. These studies demonstrated significant improvements in knowledge and attitudes toward general maternal health but did not specifically link education to the prevention or management of hyponatremia. Consequently, the impact of educational interventions on hyponatremia in these contexts remains inconclusive (278,279).

The HH size, categorized into normal-sized and crowded HHs, did not significantly impact hyponatremia prevalence. This suggests that while overcrowding is a concern in many humanitarian settings, its direct impact on specific health conditions like hyponatremia may be less significant compared to other factors. However, the statistical analysis found a significant association between HH income and hyponatremia, indicating that lower HH income was linked to a higher risk of developing hyponatremia among pregnant women in Northwest Syria. This finding underscores the importance of economic stability in maintaining health, as HHs with higher incomes likely have better access to nutrition and healthcare, reducing the risk of hyponatremia. This is consistent with broader research highlighting the critical role of economic factors in health outcomes in conflict-affected and low-resource settings. For example, a study highlighted that low HH income among Syrian refugee mothers in Lebanon significantly

increased the risk of adverse pregnancy outcomes, including hyponatremia. Poor living conditions, compromised psychosocial status, and inadequate antenatal care were key contributing factors (280). Another research comparing Syrian refugee mothers in Jordan to Jordanian women found that refugees had a higher risk of perinatal death and adverse obstetric outcomes. This disparity is influenced by socioeconomic factors, including low HH income, although the study did not specifically discuss hyponatremia (281). A comparative study in Turkey found that Syrian adolescent refugees had a higher prevalence of anemia and lower hemoglobin levels than local Turkish pregnant women. These nutritional deficiencies, often linked to low household income, suggest a potential indirect impact on conditions like hyponatremia (282).

Finally, the analysis indicated a statistically significant association between ethnicity and hyponatremia, with Arabs showing a higher prevalence. However, this did not remain significant in the logistic regression model. This could suggest that while there may be observable differences in health outcomes among ethnic groups, these differences might be attributable to socioeconomic and environmental factors rather than ethnicity.

5.5.4. Hypokalemia

research indicating that nutritional deficiencies such as hypokalemia may affect individuals across various age groups similarly, particularly in populations with widespread food insecurity and inadequate healthcare access. A study by Burrell (2022) indicated that individuals in conflict-affected areas and humanitarian contexts experiencing food insecurity are at risk of hypokalemia at any age due to limited access to adequate healthcare and nutritious food sources (283).

The governorate of residency emerged as a significant predictor of hypokalemia. Individuals residing in Aleppo had a markedly lower incidence of hypokalemia compared to those in Idleb. This significant difference could reflect varying levels of access to healthcare services, nutritional support, and overall living conditions between the two regions. In fact, there is a need to further explore these results and identify area-specific risk factors and the underlying reasons. Additionally, the combined employment status of the patient and their spouse significantly impacted hypokalemia prevalence. Households where at least one person was employed had lower odds of hypokalemia. This finding underscores the importance of economic stability and access to employment in mitigating

nutritional deficiencies. Employment provides not only financial resources but also access to health benefits and food security, which are crucial in preventing conditions like hypokalemia. Similar to other maternity outcomes, we could not find sufficient evidence related to hyponatremia and employment status in humanitarian settings. Several articles discussed the significant relationship between employment and pregnancy outcomes in emergency and conflict contexts as well as in other Arabic countries, without a focus on hypokalemia among pregnant women (250,284,285).

While HH size did not emerge as a significant predictor in the final model, HH income was a significant predictor of hypokalemia. HHs with income below the average had substantially higher odds of hypokalemia among pregnant women. This correlation highlights the critical role of economic resources in ensuring adequate nutrition and health. In humanitarian settings, where economic stability is often disrupted, providing financial support and improving economic opportunities could be vital strategies in combating nutritional deficiencies. We could not find relevant literature on this topic in humanitarian and conflict-affected regions. As mentioned, the available studies did not address hyponatremia specifically, but maternal outcomes in general.

In general, the significant predictors of hyponatremia among pregnant women in Northwest Syria identified in this study were the governorate of residency, combined employment status, and HH income. These variables underline the complex interplay of socioeconomic factors in determining maternity outcomes like hypokalemia. These findings suggest that improving economic stability, employment opportunities, and regional healthcare infrastructure are essential steps in addressing nutritional deficiencies.

Residency status, education attainment among patients and spouses, and ethnicity did not significantly contribute to the prediction of the outcome variable in the model equation.

5.5.5. Hypocalcemia

The study found a significant correlation between the governorate of residency and hypocalcemia status. Individuals residing in Aleppo had significantly higher odds of hypocalcemia compared to those in Idleb. This result showed that geographic location within Northwest Syria potentially reflects differences in influencing factors, such as access to healthcare, nutrition, and environmental factors. These factors play a crucial role in the

prevalence of hypocalcemia. The significant association between HH size and hypocalcemia indicated that pregnant women living in crowded HHs were more likely to suffer from hypocalcemia. This finding underscores the impact of living conditions on health, as crowded living environments often correlate with inadequate nutrition and limited access to healthcare services. In humanitarian settings, overcrowding is common due to displacement and limited housing availability, exacerbating health risks. Eeshal et al., (2021) argued that crowded households in Syrian refugee areas in Lebanon could contribute to hypocalcemia among pregnant women. Poor living conditions, low socioeconomic status, and compromised psychosocial status of mothers were linked to increased risk of neonatal complications and low birth weight in newborn infants among the target population of this research (280). In a recent study, Al-Shatanawi et al., (2023) highlighted that crowded HHs in refugee areas in Jordan could contribute to hypocalcemia among pregnant women. Poor living conditions, low socioeconomic status, and compromised psychosocial status of mothers were linked to increased risk of maternal and neonatal complications (281).

Additionally, HH income was identified as a significant predictor of hypocalcemia among pregnant women. Cases from HHs with income below the average had significantly higher odds of hypocalcemia. This highlights the critical role of economic status in health outcomes, as lower income levels are typically associated with food insecurity and poor nutrition. There is a lack of relevant studies in the literature that study the relationship between hypocalcemia and HH income or economic conditions on the HH level.

In general, the study underscored the significant correlation between hypocalcemia and geographic location, HH size, and HH income among pregnant women in Northwest Syria.

6. CONCLUSION

The majority of participants in Northwest Syria face limited access to a diverse range of food. This highlights the significant role that aid distributions play in ensuring food security. To address this, a comprehensive and sustained approach is required, with a focus on studying food group consumption and overall food uptake patterns. The study reveals a high dependency on certain food items available in markets or provided through humanitarian aid, underscoring the importance of these programs in meeting basic nutritional needs. It is crucial to support local markets, even in the face of disruptions, through livelihood programs that enhance market access and support local food systems.

It is essential to address food insecurity and access disparities, particularly for those who face barriers such as economic instability and displacement, leading to infrequent consumption. Aid distributions should prioritize nutritional diversity to counter the limited access to varied diets. Special attention should be given to displaced pregnant women, who are particularly vulnerable and require targeted support to overcome additional barriers to food access.

To strengthen food security interventions, a focus on long-term solutions such as agricultural development and robust social protection systems is necessary. Collaboration with international organizations and UN agencies, such as the WFP, is vital for mobilizing resources and implementing comprehensive strategies. By addressing these critical areas, policymakers can develop effective strategies to improve food security, enhance nutritional outcomes, and build resilience among populations affected by conflict and instability.

The analysis of food consumption patterns among pregnant women in Northwest Syria highlights the urgent need for specific, comprehensive interventions to tackle food insecurity. The study found that factors such as geographic location, displacement status, HH size, and income levels significantly influence food consumption. On the other hand, age group, employment status, and spouse's education level have less impact.

Pregnant women who live in Aleppo were more likely to experience a decrease in food consumption in comparison to those in Idleb, mainly as a result of disruptions in food supply chains. This geographical discrepancy underscores the importance of implementing localized approaches to food security. It emphasizes the need for enhanced agricultural support,

humanitarian aid, and market accessibility in areas severely impacted by the crisis, such as Aleppo.

The crucial role of displacement status has been highlighted, as displaced pregnant women experienced significantly higher levels of food insecurity compared to host populations. This finding is consistent with previous research, which suggests that displacement worsens food insecurity by limiting access to resources and markets. In light of this, policies should prioritize the implementation of targeted nutritional support, food aid, and integration programs for IDPs.

Socioeconomic factors, specifically HH income and size, had a significant correlation with food consumption patterns. It was observed that lower-income HHs and those residing in crowded conditions were more likely to experience poor nutritional status. In order to enhance food security and overall well-being, it is imperative to address these socioeconomic disparities by providing financial support, creating employment opportunities, and implementing initiatives to alleviate HH overcrowding.

Educational attainment has a significant impact on food consumption, as higher levels of education are associated with improved dietary outcomes. This highlights the crucial role of educational interventions that target nutrition and health. By empowering women through education, we can promote better dietary practices and enhance the outcomes related to maternal and child health.

The findings highlight the importance of implementing holistic nutritional support programs that take into account the mutual relationship between different factors that affect food security. By integrating food aid, economic assistance, educational initiatives, and measures to reduce household overcrowding, we can develop a more efficient approach to enhancing food security in areas affected by conflict.

The study on maternity outcomes in Northwest Syria has brought to light significant associations between several sociodemographic factors and health conditions, including anemia, GDM, hyponatremia, hypokalemia, and hypocalcemia. Geographic location emerged as a significant predictor, with regions like Aleppo showing higher incidences of these conditions compared to Idleb, indicating the urgent need for region-specific healthcare interventions, including investments in healthcare infrastructure, utilizing available mobile services, and developing a targeted model of outreach services. HH

income was another critical factor, with economic instability directly affecting nutritional status and access to healthcare, underscoring the necessity for economic support programs like cash transfers, food assistance, and job creation initiatives. The study also found a significant association between crowded living conditions and higher rates of maternity outcomes, highlighting the need for housing programs and improvements to existing shelters to reduce health risks. Nutritional deficiencies prevalent among the population necessitate comprehensive programs providing pregnant women with access to supplements and fortified foods, particularly in conflict zones. While education and employment status were not significant predictors in this study, they are generally important for overall health outcomes, suggesting the need for enhanced educational programs on maternal health and vocational training to improve economic stability and health literacy. Continuous monitoring and evaluation of public health programs are essential to track maternal and neonatal health outcomes and ensure that healthcare policies remain effective and responsive. Engaging local communities in the design and implementation of health interventions ensures cultural appropriateness and wider acceptance, with partnerships between government agencies, NGOs, and community leaders fostering community participation in health education and promotion activities. Overall, addressing regional healthcare disparities, economic stability, living conditions, and community engagement can significantly improve maternal and neonatal health outcomes in conflict-affected and low-resource settings.

7. LIMITATIONS, STRENGTHS AND RECOMMENDATIONS

Limitations: The study's reliance on data collection within conflict-affected areas posed challenges in obtaining comprehensive and representative samples. The findings may be influenced by regional disparities and the constraints of operating in high-risk context, which can affect the accuracy and generalizability of the results. Additionally, the absence of psychological impact analysis limits the exploration of how stress and trauma influence dietary habits and maternal outcomes.

Strengths: This research provides valuable insights into the maternal health landscape in Northwest Syria, emphasizing the complex interplay between nutrition, socio-economic factors, and health outcomes during pregnancy in a conflict setting. The use of trained local midwives and assistants for data collection enhanced the reliability of the data, ensuring culturally relevant and context-specific findings. The incorporation of a Biopsychosocial Model added depth by considering various influencing factors on maternal health beyond basic nutritional data.

Recommendations: Future studies should expand to include the psychological impacts on maternal health, as this aspect remains underexplored. Implementing more extensive data collection methods that cover different regions and time periods could improve representativeness. Policymakers should focus on comprehensive intervention programs that integrate nutritional support, healthcare accessibility, and educational outreach to better address the multifaceted challenges faced by pregnant women in conflict zones.

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10. APPENDIXES

Appendix 1: Assessment of Dietary Practice and Anthropometric Status and Related Risk Factors of Pregnant Women in North West Syria

1. Introduction to the survey:

It is crucial that the diet during pregnancy contains the nutrients and energy needed to keep the mother healthy, prevent problems associated with pregnancy, and enable the fetus to grow and develop in a healthy condition.

The mother's dietary intake prior to pregnancy period and/or throughout pregnancy can influence the perinatal phase, in addition, pregnancy outcome could potentially be connected to hypertension, non-insulin dependent diseases, cardiovascular issues, and child diabetes mellitus.

The nutritional state of the mother is thought to play a significant role in whether or not a pregnancy will end successfully. Low calorie intake during pregnancy was linked to low birth weight in severe cases of chronic malnutrition (LB-W).

As the northwestern region of Syria is one of the areas affected by war, displacement and deteriorating economic conditions, and considering that pregnant women are among the vulnerable groups and are severely affected by the changes taking place.

This questionnaire aims to assess the nutritional status of pregnant women attending the health center, in addition to taking body measurements, and risk factors related to nutritional status.

2. Survey Contents:

Date of interview: ----------

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

ID hospital: ----------

Research ID: ----------

2.1 Demographics:

1. How old are you this year? ----------(years)
2. Date of birth ---------- (calendar)
3. Place of current residence ----------
4. Place of residence before conflict ----------(years)
5. What is your current residency type?
   - Resident
   - IDP
   - Live at home
   - Live at tent
   - IDP living in collective housing such as a school, government
   - building, warehouse
   - Other ----------
6. What is your current marital status?

- Married
- Divorced
- Widow
- Other

7. What is your highest educational level?
    - Never went to school
    - Elementary / Primary or less. *Please specify which class reached*
    - Secondary/ High school or less. *Please specify which class reached)*
    - Institute
    - University
    - Postgraduate.
8. What is your husband highest educational level?
    - Never went to school
    - Elementary / Primary or less. *Please specify which class reached*
    - Secondary/ High school or less. *Please specify which class reached*
    - Institute
    - University
    - Postgraduate.

9. What is your employment status?
    - Not employed
    - Job with salary
    - Unpaid work. *Excluding domestic work but including work in any formal and informal sector*.
    - Other, Specify: ----------
10. What is your Occupation
    - Not working
    - Agricultural
    - Self Employed
    - Professional
    - Employee Technical/ Managerial
    - Household/ Domestic
    - Clerical
    - Sales / Services
    - Unskilled Manual
    - Skilled Manual
    - Other, Specify: ----------
11. What is your husband employment status?
    - Not employed
    - Job with salary
    - Unpaid work (excluding domestic work but including work in any formal and informal sector)
    - Other, Specify: ----------
12. What is your husband Occupation
    - Not working

- Agricultural
- Self Employed
- Professional
- Employee Technical/ Managerial
- Household/ Domestic
- Clerical
- Sales / Services
- Unskilled Manual
- Skilled Manual
- Other, specify:

13. What is your family type?
    - Nuclear . *It consists of a married couple and their dependent children. A "new family" is a nuclear family within first 10 years of formation (marriage).*
    - Joint/ Extended. *It consists of a number of married couples and their children living in the same household. All the men in the household are related by blood and the women are their wives, unmarried daughters or widows.*
    - Three generation family. *It occurs when the married children of a couple continue to stay with their parents and have their own children. Hence, three generations related by direct descent live together.*
14. How many people living in the house? *Number of usual members* ----------
15. What is your current monthly income in Turkish Lira?---------- TL
16. What is your husband current monthly income in Turkish Lira? ----------TL
17. Which is true for your household income and expenditure?
    - Income = expenditure.
    - Income < expenditure.
    - Income > expenditure.
18. What is your Ethnicity ?
    - Arab
    - Turkman
    - Kurdish
    - Don't know
    - Don't want to reply
    - Other, Specify: ----------

2.2 DOMESTIC VIOLENCE:

1. Have you ever been physically, verbally, emotionally, or sexually abuse in a relationship?
    - No
    - Yes Specify type ----------

2. Who is the perpetrator?
   - Husband/ In-laws…….
   - Others ……
3. How many times in the past year? ----------

2.3 ADDICTION/SUBSTANCE ABUSE

1. Do you currently smoke tobacco (including hookah) on daily basis, less than daily or not at all?
   - Daily
   - Less than daily
   - Not at all
   - Don't know
2. Have you smoked tobacco (including hookah) in the past?
   - Yes
   - No
   - Don't know
3. Have you stopped smoked tobacco (including hookah) before pregnancy?
   - Yes
   - No
   - Don't know
4. On average, how many of the following products do you currently smoke each (day/ week)? Also, let me know if you smoke the product, but not every (day/week)
   - Manufactured cigarettes ---------- Per day/week
   - Hand rolled cigarettes----------Per day/week
   - Cigar / pipes/ etc---------- Per day/week
   - Number of water pipe sessions---------- Per day/week
5. Do your husband currently smoke tobacco (including hookah)?
   - Yes
   - No
   - Don't know
6. Did your husband change his smoking habit due to your pregnancy?
   - He is not smoker
   - He stopped smoking
   - He stopped smoking inside the home
   - He is smoking in the home but not near me.
   - No change
7. How often does anyone smoke inside your home? Would you say daily, weekly, monthly, less than monthly, or never?
   - daily,
   - weekly,
   - monthly,
   - less than monthly,
   - never
8. Anyone smoke at work during the current pregnancy?
   - Yes

- No
- Don’t know

9. Are you currently addicted to any of the following?
    - Alcohol
    - Cannabis plant
    - Captagon (amphetamine)
    - injectable drugs (heroine)
    - anxiolytics
    - stimulants

2.4 Menstrual History:

1. Age at the time of the first period? ..... year
2. Pattern of the menstrual cycle?
    - Regular
    - Irregular
3. Menstrual cycle length?
    - Period usually comes every ……days and lasts for.....days.
4. How much amount of Menstrual flow?
    - Normal
    - Light
    - Moderate
    - heavy
5. What is the type of Pads?
    - Homemade
    - commercial
6. Average number of Pads used per day?..... /day
7. Do you have cramps with your period?
    - Yes
    - No
8. Do you take any medication for menstrual pain?
    - No
    - Yes, If yes, what? ……
9. Do you have bleeding in between periods
    - Yes
    - No
10. Do you have bleeding after intercourse?
    - Yes
    - No
11. Do you have any vaginal discharge currently
    - Yes
    - No
12. Have you ever seen any health professional about problems associated with your period?
    - Yes, if yes, what did she/he tell you?
    - No
13. Date of LMP?

2.5 CONTRACEPTIVE HISTORY

1. Have you ever used any of the method to avoid or delayed the pregnancy? (Check all that apply)
    - Don’t know about any method
    - Never used any method
    - IUD
    - Injectable
    - Implants
    - Pill
    - Condom
    - Emergency Contraception
    - Standard Days Method
    - Lactational Amenorrhea Method (LAM)
    - Withdrawal
    - Any other method …….

2.6 Medical history

1. Have you been diagnosed with any of the following diseases in the past? (Select all that apply)
    - Hypertension
    - Diabetes Miletus
    - Asthma
    - Ischemic Cardiovascular disease
    - Cancers (Type .....)
    - COPD
    - Anemia
    - immune diseases/ Rheumatic or joint disease
    - Osteoporosis
    - Thyroid Disorder
    - Other Endocrine diseases
    - Epilepsy
    - Migraines
    - Other Neurological diseases
    - Acid peptic disease
    - Malabsorption disorders or irritable bowel syndrome.
    - Chronic Liver Disease/Hepatitis
    - Chronic Kidney Disease
    - Bleeding Disorder
    - Arterial venous Thrombosis (Blood Clots in legs, lung, brain)
    - Depression
    - Psychosis
    - Bipolar disorder
    - PTSD (Post Traumatic Stress Disorder)
    - Urinary Tract Infections
    - STDs
    - TB
    - Worm infestation

- HIV/AIDS
- COVID-19
- Other …….

2. Is there a history of surgery?
   - No
   - Yes, if yes specify

	Surgery	**Reason**	**date**
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..

3. Is there a history of physical trauma?
   - No
   - Yes, if yes, please specify type: (Gunshot, blast, RTA, Knife/stabbed injury, fall requiring emergency care,

	Trauma type	**date**
☒	……..……..	……..
☒	……..……..	……..
☒	……..……..	……..
☒	……..……..	……..
☒	……..……..	……..

4. What are the medications that you are using regularly?

	Name	**dose**	**used since**
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..
☒	…….	……..	……..

2.7 Pregnancy History

1. Before the current pregnancy Have you ever been pregnant?
   - Yes
   - No
2. Number of previous pregnancies that ended in live births ---------
3. Number of previous pregnancies that ended in stillbirths/dead born----------
4. Number of previous abortions----------
5. Number of previous natural vaginal deliveries----------
6. Number of previous cesarean deliveries----------
7. Number of previous instrumental deliveries:
   - Gravida ……
   - Para ……
8. Now I will ask specifically about the last birth
   i. When was the last birth take place ……
   ii. What was the outcome: Live birth/ dead born/ stillbirth /abortion
   iii. Where was the last birth took place: At home/ health facility
   iv. What was the mode of delivery: vaginal deliveries/ cesarean deliveries/ instrumental deliveries?

v. Did anyone advice you about contraception after the last birth
vi. Did anyone advice you about the spacing between the birth

9. What is the Current GESTATIONAL AGE IN WEEKS?
    - By dates
    - By ultrasound
    - EDD

10. What is the health problems during previous pregnancies:

	First pregnancy	Second pregnancy	Third pregnancy	Fourth pregnancy	Fifth pregnancy	Sixth pregnancy
hypertension						
High blood sugar						
preeclampsia						
eclampsia						
anemia						
Other disorders						

11. When you got pregnant now, did you want to get pregnant at that time?
    - Yes
    - No
12. Were you or your husband using any contraceptive method when you get pregnant with the current pregnancy?
    - Yes
    - No
13. Who decided for the current Pregnancy?
    - My self
    - My husband
    - Me and my husband both
    - Someone else specify ----------
14. Anthropometric measure
    - Weight in kilograms: ----------
    - Height in centimeters----------
    - BMI (Body Mass Index) =

Lab and U/S report

2.8 Nutritional questionnaire

1. The main food groups

Choose the food groups you have eaten in the past 24 hours:

Group 1 (Cereals, wheat)	**you have eaten in the past 24 hours**	**number of times per day**	**number of times per week**
rice			
Pasta			
Bread			
bulgur			
corn			

Oats			
other tubers			
Group2 Legumes			
Beans			
peas			
fava beans			
Lentils			
chickpeas			
Group 3 Nuts and seeds			
pistachios			
Sesame			
sunflower			
seeds (watermelon ,pumpkin)			
Hazelnuts			
Sesame tahini			
Peanuts			
Nut			
Almonds			
Group 4 **Vegetables and fruits rich in vitamin A**			
Apricots			
Peaches			
Melons			
Carrots			
Pumpkins			
Peppers			
Group5 **Dark green leafy vegetables**			
Spinach			
Chard			
Mulukhiyah			
Lettuce			
Parsley			
Mint			
Watercress			
Group 6 **Other types of vegetables and fruits**			
Apple			
Orange			
Banana			
Manga			
Pomegranate			
Pear			
Kiwi			
Strawberry			
Fig			
Tomato			
Cucumber			
Radish			

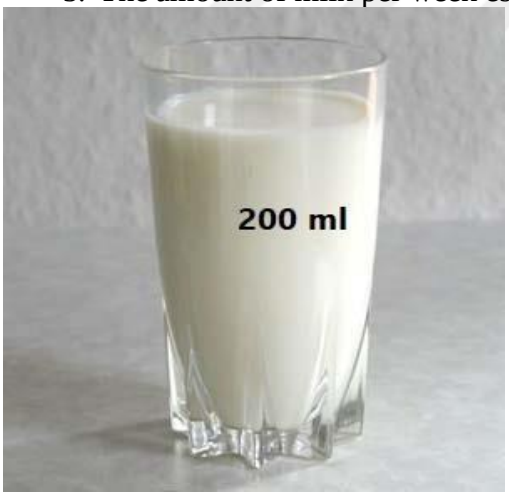
Potatoes			
Zucchini			
Eggplant			
Cauliflower			
Cabbage			
Mushroom			
Onions			
Garlic			
Lemon			
Olive			
Black olive			
Group 7 **Milk and its derivatives**			
Cheese			
Yogurt			
Dried labne			

The minimum acceptable level is the participation of five food groups in the past 24 hours

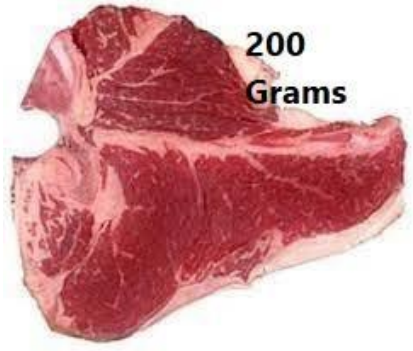
2. What types of oils do you usually consume?

- sunflower oil
- olive oil
- Cotton oil
- animal ghee
- Vegetable Ghee
- Butter

3. The amount of milk per week estimated by number of glasses of water



4. The amount of red meat eaten per week estimated in grams



5. The amount of chicken eaten per week estimated per chicken:
    - a quarter of a chicken
    - a third of a chicken
    - half a chicken
    - a compete chicken
    - More than a chicken
6. The amount of fish eaten per month estimated by KG: -
7. Average number of chicken eggs per week: ----------
8. The number of canned food (tuna, sardines, mortadella, pastrami,) eaten per week: ----------
9. How often did you eat dry fruits (diluted fig, dried apricots, raisins, dates)?

- NEVER
- 1–6 times per year
- 7–11 times per year
- 1 time per month
- 2–3 times per month
- 1 time per week
- 2 times per week
- 3–4 times per week
- 5–6 times per week
- 1 time per day
- 2 or more times per day

10. Do you take any medical supplements, during your current pregnancy?

- Iron
- Folic acid
- Calcium
- Vit. D
- Herbs (.....)
- Other / specify) ……

11. What is the Reason for taking supplements?

……..

12. Please determine the amount of tea or coffee you drink per day according to the number of cup? .....Cups

13. Did anyone advice you about dietary practice/feeding option during pregnancy?

- NO
- Yes who: ……..

2.9 Physical activity

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, Quick moving , pull or push?
   - ---------- days per week
   - No vigorous physical activities
2. How much time did you usually spend doing vigorous physical activities on one of those days?
   - ---------- hours per day
   - ---------- minutes per day
   - Don't know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis, climbing, cleaning all home, cleaning machines or devices ? Do not include walking.
   - ---------- days per week
   - No moderate physical activities
4. How much time did you usually spend doing moderate physical activities on one of those days?
   - ---------- hours per day
   - ---------- minutes per day
   - Don't know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
   - ---------- days per week
   - No walking
6. How much time did you usually spend walking on one of those days?
   - ---------- hours per day
   - ---------- minutes per day
   - Don't know/Not sure

2.10 Misconceptions:

1. Have you changed your physical activity during the current pregnancy?
   - No
   - Yes, Increased
   - Yes, decreased
2. Have you changed quantity of your food intake during pregnancy?
   - No
   - Yes, Increased
   - Yes, decreased
3. Have you changed type of your diet during pregnancy?
   - No
   - Yes (Specify what type of dietary changed you made during the current pregnancy .....)
4. According to your knowledge:
   - ❖ What food should be stopped altogether during pregnancy?
     ……..
   - ❖ What is the amount/quantity of food need to change during pregnancy?
     ……..
   - ❖ Should undertake regular physical activity throughout pregnancy?
     ……..
   - ❖ Exposure to OR Smoking is harmful for the development of the future child?
     ……

The end of survey

At the end of the questionnaire, we thank you very much for giving us the required confidence and time, and we wish you abundant health and wellness.

Appendix 2: Consent Form

PLEASE ALLOW ENOUGH TIME TO READ THIS DOCUMENT CAREFULLY

You are invited to participate in the **research** Assessment of Dietary Practice, Anthropometric Status and related risk factors of the pregnant women in north western Syria by **Osama Sallom Alabd** You have to know how and why this research will be conducted. For this reason, it is very important to read and understand this form. If you do not understand things that are not obvious to you, or if you want more information, please do ask for further clarification.

Participation in this study is entirely **voluntary**. You **do not have to participate** in this study and if you participate, you have the right to **discontinue** at any time. **Your positive response to the study will be interpreted as you consent to participate in the study.** Do not feel oppressed or manipulated by anyone while answering the questions in the **forms** provided to you. The information obtained from these forms will be used purely for research purposes.

1. **Information About the Research Study:**

a. Purpose of the Study: The study will be on Dietary Practice , Anthropometric Status and related risk factors among pregnant women who visit the hospital with the intention of receiving medical consultations during pregnancy in all its phases, as the region is considered a crisis and tension area that witnessed violence and forced displacement, and included a large number of camps and displaced persons, and malnutrition spreads in the region and the poverty rate is close to about 90%, while 45% of the population and displaced especially, to the point of starvation

b. Content of the Study: The study will include a questionnaire in Arabic to be filled out by the participant and with the help of the trained nurse, it includes many variables, which include age, sex, previous diseases, socio-economic status and birth antecedents, in addition to the nutritional status and general living situation, In addition to a simple assessment of the psychological status, physical activity, family history and comprehensive details of the reproductive status of the pregnant woman

c. Type of Research: () Scientific Research Study (√) Thesis Study

d. Estimated Time for the Study: 6 months

e. Expected Number of Participants / Volunteers to the study: 267 participants

f. Location (s) of the Research: **Syria – Idleb – Aldana maternity hospital**

2. **Consent to Participate in the Study:**

I fully understand the scope and purpose of the study and the volunteer responsibilities by reading the information above that should be given to the participants before participating/volunteering in the study. **Written and oral explanations about the study were made by the researcher named below, I had the opportunity to ask questions and discuss and got satisfactory answers. The potential risks and benefits of the study have been explained to me verbally as well.** I understand that I have the right to discontinue the study at any time without mentioning any reasons and that I will not encounter any negativity when I leave this study.

I agree to participate in the aforementioned study voluntarily under the conditions explained to me, without any pressure or force.

Participant's (with your own handwriting)
Name-Surname:..... .....
Signature:

(If any) For those in custody or tutelage;
Parent/s or Vassin/s (with your own handwriting)
Adı-Soyadı:..... .....
Signature:

P.S. : *This form is arranged in two copies. One of these copies is given to the volunteer by signature, and the other is kept by the researcher.*

Appendix 3: Aldana Maternity Hospital

Aldana maternity hospital

Hospital Manager
Dr. Abdulilah Ismaiel

Subject: Letter of approval for sharing maternity medical history records and

conducting a questionnaire and blood analysis for pregnant women

Dear respected colleagues in Ankara Yildirim Beyazit University.

On behalf of Aldana maternity Hospital, this letter is to inform you of our approval in regard to the request for data sharingfor the purpose of research by Dr.Osama Sallom Alabd

The hospital shared the patients' medical history records of SAMS supported the hospital in northwest Syria excluding the personal identification information of the patients according to the Turkish personal data protection protocol as well as SAMS data protection protocol to support the purpose of this study.

Aldand maternity gospital is looking forward to more cooperation with your respectful university to increase the capacity building of health workers in Syria.

Your sincerely,

Dr. ABDULILAH
June 25, 2022

Appendix 4: Ankara Yıldırım Beyazıt University Health Sciences Ethics Committee Project Approval Certificate

ANKARA YILDIRIM BEYAZIT UNIVERSITY (AYBU)
HEALTH SCIENCES ETHICS COMMITTEE
PROJECT APPROVAL CERTIFICATE

Ankara Yıldırım Beyazıt University Public Health Institute Global Health and Health Policy Department student Osama Sallom Alabd research titled Assessment of Dietary Practice , Anthropometric Status and related risk factors of Pregnant Women in north west Syria was reviwed (This section must be filled by the applicant)

Approved. ☒

To be resubmitted. ☐

Rejected ☐

AYBU HEALTH SCIENCE ETHICS COMMITTEE DECISION (This section will be filled by the committee)	
Research code (Year – Research sequence no)	2022- 1097
The date the application form reaches the Ethics Committee	29.09.2022
Ethics Committee Decision meeting date and decision number	06.10.2022-14
Place	Ankara Yildirim Beyazit University, Esenboga Kulliyesi, Ankara-Turkey
Participants	Members who signed the form attended the meeting

THE CHAIRMAN AND THE MEMBERS OF THE COMMITTEE

	SIGNATURE
Prof. Özden YALÇINKAYA ALKAR, MD	Chairma
Prof. Dr. Tahir Kurtuluş YOLDAŞ	Membe
Assoc. Prof. Oktay GÜRCAN, MD	Membe
Assoc. Prof. Sevil ŞAHİN, MD	Membe
Assoc. Prof. Bahar KÜLÜNKOĞLU, MD	Membe
Assoc. Prof. Metin DİNÇER	Membe
Assoc. Prof. Dr. Gözde ALGÜN DOĞU	Membe
Asst. Prof. Dr. Prof. Dr. Günsel BİNGÖL	Membe
Asst. Prof. Dr. Member Şule ÇEKİÇ	Membe
Asst. Prof. Dr. Prof. Dr. Nural ERZURUM ALİM	Member
Asst. Prof. Dr. Member Bünyamin ÇILDIR	Member
Asst. Prof. Dr. Member Nimetcan Mehmet YAĞMA	Member
Asst. Prof. Dr. Member Esra Ceren TATLI	Member

CURRICULUM VITAE

Osama Sallom Alabd

Nationality : Syrian

Marital Status : Married, 4 Children

Professional Summary

Dedicated medical professional with over a decade of experience in general surgery, healthcare management, and humanitarian medical support. Proven ability to operate under challenging conditions, lead medical teams, and implement effective health initiatives in conflict zones. Skilled in project management, strategic planning, and cross-functional collaboration to deliver high-quality healthcare services.

Core Competencies

- **Medical Leadership**: Expertise in managing healthcare facilities and leading cross-functional teams in high-stress environments.
- **Project Management**: Proficient in planning, coordinating, and executing health projects with a focus on sustainable and impactful outcomes.
- **Technical and Communication Skills**: Strong background in CAD, Microsoft Office, internet research, and fluency in English.
- **Negotiation and Decision-Making**: Talented in persuasive communication and collaborative decision-making, with a focus on win-win outcomes.
- **Risk Management**: Skilled in assessing security risks and ensuring safe operational conditions in complex and conflict-prone areas.

Education

- **General Medicine Degree**

Aleppo University, Syria, 2009

Specialization: Medicine

- **Certificate as a General Surgeon: Syrian board for medical specialties- SBOMS , 2016**

Professional Experience

Syrian American Medical Society (SAMS)

Aleppo & Northern Syria

Aleppo Coordinator

December 2013 – Present

- Lead coordination of healthcare services in conflict zones, overseeing medical and logistical support across Aleppo and surrounding areas.
- Implement and monitor health programs in alignment with humanitarian standards, ensuring high-quality care delivery under challenging conditions.
- Liaise with international humanitarian organizations and local partners to optimize resource allocation and enhance service impact.

Mercy USA

Aleppo

Technical Manager of Medical Center

November 2014 – March 2016

- Managed daily operations of a medical center, coordinating patient care, staff performance, and facility logistics.
- Developed emergency response protocols and implemented infection control measures, significantly improving patient outcomes and safety.

Omer bin Abdulaziz Hospital

Aleppo

General Surgeon and Manager

May 2013 – August 2016

- Performed general surgical procedures and managed hospital operations in a high-demand environment.
- Supervised clinical staff and optimized resource allocation, contributing to increased hospital efficiency and patient care standards.

Aleppo City Medical Council

Aleppo

Financial Coordinator

October 2012 – January 2015

- Oversaw financial operations, managed budgets, and facilitated financial planning to support healthcare programs and services.
- Ensured compliance with financial regulations and optimized budget allocation, contributing to program sustainability.

Training and Certifications

- **WHO Hospital Management for Medical Directors** - 2017, Gaziantep
- **WHO Infection Control** (40 hours) - 2017, Gaziantep
- **Burn Care in Conflict Scenarios** - 2017, Gaziantep
- **Mental Health Gap Action Program (MH GAP)** - 2020, Gaziantep
- **Project Management for Development Professionals (PMD Pro 1 & 2)** - 2017, Gaziantep
- **Istanbul Protocol Training** (120 hours) - 2019, Gaziantep
- **Ethical Challenges in Humanitarian Health** (Johns Hopkins University) - 2018, Gaziantep
- **Protection of Sexual Exploitation and Abuse (PSEA) - Training of Trainers** - 2020, Gaziantep
- **Hostile Environment Emergency Training (HEET)** - 2018, Gaziantep
- **Suicide Prevention and Response Training** - 2020, Hatay
- **Advanced Training in Forensic and Psychiatry Medicine** - 2021, Istanbul

Professional Skills

- **Healthcare Management**: Demonstrated ability to lead teams, manage resources, and coordinate healthcare services in humanitarian and conflict-prone settings.
- **Technical Proficiency**: Proficient in CAD, Microsoft Office, and internet research for project and resource management.
- **Languages**: Fluent in English, with strong communication skills for multicultural teamwork.