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Faculty of Graduate Studies

Department of Health Sciences

Master Program in Immunohematology

“Iron Supplementation Adherence in Anemic Populations: Investigating Factors Influencing Adherence to Iron Supplementation among Anemic Individuals”

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Thesis Approval

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Declaration

I declare that, except where explicit reference is made to the contribution of others, this thesis is substantially my own work and has not been submitted for any other degree at the Arab American University or any other institution.

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Dedication

In the name of Allah.

To my great teacher, Prophet Mohammed.

To my country, Palestine, and its beloved capital, my birthplace, and the delight of my heart, Jerusalem.

To the great martyrs and prisoners, living examples of sacrifice.

A heartfelt letter to my dear parents.

Dear beloved brothers and sisters.

To my beloved wife, whose persisting hope and assurance gave light to my path.

To my wonderful kids: Ali, Sara, and Qassem.

To the whole family, that symbolizes love and generosity.

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Many thanks,

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Abstract

Background: Iron deficiency anemia (IDA) remains a major public health challenge in Palestine, with suboptimal adherence to iron supplementation limiting the effectiveness of treatment programs.

Aims: This study aimed to assess the level of adherence to oral iron supplementation and to identify the psychosocial, demographic, and contextual factors influencing adherence among anemic adults in the Northern West Bank of Palestine.

Methodology: A quantitative, multi-center, cross-sectional design was employed, involving 391 adult outpatients diagnosed with IDA and receiving oral iron therapy at public and private hospitals in Jenin. Data were collected using a structured questionnaire grounded in the Health Belief Model (HBM), incorporating measures of perceived benefits, perceived barriers, and perceived behavioral control, alongside demographic and clinical variables. Statistical analyses included descriptive statistics, reliability testing, multiple linear regression, hierarchical regression, t-tests, and ANOVA.

Results: The findings revealed a generally high level of self-reported adherence to iron supplementation. Perceived benefits emerged as the strongest positive predictor of adherence, while perceived barriers, particularly side effects, misconceptions, and logistical challenges, were negatively associated with adherence. Perceived behavioral control did not demonstrate a statistically significant independent effect. Several demographic and contextual factors moderated adherence behaviors: age, education, income, duration of supplementation, employment status, and type of healthcare institution significantly influenced how perceived benefits translated into adherence, whereas gender showed no significant effect. Patients attending private hospitals and those who were employed exhibited higher adherence levels.

Conclusion: Adherence to iron supplementation among anemic adults in the Northern West Bank is primarily driven by patients' perceptions of benefits and barriers, rather than by perceived behavioral control alone. These findings support the applicability of the Health Belief Model in the Palestinian context and highlight the need for targeted, culturally sensitive educational interventions, side-effect management, and strengthened support within public healthcare settings to sustain and improve adherence to iron therapy.

Keywords: Iron deficiency anemia; Iron supplementation adherence; Health Belief Model; Perceived behavioral; Perceived barriers.

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List of Definitions of Abbreviations

No.	Abbreviations	Title
1.	Hb	Hemoglobin
2.	MCV	Mean Corpuscular Volume
3.	RWD	Red Cell Width Distribution
4.	WHO	World Health Organization
5.	IDA	Iron Deficiency Anemia
6.	HBM	Health Belief Model
7.	UNRWA	The United Nations Relief and Works Agency
8.	FIGO	International Federation of Obstetrics and Gynaecology
9.	UNICEF	United Nations International Children's Emergency Fund
10.	LMICs	Low- and Middle-Income Countries
11.	RBCs	Red Blood Cells
12.	GI	Gastrointestinal
13.	GDP	Gross Domestic Product
14.	SDG	Sustainable Development Goals
15.	SCT	Social Cognitive Theory
16.	TPB	Theory of Planned Behavior
17.	Fe^{2+}	Iron in the Ferrous Form
18.	FAO	Food and Agriculture Organization
19.	MMS	Multiple Micronutrient Supplements
20.	IQ	Intelligence Quotient
21.	H	Hypothesis
22.	P	Proportion
23.	I-CVI	Item Content Validity Index
24.	S-CVI/Ave	Scale Content Validity Index
25.	CFA	Confirmatory Factor Analysis
26.	VIF	Variance Inflation Factor
27.	SPSS	Statistical Package for the Social Sciences
28.	ANOVA	One-Way Analysis of Variance
29.	r	Correlation Coefficient
30.	MLR	Multiple Linear Regression

31.	R2	Coefficient of Determination
32.	β	Beta Coefficients
33.	IRB	Institutional Review Board
34.	AAUP	Arab American University
35.	n	Number
36.	NIS	New Israeli shekel
37.	SD	Standard Deviation
38.	CV	Coefficient of Variation
39.	ADH	Adherence
40.	PBC	Perceived Behavioral Control
41.	BEN	Benefits
42.	BARR	Barriers
43.	SOC	Sociocultural
44.	KNOW	Knowledge
45.	PERS	Personal
46.	SE	Side-Effect
47.	MIS	Misconceptions
48.	Sig.	Significant

Chapter One: Introduction

1.0 Introduction

Anemia is a disease that affects people's health all over the world and is caused by a decrease in the concentration of hemoglobin (Hb) in erythrocytes, which leads to a diminished oxygen-carrying capacity of the blood. The World Health Organization defines anemia as a Hb levels lower than cut-off values if Hb < 13.0g/dl, MCV < 76fl, and RWD>14.5% for male and Hb <12.0g/dl, MCV < 76fl, and RWD>14.5% for female, which is the standard that is often used in case finding through epidemiological studies (WHO, 2025b). Anemia is a condition that affects approximately one-fourth of the global population, with occurrence rates as high as 54% in certain regions, especially among adolescents and young adults in low-income countries (Elshemy, 2018).

Iron deficiency anemia is among the top global causes of anemia, particularly in developing countries; it is still a matter of concern in public health, where malnutrition, poverty, war, and infections are widespread (Natekar et al., 2022). According to WHO (2024a), Yemen, Syria, Gaza, and Sudan are some of the countries globally and in the Arab world that suffer the most from anemia, which is a serious health issue. The iron deficiency anemia (IDA) rates in these areas are incredibly high, and that is alarming.

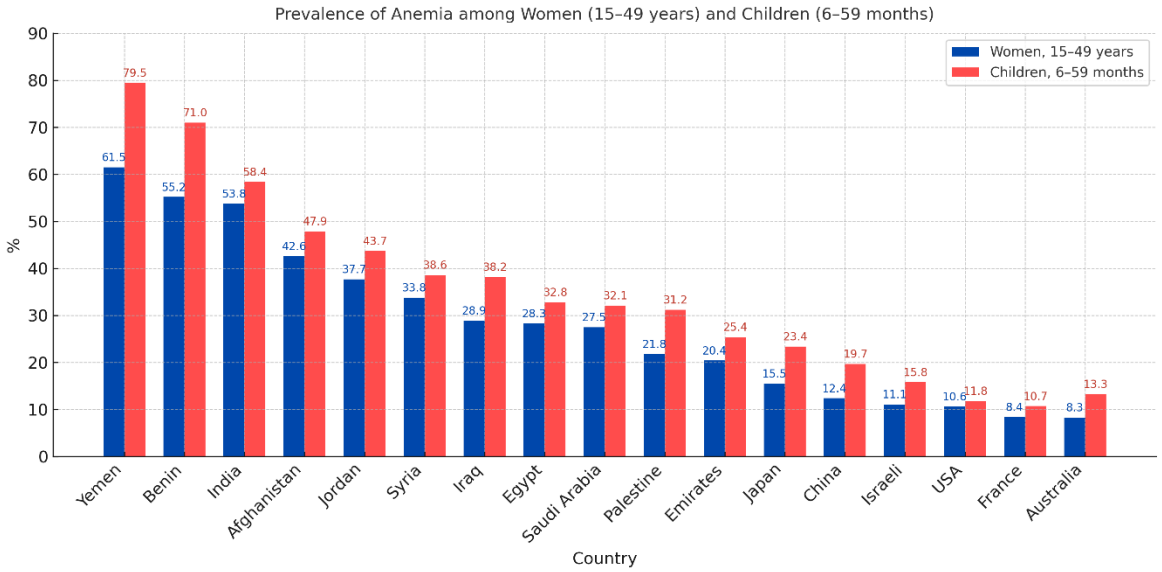

Figure 1.1: Prevalence of anemia among children and women by country

Currently, IDA is the most prevalent nutritional deficiency worldwide, and it is estimated that about 2 billion people suffer from it predominantly in less developed countries. IDA is regarded as a health hazard for infants, young children, and women of reproductive age (Kolarš et al., 2025). According to WHO (2025b), anemia is considered a public health issue when the number of people suffering from anemia in a specific population exceeds a defined limit. IDA can be caused by a lack of iron intake, increased demand in the body, or bleeding, and the situation is aggravated by poor hygienic conditions and a high prevalence of infections caused by parasites like hookworm and malaria. The quick growth of infants and toddlers makes them more susceptible to the disorder. The scenario is so critical that the IDA among children causes the drainage of poor health of individuals, cognitive dysfunctions in children, the decrease in adults' productivity, along with the increase in maternal and neonatal mortality globally, thus leading to the demand for the development of efficient prevention and treatment strategies (WHO, 2025b; Youssef et al., 2020).

Anemia has a variety of different causes, and it mainly exists due to the interaction of biological, social, economic, and environmental factors. Among the causes of IDA, iron deficiency, hookworm infection, folate deficiency, and malaria can be listed as the most common ones (Teressa, 2019). Additionally, genetic blood disorders like Thalassemia continue to be important partners in anemia (Hussien et al., 2023). The interaction of socioeconomic conditions such as poverty, lack of education, food shortage, and poor access to medical care has been shown to worsen and prolong the effects of IDA, since diagnosis, treatment, and prevention are delayed in these areas (Fleming, 1987; Hess et al., 2023; Van de Laar, 1980).

Oral iron supplementation, an inexpensive and thus widely accepted method in the treatment of iron-deficiency anemia, is still the primary strategy. Nonetheless, the use of oral iron therapy is very limited due to the gastrointestinal discomforts that are frequently encountered, including nausea, constipation, and a metallic taste (Bloor et al., 2021). Furthermore, dietary inhibitors and infections can also affect the absorption of oral iron. If oral iron supplementation is not well tolerated or is ineffective, intravenous (Kolarš et al.) iron therapy can be considered as an alternative, although it is more costly, provides quicker replenishment of the iron stores, and still requires medical supervision, while allergic reactions are a risk (Richards et al., 2021). A significant increase in hemoglobin by day 14 of treatment with oral iron can serve as an important

indicator for clinicians to select between continuing the oral approach or switching to IV iron, thus providing the most beneficial approach for the patient (Okam et al., 2017).

Adherence to iron supplementation is one of the most important factors in determining the success of the treatment for anemia; nevertheless, in most parts of the world, compliance with treatment is still below acceptance levels (Dinga, 2013; Galloway & McGuire, 1994; Silitonga et al., 2023). Low compliance is due to a variety of reasons, among which are side effects, lack of knowledge among patients, and their low health awareness of anemia and its treatment, affordability, cultural considerations, and even health systems having such limitations as drug inaccessibility, unavailability, and lack of follow-up. It has been proven that health awareness and patient counseling interventions that address the myths regarding anemia and stress the advantages of completing the therapy can significantly increase adherence rates (Ciont et al., 2025). Furthermore, the introduction of strategies for managing side effects can lead to increased tolerance and, hence, the prolongation of iron therapy (Pasini et al., 2021).

The diverse characteristics of IDA and its triggers make it unavoidable that a very good solution be aimed at in a manner that a balanced diet, infection control, and socio-economic measures are all incorporated; moreover, this solution has to function in a synchronized way. Iron supplementation therapy is one of the most important options among all the treatments for IDA, but at the same time, the extent of the advantage is very much reliant on the patient's compliance with the prescribed regimen (Alanezi, 2024). Learning about the reasons for non-compliance, as well as the application of custom-made interventions involving health promotion, side-effect management, and strengthening of the health system, are all vital steps for successful treatment. It is very important to carry out more research to ascertain the specific factors that lead to non-adherence and to come up with evidence-based strategies to motivate patients to participate in iron supplementation programs. More studies are required to discover the factors that are specific to different populations and that influence adherence.

1.1 Problem Statement

The Health Belief Model (HBM) has been extensively employed in various health-related behavior research, but it does not fully reach its potential in applying to the case of compliance to iron supplementation among anemia patients (Mekonnen et al., 2021). The HBM considers health-related practices to be affected mutually by a

person's perception of vulnerability to a disease, the seriousness of its repercussions, and the benefits derived from the adoption of preventive measures. Nonetheless, it has not been significantly applied in the situation of compliance with iron therapy by anemic patients (Andani et al., 2021). The comprehension of the psychological features is of utmost importance, since adherence to iron therapy is the principal factor determining the success of anemia management programs.

Anemia is a major health issue in Palestine, and it apparently harms the health of the people; hence, finding a remedy for this problem is necessary (A. Assaf et al., 2023; Malak et al., 2025). About 29% of non-pregnant women aged 15-49 in Palestine, for example, are reported to suffer from anemia, which is caused by various factors such as food insecurity, limited access to health care, and economic constraints (A. Assaf et al., 2023). Regional factors such as people's beliefs, the literacy level regarding health issues, and the limitations of the healthcare system also contribute to adherence, leading to specific difficulties that are not completely solved by worldwide studies (Malak et al., 2025; WHO, 2021).

Alteration of behavior related to iron therapy has been investigated in various countries before, in addition to Palestine (Harada et al., 2022; Mahfouz et al., 2025; Shaheen & Hejaz, 2019a), However, regional considerations like the exceptional culture, social and economic conditions of Palestine, and the public health system's arrangement rarely get mentioned in the mentioned studies. The contributions of international research to the understanding of the problem are significant but only to a certain extent, thus necessitating a comprehensive and context-specific investigation in Palestine owing to its unique healthcare resources, literacy rates, and cultural beliefs.

The Health Belief Model (HBM) is a strong model to understand and improve adherence behaviors, as it was shown in time-proven educational interventions in anemia management based on HBM worldwide (Abd Rahman et al., 2022; Abraham & Sheeran, 2014; Salama, 2018). By studying the influence of HBM constructs on iron therapy adherence among the Palestinian population, this research will fill the significant knowledge gap and work towards creating culturally sensitive, effective interventions to improve compliance and thus control of anemia.

Iron deficiency anemia (IDA) is very common in Palestine, and the vulnerable groups, especially women and children, are the most affected by it. Research studies have shown that Children are the group with the highest rates of anemia, with almost 60% of the under-one-year-old children in Gaza being affected (El Bilbeisi, 2025). The

non-adherence to iron therapy is a common issue, and the awareness, cultural beliefs, side effects, and the local healthcare system are the main factors that influence it negatively. A series of interventions, including nutritional education and supplementation programs that were provided by primary healthcare and UNRWA, have been unable to attain the expected levels of adherence and have been mostly impacted by these difficult contextual factors (Harada et al., 2022). The application of the HBM in this case can lead to the patients' perceptions being changed and thus adherence to the treatment being increased, resulting in a better control of anemia in Palestine.

1.2 Study Significance and Justification

Theoretically, this research has a great impact on IDA management by applying HBM, which is based on patients' beliefs about susceptibility, severity, benefits, and barriers in relation to iron therapy adherence. Previous studies indicate that HBM-based educational interventions have a significant impact globally and regionally on knowledge, perceptions, and adherence to iron supplementation (Jalambo et al., 2018; Mekonnen et al., 2021). The combination of behavioral and spiritual dimensions in this research acts as a strong support to the theoretical framework of health behavior change in the field of chronic disease management and clinical nutrition.

Practically, the research intends to make the healthcare professionals and hospital staff more visible and to encourage their patient interactions with the followers of anemia to be more aware and productive. Moreover, the research backs up the statement that communication and education among the medical staff should be the basis for the individualized treatment plans that will, in turn, help patients appreciate the advantages of iron intake. Thus, increased awareness can lead to greater compliance rates, which, subsequently, will bring about better treatment results and lower health and economic burdens linked to anemia (Septiana et al., 2025).

Moreover, the study, besides focusing on the physician, its goal is to help the patients know the importance of iron medication and its role in overcoming anemia. Patients who are aware of the positive effects of the treatment and the importance of sticking to their regimens will cooperate with the doctors more. Thus, this study fosters patient-centered care and supports self-management through the improvement of patient knowledge and encouragement.

From the system's perspective, the output will be very beneficial to the Ministry of Health and the other medical institutions. The research indicates that hospitals, clinics, and health centers should all get a suitable supply of iron supplements distributed in an equal and just way for treating anemia patients. The government's perspective on the matter brings out the key role of healthcare facilities and resource distribution in accessibility of treatments to all anemic patients, rather than just a few. The national government is likely to consider such information when making decisions about purchasing and distributing, as well as health policies. As a result, anemia management programs in the country could benefit indirectly.

1.3 Objectives of the study

1.3.1 Main Objective

1.3.1.1 To assess the factors influencing adherence to iron supplementation among anemic individuals.

1.3.2 Specific Objective

1.3.2.1 To assess the adherence behavior of anemic individuals with respect to their prescribed iron supplementation, emphasizing the frequency and consistency of medication intake.

1.3.2.2 To identify the motivators for iron supplementation. This includes examining the perceived benefits of therapy from the patient's perspective and the availability of iron supplements.

1.3.2.3 To investigate the obstacles to adherence, including perceived side effects, forgetfulness, misconceptions regarding iron therapy, and other psychosocial factors.

1.3.2.4 To explore the nature of interactions between the patient and provider regarding iron supplementation, especially with respect to clarity and understandability of the instructions and the availability of support systems.

1.3.2.5 To analyze how demographic variables, such as age, gender, socioeconomic status, and educational level, influence adherence behaviors and patterns.

1.4 Research Questions:

1.4.1 Main questions:

1.4.1.1 Do anemic patients in the Northern West Bank adhere to iron treatment through supplements?

1.4.1.2 If they adhere, to what extent are they committed to the treatment?

1.4.2 Specific questions:

1.4.2.1 What are the main barriers that prevent patients from continuing the treatment?

1.4.2.2 Does cost and financial status impact adherence to iron supplementation?

1.4.2.3 Can societal culture influence patients' decisions regarding iron supplement adherence?

1.4.2.4 What are the main facilitators that can improve patients' commitment to treatment?

1.4.2.5 Is there a correlation between the type of interaction with healthcare providers and patients' adherence to iron supplements?

1.4.2.6 How do demographic factors affect patients' adherence differently?

1.4.2.7 Do iron supplements cause side effects that influence adherence?

1.5 Conceptual Definition

1.5.1 *Anemia*: Anemia is a medical condition characterized by a deficiency in the number or quality of red blood cells (RBCs) or hemoglobin concentration, resulting in a reduced capacity of the blood to carry oxygen to the body's tissues (Wagh et al., 2024). Hemoglobin is a protein in RBCs responsible for oxygen transport from the lungs to organs and tissues (Singh et al., 2024). When hemoglobin levels fall below established thresholds, commonly less than 12 g/dL in women and less than 13 g/dL in men, an individual is considered anemic (WHO, 2025b).

1.5.2 *Iron Deficiency Anemia* (IDA): IDA is a specific type of anemia that is caused by a lack of iron, which in turn diminishes the production of hemoglobin and affects the generation of red blood cells (Iolascon et al., 2024). Iron deficiency is the most frequent reason for anemia worldwide and mostly comes from low dietary intake, poor absorption, or continuous blood loss (Leung et al., 2024). It mainly takes place in newborns, young children, and women of childbearing age, and pregnant women in economically disadvantaged areas (WHO, 2025b; Youssef et al., 2020).

1.5.3 *Adherence*: Defined as the degree to which the patients follow the doctors' orders for iron supplementation. It includes the timing, dosage, and duration of the therapy. High adherence level is essential for anemia treatment to be effective; on the other hand, poor adherence is often associated with treatment failure (Okam et al., 2017).

1.5.4 *Health Belief Model (HBM)*: The HBM is a psychological model that helps to explain health-related behaviors (Alagili & Bamashmous, 2021). According to this model, the probability of a person taking up a health behavior (for example, sticking to medication) is determined by five factors: their perceived susceptibility to the health condition, their perception of the severity of the condition, their assessment of the benefits of the behavior, their judgment of barriers, and the presence of cues to action.

1.6 Limitations of the study

1.6.1 The method of convenience sampling or selecting participants from particular healthcare centers in the West Bank could potentially restrict the representativeness of the study sample. Consequently, the findings might not apply to the whole anemic population in Palestine or in regions with varying demographic and healthcare characteristics (Ba et al., 2019).

1.6.2 The implemented measurement of adherence consistently depends on the patients' self-reports, which results in introducing possible biases, for instance, recall bias or social desirability bias. It is quite possible that patients would report adherence even more than their actual behavior to meet the assumed expectations, thus causing an increase in adherence rates (Demie et al., 2023).

1.6.3 The research might overlook long-term adherence patterns that go past the study period. A lot of adherence studies have a short to medium duration as their focus, whereas iron supplementation demands committed adherence throughout a period of several weeks up to months if it is to show any positive effects. Non-existence of the long-term monitoring might impair the getting of a clear picture about adherence sustainability and its influence on the outcome of treatment (Ba et al., 2019).

1.7 Structure of the Study

This study is organized into five chapters, each addressing a fundamental aspect of the research systematically:

1.7.1 *Chapter One*: Introduction: An introduction to the research study and its importance, background to the study, including the problem statement, aims and objectives, as well as the main research questions. Setting limitations and giving the whole structure of the research.

1.7.2 *Chapter Two*: Literature Review: This is an exhaustive review of the current research about anemia, iron deficiency, and adherence to iron supplementation. Furthermore, it studies significant theories and conceptual frameworks that support the issue. In addition, it examines empirical research associated with anemia, iron deficiency, and adherence to iron supplementation in healthcare with an emphasis on developing countries, such as Palestine.

1.7.3 *Chapter Three*: Research Methodology: This chapter covers research designs, methods, and data collection methods. The chapter further addresses populations, sampling, and ethical considerations in research methods.

1.7.4 *Chapter Four*: Data Analysis and Findings: The research outcomes based on the data collected will be reported in this chapter. Qualitative and quantitative assessments based on the study's objectives and hypotheses will be given. The results are examined with the aid of the theoretical framework and the existing literature.

1.7.5 *Chapter Five*: Discussion and Conclusion: The current chapter thoroughly discusses the findings of the research and connects them to the objectives and the overall significance of the research. It gives results, a few practical recommendations for hospital administrators and decision-makers, and ideas for more studies to be done. Following the discussion, the chapter addresses the limitations of the study. Finally, it concludes by highlighting the contributions of the research.

Chapter Two: Literature Review

2.0 Introduction

This chapter reviews evidence on iron-deficiency anemia (IDA) with emphasis on Palestine and comparable LMICs. It synthesizes prevalence patterns, adherence challenges to iron supplementation, and behavioral theories that explain adherence, and it identifies gaps that the current study addresses. Primary attention is given to studies from Palestine and similar LMICs, with emphasis on sociocultural and behavioral factors that influence adherence to iron therapy. Understanding these determinants informs culturally responsive, sustainable interventions to improve adherence, reduce IDA prevalence, and enhance public health. The chapter further points out the methodological and theoretical gaps of previous research, which the current study, through a more integrative behavioral approach, endeavors to fill.

2.1 Conceptual Foundations

2.1.1 Anemia

Anemia is one of the most significant health concerns worldwide, and it is estimated to affect approximately 1.9 billion individuals, with children, adolescents, and women of childbearing age constituting the highest number of cases (Atkinson et al., 2025). According to the WHO (2025b), anemia is defined as a reduction in Hb concentration below 13 g/dL for males and 12 g/dL for non-pregnant females, but it should be noted that such criteria may change depending on a person's age, sex, and pregnancy condition. Alem et al. (2023) indicate a staggering worldwide prevalence of anemia among children below five years of age at 39.8% and women of reproductive age at about 29%.

Epidemiological studies have shown that the causes of anemia are multifactorial. Anemia, besides being linked with low hemoglobin levels, harms the overall illness burden, death rate, and development of children. Anemia adds to the difficulty in treating chronic diseases and results in higher healthcare costs (Cappellini & Motta, 2015; Kujovich, 2016). In old age, the rate of anemia rises significantly, reaching as much as 44% in men above 85 years of age, mostly mild cases that still affect the quality of life negatively and contribute to higher mortality rates (Guralnik et al., 2022).

The classification of anemia depending on the cause, red cell morphology, or clinical presentation provides significant information for diagnosis and treatment. The

two major mechanisms of pathophysiology are the inadequate production of erythrocytes (hypo-regenerative anemia) and the loss of erythrocytes (regenerative anemia) through either bleeding or destruction (Chaparro & Suchdev, 2019). From a hematological point of view, anemia is frequently divided into microcytic, normocytic, and macrocytic types based on the mean corpuscular volume (MCV), which aids clinical interpretation and management (Chulilla et al., 2009).

Microcytic anemia, which is diagnosed by an MCV of less than 80 fL and hypochromia, is mainly due to iron deficiency, lead poisoning, thalassemia, and chronic disease (Chaudhry & Kasarla, 2023). Normocytic anemia is common in clinical practice and typically has an MCV of 80–100 fL; it is often associated with chronic disease or acute blood loss (Yilmaz & Shaikh, 2020). Macrocytic anemia (MCV > 100 fL) is most often due to vitamin B12 or folate, and if left untreated, it can lead to neurodevelopmental disorders (Nagao & Hirokawa, 2017).

The most common cause of anemia worldwide is still a lack of nutrients in the diet. Almost half of the world's anemia cases are caused by iron deficiency due to reasons such as not eating enough iron-rich foods, poor iron absorption, high body iron demand being high, or chronic blood loss (Hahn et al., 1988; WHO, 2021). Daily iron requirements vary by age and physiological status: 0.5 mg for infants 0-6 months, 6-8 mg for young children, up to 16 mg for breastfeeding women (Miller & Berner, 1989). In poor countries, the diet is generally low in accessible iron, and this is made worse by worm infestations that cause iron loss (Aedh et al., 2019).

Deficiencies of vitamins B6, B12, folate, and riboflavin can cause anemia by impairing hemoglobin synthesis and red-cell maturation (Hafiza et al., 2024). The lack of folate, particularly during the time of increased need, like pregnancy, is also responsible for megaloblastic anemia and developmental delay in infants (Margo et al., 2017).

Anemia is classified into four types according to its severity based on Hb levels: mild, moderate, severe, or life-threatening, with the symptoms indicating that tissues are not getting enough oxygen. The main clinical signs are fatigue, shortness of breath, difficulty in thinking, and skin becoming pale. However, in many cases, especially those at mild stages, patients are often still without any noticeable signs (Tvedten, 2022). The body initiates several changes in the circulatory and respiratory systems to cope with anemia, and these changes, once anemia is prolonged, progressively reduce the health and function of the individual (Lee et al., 2021).

The treatment of anemia is determined by the cause, the degree of the problem, and individual patient characteristics. First-line treatment for IDA is oral iron—commonly totaling ~120 mg elemental iron/day for ~3 months—to restore hemoglobin and iron stores (Pantopoulos, 2024). Besides, intravenous iron is prescribed when oral iron therapy fails or has contraindications. Megaloblastic anemia treatment involves vitamins and taking them up to the levels that are needed. Chronic or hemolytic anemias require more specialized methods, and these may include erythropoiesis-stimulating agents, immunosuppressants, in severe cases, transfusions, and stem cell therapy (Sankar & Villa, 2021).

2.1.2 Iron Deficiency Anemia (IDA)

IDA is highly prevalent in low-income and conflict-affected settings, including Palestine. IDA results from the body's inability to draw from iron storage for erythropoiesis, which causes a decrease in hemoglobin formation and the disruption of oxygen transport. IDA is diagnosed by observing the common symptoms of fatigue, paleness, dizzy spells, mental dullness, and less physical stamina (Kassebaum et al., 2014; WHO, 2024b).

From a pathophysiological perspective, IDA is classified into three stages: depletion of iron stores, iron-deficient erythropoiesis, and the development of anemia (Kolarš et al., 2025). The initial phase is marked by a drop in serum ferritin levels with normal hemoglobin still present. As the deficiency continues, the saturation of transferrin decreases, leading to a limitation of iron supply to the bone marrow, where hemoglobin is produced. Eventually, red cells become microcytic and hypochromic, indicating insufficient iron for hemoglobin synthesis (Cappellini et al., 2020).

According to the International Federation of Gynecology and Obstetrics, anemia affects around two billion people worldwide; this amount is equivalent to almost one-third of the total population on earth (FIGO, 2023). Physiological factors make women of reproductive age, pregnant women, and infants the most affected categories. The issue in poor and middle-income nations is worsened by a less-than-ideal diet, poor availability of fortified foods, and unstable economies (Mantadakis et al., 2020). In the Eastern Mediterranean area, WHO (2025c) reports that one out of three women aged 15-49 years old has anemia, mainly due to iron deficiency. In Palestine, anemia is a serious health problem: Srour et al. (2018) mentioned that the prevalence of iron

deficiency anemia among pregnant women was 25.7% and 52% of them had depleted iron stores, while UNICEF (2019) pointed out that children below five years have the highest rates of iron deficiency, which is linked to food insecurity and political instability.

IDA has a complex etiology that is multifactorial. It is caused by inadequate iron consumption, chronic bleeding, poor absorption, and increased iron needs during pregnancy or the growth phase (Haider et al., 2013). Iron in the diet is of two kinds: heme iron (animal-based, highly bioavailable) and non-heme iron (plant-based, less bioavailable). Absorption of non-heme iron is very much dependent on the presence of dietary enhancers (vitamin C) and inhibitors (phytates, tannins, calcium) (WHO-FAO, 2020). In Palestine, the reliance on vegetarian diets and economic hardship leading to limited accessibility of animal-source foods are factors that contribute to the widespread deficiency of iron. Moreover, among the factors are heavy menstrual flow, GI (gastrointestinal) disorders, worms (parasitic infections), and malabsorption syndromes like celiac disease or H. pylori infection (El Idrissi El Houcine & Naoufal, 2025; Kalaivani, 2009).

IDA's clinical manifestations are not limited to hematological symptoms only. Common signs of it are fatigue, weakness, pallor, increased heart rate, in very severe cases, pica (which is the craving for non-nutritive substances like ice or clay), inflammation of the tongue, and spoon-shaped nails (Lacy, 2021). Chronic deficiency is linked to cognitive and perceptual impairments, delayed psychomotor development in infants, low productivity at work, and poor immunity in adults (Lozoff et al., 2006; Pivina et al., 2019). The prevalence of IDA among pregnant women is connected to the increased risk of preterm delivery, newborns with less than normal weight, and maternal mortality (Babah et al., 2024).

The process of diagnosing the ailment involves a thorough clinical observation and several lab tests, among which is the determination of the amounts of hemoglobin, hematocrit, mean corpuscular volume (MCV), and serum ferritin. According to the WHO (2025b) standards, a hemoglobin level ≤12 g/dL for non-pregnant females and ≤11 g/dL for pregnant females represents a case of iron deficiency. Serum ferritin is the most reliable single measure of iron deficiency; transferrin saturation provides complementary confirmation (Cancado et al., 2025). In resource-limited countries like Palestine, where diagnostic facilities are scarce, comprehensive assessments are often

not possible due to the limitations of resources, thus highlighting the importance of preventive public health strategies.

The main goal of IDA management is to restore iron levels and to deal with the root causes of the problem. According to the WHO (2016), oral iron supplementation (30–60 mg of elemental iron per day for non-pregnant women and 60 mg with 400 µg of folic acid during pregnancy) plus dietary modification is the recommended strategy. Ferrous sulfate is the usual oral iron preparation, although its gastrointestinal side effects are a common reason for patients not to continue taking it (Tolkien et al., 2015). For those patients who cannot tolerate oral iron, the intravenous iron formulations, such as ferric carboxymaltose, have become very effective and available alternatives (Auerbach et al., 2020). Iron fortification of food and community nutrition programs have always been major public health measures that successfully contributed to the reduction of IDA prevalence. The Ministry of Health in Palestine and UNRWA have been issuing iron–folic acid supplements to pregnant women through antenatal programs, but still, challenges in adherence remain due to the side effects, the misconceptions, and the limited counseling (Horino et al., 2021).

IDA imposes substantial economic costs; in high-burden settings, productivity losses can account for a meaningful share of GDP. Specify the range and add a current source. The median annual economic loss because of IDA in 10 developing countries was estimated at $16.78 per capita, or 4% of gross domestic product (Pasricha et al., 2013). Moreover, the anemia cycle keeps on going, and this leads to more poverty: anemic mothers are more likely to have low-birth-weight infants who suffer from developmental disadvantages for their whole lives. Treating IDA is in line with the Sustainable Development Goals (SDG 2: Zero Hunger; SDG 3: Good Health and Well-being) as well as the WHO's Global Nutrition Target of cutting down the incidence of anemia among women of reproductive age by 50% by 2030 (WHO, 2025a). To reach these goals, a combination of approaches based on biomedical, behavioral, and social interventions is required.

Theoretical Underpinning

This research is based on three widely accepted behavioral theories, the Health Belief Model (HBM), Social Cognitive Theory (SCT), and Theory of Planned Behavior (TPB), to analyze the determinants of adherence to iron supplementation for iron-

deficiency anemia (IDA). The theories are combined to give a complete picture of the factors affecting preventive health behaviors in at-risk groups, for instance, women of childbearing age and pregnant women living in places like Palestine.

- The Health Belief Model (HBM), introduced by Rosenstock (1974) and later elaborated by Champion & Skinner (2008), posits that people would go for preventive health behaviors, depending on their views about the risk of getting a condition, the severity of its consequences, the perceived benefits of taking action, and the perceived barriers to acting. These factors combined directly affect the chances of changing behavior. Talking about IDA, taking iron supplements regularly depends on women's opinions about their risk of anemia, the consequences they consider to be very serious, the extent to which they consider iron supplementation to be beneficial, and the magnitude of the barriers to adherence that they recognize.
- The Social Cognitive Theory (SCT) of Bandura (1986) enriches the HBM by asserting a constant interaction of personal factors, environmental influences, and behavior, a concept known as reciprocal determinism. SCT argues that people acquire and maintain behaviors not merely through their direct involvement but also through seeing, getting rewarded, and imitating others. Self-efficacy, the faith in one’s capability to carry out a certain task successfully, is a major concept of SCT.
- The Theory of Planned Behavior (TPB) proposed by Ajzen (1991) elaborates the principles of HBM and SCT by making behavioral intention the most immediate determinant of action. The integration of HBM, SCT, and TP models leads to an astonishingly intricate and stimulating picture of compliance with iron supplementation. The HBM deals with risk and benefit mental evaluation, the SCT brings self-efficacy and environment influence, and the TPB underlines social norms and perceived control as the main factors.

Merely combining the models of HBM, SCT, and TP allows one to get a superbly intricate and engaging picture of compliance with iron supplementation. The HBM indicates a mental evaluation of risks and benefits, the SCT discusses self-efficacy and the impact of the environment, whereas the TPB brings forth the importance of social norms and perceived control. The three models together imply that adherence takes place due to a combination of different belief systems, perceived capabilities, and context-related realities.

In the Palestinian context, the integrated theoretical approach is paramount as healthcare access is very limited and cultural conventions greatly impact women's health habits. The model suggested in this research states that perceived benefits, perceived barriers, and perceived behavioral control (taken from these theories) are the main determinants of adherence and that demographic and socioeconomic factors (like education, income, and healthcare access) are moderating or control factors.

2.1.3 Adherence to Iron Supplementation

Iron supplementation is delivered orally (first line) or intravenously (when oral therapy fails or is contraindicated) to replete iron and prevent relapse. It is globally at the forefront of nutrition and maternal health interventions and is considered the main approach for tackling anemia in communities where there is an inadequate dietary iron intake. Iron supplementation is a process through which iron preparations are administered both orally and parenterally, or otherwise, to replenish the iron stores that have been depleted, to increase the synthesis of hemoglobin, and to prevent the recurrence of anemia. The World Health Organization has taken this strategy, and therefore it is extremely important, especially in places like Palestine, where there is a lot of food insecurity, healthcare access is restricted, and dietary diversity is limited, making iron deficiency more likely (WHO, 2016).

Iron is a crucial micronutrient that is responsible for, among other things, the transport of oxygen, cellular respiration, and the overall metabolism of energy. In the case of failure to absorb or a diet not providing enough iron, supplementation would be the way to go to ensure that normal physiological functions are maintained and anemia is prevented. According to the WHO (2023), there are two main objectives of iron supplementation: therapeutic and preventive. The first one, therapeutic supplementation, is aimed at correcting anemia by restoring the iron stores and increasing red blood cell production, while the second one, i.e., preventive supplementation, is given to the groups considered at high risk, pregnant women, children, and adolescents, for preventing the development of deficiency. In Palestine, both forms are utilized in the maternal and child health programs. However, adherence challenges and logistics constraints often hinder their success (Jalambo et al., 2018).

Iron supplementation is available in various forms, with oral preparations being the most common ones due to their cost-effectiveness and the convenience of

administration. Common oral formulations are ferrous sulfate, ferrous fumarate, and ferrous gluconate, which differ in elemental iron content and tolerability (Camaschella, 2015). Even though ferrous sulfate has such adverse gastrointestinal effects as nausea, constipation, and abdominal pain, it is still the standard reference preparation that is recognized mostly for its low cost and proven efficacy. The WHO (2016) suggests a daily intake of 30–60 mg of elemental iron for non-pregnant women of childbearing age and 60 mg for pregnant women, along with 400 μg of folic acid for a minimum of six months during pregnancy and three months postpartum. For children and adolescents living in high-risk areas, the doses are reduced and given in either syrup or tablet form according to the child's weight. These supplements are given out through healthcare centers, antenatal clinics, and school-based programs as part of the country's national anemia-prevention strategy.

Parenteral iron preparations find their use in situations where the oral route cannot be used due to reasons such as ineffective absorption, intolerance, or contradictions. Anemia correction requiring rapid therapies is possible with intravenous formulations like iron sucrose, ferric carboxymaltose, and iron polymaltose complex, which subsequently create better patient compliance with those who cannot take oral medications (Steinbicker & Pantopoulos, 2025). Such formulations are mainly required for patients suffering from gastrointestinal malabsorption syndromes, inflammatory bowel disease, chronic kidney disease, or severe anemia cases that need prompt repletion. Nevertheless, parenteral iron not only lessens gastrointestinal side effects but also hastens hemoglobin level increase; however, it is more costly and requires skilled medical personnel for safe administration. In Palestine, due to limitations regarding infrastructure and costs, intravenous iron therapy is generally restricted to the level of hospital-based care (UNRWA, 2020).

The physiological process behind iron supplementation is that the body's iron stores are being restored so that there is enough hemoglobin produced. After taking the iron supplement, it will be mainly absorbed in the duodenum and upper jejunum, which are the first and second parts of the small intestine. The iron in the ferrous form (Fe^{2+}) is taken in by the intestinal mucosa through the DMT1 (divalent metal transporter 1) and is then either kept as ferritin or sent into blood circulation by the ferroportin channel (Woloshun, 2020). Iron in the blood then attaches itself to transferrin and is transported to the marrow, where it becomes a part of hemoglobin during the process of red blood cell formation (Abbaspour et al., 2014). And the extent to which iron is absorbed varies

with the type and amount of food consumed, the body's iron levels, and the interaction between optimizers and suppressors of iron absorption.

Iron supplementation has been found to yield a significant reduction of anemia in terms of its prevalence and, at the same time, improve the hemoglobin levels among different populations, and thus it is supported by very strong and steady evidence. Haider et al. (2013) conducted a meta-analysis, the findings of which indicated that daily iron–folic acid supplementation during pregnancy has significantly increased the levels of hemoglobin and ferritin in mothers, decreased the incidence of maternal anemia, and positively influenced the outcomes of birth weight of newborns. In addition, the application of long-term supplementation interventions resulted in considerable drops in anemia incidence in major public health programs in South Asia and the Middle East (WHO-FAO, 2020).

The absorption level into the body is due to the interaction of biological and environmental factors. Bodily conditions such as infections, inflammation, and genetic disorders influence the absorption and utilization of iron in the body. One of the factors is hepcidin, a hormone produced during the infection in large quantities, which might reduce the iron absorption in the intestines by keeping it in the storage sites (Nemeth & Ganz, 2021). The diet is also an important factor in the whole absorption process. The presence of dietary inhibitors like tea, coffee, whole grains, and legumes, which are commonly consumed in Palestinian households, can notably reduce iron bioavailability, particularly if meals are not accompanied by enhancers such as vitamin C-rich fruits or animal protein.

Iron supplementation is a treatment that has been proven to be beneficial in several aspects; however, it still has to deal with side effects primarily, and the unwillingness of patients to take it is the main problem. Non-adherence is mainly due to gastrointestinal symptoms, which very often lead to the individual's discontinuation of the therapy earlier than planned (Shaheen & Hejaz, 2019b). Along with making the tolerability better, some methods, such as taking the medicine with food, smaller doses, slow-release formulations, or alternate-day dosing, have also been suggested. Among these, alternate-day dosing is the one that comes out as the one with the most benefits through improving absorption and reducing hepcidin's blockage of iron uptake, thus making it a new method for achieving better tolerance and patients' adherence (Cappellini et al., 2020).

WHO and UNICEF issue harmonized global recommendations and emphasize implementation supports (counseling, reliable supply, monitoring) to improve adherence and program sustainability (UNICEF, 2019). For instance, according to the WHO (2016), pregnant women are to take daily 60 mg elemental iron and 400 μg of folic acid throughout pregnancy and even after the birth of the baby. Non-pregnant women of reproductive age should either be given daily or weekly supplements, depending on the area they live in; this is highly recommended for regions that have a high prevalence of anemia. Iron supplementation is for infants and young children from 6 to 23 months old, the dosage being 2 mg/kg body weight per day (WHO, 2023). School-based supplementation programs address adolescent girls, as this is a critical stage for growth and increased iron needs. The currently available evidence has led to the setting of global standards for iron supplementation by the WHO and UNICEF, as mentioned previously, and these recommendations provide a rough outline for the health systems of the countries involved.

Iron supplementation plans have been merged into the maternal and child health framework of the Ministry of Health and the United Nations Relief and Works Agency (UNRWA) in Palestine. Antenatal visits provide iron–folic acid tablets to pregnant and lactating women, and health workers give basic advice on their use. Nevertheless, the side effects, forgetfulness, misconceptions, and inconsistent follow-up have all contributed to the low adherence levels. A UNRWA (2020) report pointed out that many women do not start taking the supplements or stop using them after having gastrointestinal discomfort. Moreover, intermittent supply shortages, lack of health education, and limited provider–patient communication have further diminished the program's impact. Culturally appropriate educational interventions and constant counseling by healthcare providers have been proven to greatly enhance compliance and thus ought to be incorporated in local programs.

In addition to the conventional methods, different and complementary strategies such as intermittent dosing, multiple micronutrient supplementation, and food fortification are slowly getting recognition as ways to enhance patient compliance and sustainability. A reduction in gastrointestinal side effects has been reported when intermittent iron supplementation is given one to three times per week instead of daily (Bloor et al., 2021). In this case, the same increase in hemoglobin levels is achieved. Moreover, the application of the mixed multiple micronutrient supplements (MMS),

which comprises iron with folic acid, zinc, and vitamins A and B12, has been associated with broader maternal and infant health benefits (WHO-FAO, 2020).

Iron supplementation has enormous benefits to public health. The productivity of workers was enhanced, people’s fatigue was lessened, and children's IQ was increased, so the whole economic development was supported (Horton & Ross, 2003). However, the barriers of availability, compliance, and acceptability still need to be eliminated for iron supplementation programs to be successful. The global anemia-reduction targets cannot be met with supplement availability only; counseling and adherence support are vital as well. The WHO (2011) will have the iron supplements not only to supply but also to keep the patients informed and make sure that they are really taking them. It means a Palestinian system will have to be built to address both the behavioral and systemic problems; these are patient education, cultural predispositions, gender roles, and healthcare facility improvement.

Theoretical Underpinning

The combination of the HBM, TPB, and SCT theoretical perspectives offers a thorough and diverse framework for the examination of iron supplementation adherence. The HBM points out the way that people's knowledge of the good and bad of health practices influences their willingness to do them, while the TPB goes a step further by considering the influence of social norms and intention formation as key elements of the process leading to the action. Moreover, the SCT puts stress on self-efficacy, which is the feeling of being capable of performing a behavior, and it also points out the interaction of personal, environmental, and behavioral factors that together support adherence.

Theoretical frameworks suggest that iron supplementation adherence is not a simple case of patient education, but rather a result of the individual's perception of his/her own power, social support, and good conditions. The study recognizes three factors, perceived advantages, perceived obstructions, and perceived behavioral control, as the key independent determinants of iron supplementation adherence. On the other hand, demographic and socio-economic factors like age, education, job, and income, and access to healthcare, are considered controlling and moderating variables that would affect the strength and direction of these relationships. This cohesive theoretical foundation not only reveals the entire picture of adherence behavior but also provides

the ground for the development of culturally tailored and psychologically enlightened interventions to increase compliance with iron supplementation among Palestinian women.

2.1.4 Barriers to Iron Supplementation Adherence

Iron supplementation is the focal point in the global approaches that were developed for the prevention and treatment of IDA. Yet, its effectiveness is based primarily on the continuous adherence to the recommended treatments. Adherence, even though the therapeutic benefits are usually recognized, is still very low in some areas, particularly in the case of Palestine, which is a low- and middle-income country. Nonadherence decreases the effectiveness of health measures taken by the government, resulting in the occurrence of anemia, the rise in maternal morbidity, and infant deaths that could have been averted. Therefore, it is necessary to investigate the various reasons behind nonadherence to develop interventions that are both accurate and long-lasting.

Iron supplementation barriers are not simple and can be subdivided into various classes such as physiological, psychological, behavioral, socio-cultural, economic, and health-system. These domains often co-occur and jointly influence adherence to supplementation. (Tefera et al., 2023; WHO, 2023).

Gastrointestinal side effects from oral iron commonly reduce adherence, especially early in treatment. The patients mostly report to the doctors with the complaint of gastrointestinal discomfort, which is characterized by nausea, vomiting, constipation, diarrhea, metallic taste, and abdominal pain (Cappellini et al., 2020; Shaheen & Hejaz, 2019b). The main reason why these negative effects occur is the irritating action of the iron that remains unabsorbed in the intestines, leading to local inflammation and also causing changes in the motility of the gut (Camaschella, 2015). In some cases, patients undergo so much discomfort that they stop their medication before time or reduce their dosage without informing the doctor.

In India, a study discovered that around thirty percent of pregnant women stopped taking iron because of its gastrointestinal side effects. In Palestine, a comparable instance was discovered, which a survey has reported as the main reasons for discontinuation: discomfort, bloating, and constipation (Shaheen & Hejaz, 2019b). These adverse effects are mostly mild and of short duration; nevertheless, the lack of

proper support triggers fear and finally cuts off the patient. The advised methods, like taking pills with meals, giving doses every other day, or using the slow-release form, are regarded as very potent in gaining acceptance (Auerbach et al., 2020).

Patients' adherence to therapy significantly depends on their attitudes, knowledge, and thoughts regarding both anemia and its treatment with supplements. The most common mental barrier is either the lack of knowledge about the negative health effects of anemia or the misunderstanding of the supplement's purpose. In poor-resource areas, a large number of women stop taking the supplements shortly after the improvement of their condition, mistakenly thinking that the treatment is for the cure and not for prevention (Silubonde et al., 2022; WHO-FAO, 2020).

Still, there exist numerous baseless convictions that people generally share. For example, with respect to women's health, some women believe that taking iron supplements will either have the effect of producing larger babies or very difficult births, while others think this is the cause for their possible sickness or gaining weight (UNRWA, 2020). Over the years, the accessibility of "natural" or herbal remedies, to a large extent in some cultures, has postponed or even replaced their medical counterpart. Moreover, it is sometimes reported that in the Middle East, women interpret anemia as a normal state of being during pregnancy and therefore do not seek medical treatment (Hwalla et al., 2017; WHO, 2023).

Among the main reasons for poor adherence are forgetfulness, fatigue, or lack of control (Osterberg & Blaschke, 2005; Unni et al., 2019). For women who have to do many household and professional activities, taking the daily and monthly doses can become a hard task. In Ethiopia, it was found that nearly half the participants missed the doses because they forgot (Taye et al., 2015). A similar study conducted in Palestine found that heavy daily workload, fasting during Ramadan, and restriction on movement were the main contributing factors to lack of compliance (Daghlas, 2021; Dahmouni, 2024).

The problems mentioned above have been reduced by the use of modern behavior modification techniques. One of these methods is connecting the ingestion of supplements to daily activities such as eating, mobile phone alerts, or visual calendars (WHO-FAO, 2020). Moreover, the introduction of social accountability techniques, such as visits to homes and group counseling, not only enhances adherence but also makes adherence procedures more regular by increasing them (Ewulu et al., 2024).

The cultural as well as the gender-related dynamics have a major role in determining the extent of women's autonomy and their health-seeking behavior. In patriarchal societies, as is the case in several Middle Eastern regions, women are frequently in need of either a male family member's consent or financial support from him to go to a healthcare facility or get drugs (WHO, 2025c). Women's health needs may get lost in the priorities due to the sociocultural emphasis on family obligations.

Moreover, the widespread negative attitudes in the community regarding iron supplementation, like the worries about possible side effects and fertility problems, are responsible for the nonuse of this essential mineral. In collectivistic cultures, the older generation and peers have a major say in the health practices; thus, negative ideas can quickly spread via the social networks. However, involving community and religious leaders, husbands, and mothers-in-law in educational campaigns might change the social norms and support the adherence of women to the treatment (Conrad et al., 2024).

Poverty, food insecurity, and unemployment are key socioeconomic barriers to adherence. These factors are social, economic, and most importantly. The indirect costs, such as traveling, looking after the kids, and lost time from work, can still be a hindrance for people to attend the clinic regularly, even if the supplements are given for free (UNICEF, 2019; UNRWA, 2020). In regions affected by conflicts like Palestine, the already difficult situation is made worse by political turmoil, restrictions on movement, and interruptions in healthcare (Abuzerr et al., 2025).

Moreover, stock shortages, the unavailability of products in stores, the availability of distribution systems on a limited scale, and the disruption in supply chains can lead women to resort to private purchasing of supplements, an expense that is usually not affordable for them. Such economic pressure not only makes it difficult for women to access the supplements but also continues to create health disparities (Ghur et al., 2025; WHO-FAO, 2020). The resolution of these systemic problems needs the merging of supplementation programs with wider social protection and food security initiatives.

Non-adherence is additionally worsened by the absence of follow-up and ineffective monitoring systems. In several low- and middle-income countries, reminder-based systems, such as SMS alerts, telehealth counseling, or community health worker follow-up, have shown remarkable improvement in the adherence rate (Thorpe et al., 2023). Despite that, such systems are still not fully utilized in Palestine because of poor infrastructure and a lack of financial support.

At the policy level, fragmented implementation of national guidelines and the lack of coordination among the various government and non-governmental organizations are the main barriers to the longevity of the programs. Continuous assessment, decision-making based on data, and strict adherence to policies are required to maintain the delivery of the program uniformly and to lessen the inequalities among different areas in the availability of supplements.

Theoretical Underpinning

Collectively, the three models provide a profound understanding of adherence behavior. For instance, women's perceived susceptibility and severity (HBM) impact their attitudes (TPB), which are ultimately bolstered by self-efficacy and social learning (SCT). The blending of these theories yields a comprehensive strategy that considers the cognitive, emotional, and contextual factors that affect adherence.

Theoretical knowledge obtained from these theories thereby forms the basis of the conceptual framework of the present study, which later on investigates the relationships between perceived benefits, perceived barriers, and perceived behavioral control in predicting adherence to iron supplementation. The demographic and socioeconomic factors like age, education, occupation, income, and healthcare access are regarded as control or moderating factors, and their influence on perceptions and behavioral outcomes is recognized. This theoretical fusion ensures the incorporation of both personal and environmental factors, thus giving a comprehensive foundation for the interventions' design.

2.2 Hypotheses Development

2.2.1 Perceived Benefits and Adherence to Iron Supplementation

Iron supplementation is considered one of the most effective ways to prevent and treat IDA (WHO, 2016). Even though the medical effectiveness is well established, the actual adherence remains inconsistent in the targeted populations, especially among women of reproductive age and pregnant women (Moshi et al., 2021). Many researchers have come to the conclusion that the perceived benefits that individuals connect with supplementation are the most powerful adherence factor. These benefits can be, for instance, increased energy, better health, fetal growth, and prevention of anemia-related complications (Cappellini et al., 2020).

The perception of benefit acts as a psychological reinforcement mechanism. People, for example, develop a stronger belief in the effectiveness of the treatment when they see such tangible changes as less fatigue, better physical strength, and overall improved health. Thus, they are motivated to take the supplement for longer (Champion & Skinner, 2008). On the other hand, if health professionals do not make the benefits clear, or if they come late, or if they are poorly communicated, adherence will start to decrease. In the case of developing countries, where the population might not see the preventive aspect of micronutrient supplements very easily, it is very necessary to highlight the direct and visible benefits of supplementation (Haider et al., 2013).

Based on the data gathered from maternal health programs, the perceived benefits seem to be the main reasons for adherence. An Ethiopian study that had a cross-sectional design indicated that women with the view that iron supplementation would take away their fatigue and weakness and even prevent complications during childbirth were, indeed, more likely to follow the guidelines for supplementation (Taye et al., 2015). In the same manner, researchers in India found that mothers who believed strongly that iron tablets were vital for their and their babies' health showed higher rates of compliance (Neogi et al., 2019). In Palestine, a very interesting study conducted by Melhim et al. (2016) indicated that women's knowledge of ways to prevent anemia and their understanding of the importance of iron for the well-being of mothers were two significant factors predicting adherence to supplementation during antenatal care. These studies confirm that the behavior of adherence is very much affected by the supposed positive effects linked to the supplementation.

Perceived benefits play the role of a motivational factor that pushes the knowledge to be acted upon. In agreement with the HBM, people take part in activities that are good for their health if they think that the advantages are greater than the possible obstacles or costs (Champion & Skinner, 2008). This is the case of iron supplementation for women who consider better energy levels, better pregnancy results, or even being safe from anemia as their expectation; therefore, they are likely to follow the treatment regularly (Haider et al., 2013).

Moreover, the self-reinforcement of healthy habits has an important role in the motivation behind the conduct of women. The Women using the supplements, showing an increase in their energy or physical endurance over the period of time, would eventually strengthen their belief in the behavior's effectiveness, which would consequently lead to their continued use of the supplement. The continuous cycle not

only promotes the use of the supplement but also the exercise of the behaviors corresponding to the supplement. It is very much in line with Bandura (1986) Social Cognitive Theory, where the outcomes perceived and then experienced positively lead to a higher self-efficacy and ultimately the behavior gets its reinforcement.

Healthcare administration, counseling, and excellent communication are the two main factors that determine the extent to which people see benefits. If medical professionals gave a detailed explanation about iron supplements and their role in the prevention of anemia, the improvement of maternal health, and the assurance of the baby's healthy development, people would be more inclined to stick to the prescribed regimens (UNRWA, 2020). Research conducted in Southeast Asia and the Middle East has it that very good health education programs bring about a big increase in both perceived benefits and actual adherence (Almazrou et al., 2020). On the other hand, when there is a lack of counseling, the individuals might not perceive the preventive function of the supplementation and thus stop taking the tablets as soon as they feel better.

Perceived benefits rely on various aspects such as knowledge and counseling, cultural beliefs, and contextual factors. For instance, women in some parts of the Middle East and other areas still consider anemia a normal state of pregnancy, and this leads to the misconception that the need for taking supplements is not that high (Hwalla et al., 2017; WHO, 2023). Hence, the perceived advantage of iron supplementation fades away since people think it is not necessary for their well-being. Moreover, in situations where herbal or “natural” cures are the ones that people choose, pharmaceutical supplementation might be considered less effective or even harmful (Green et al., 2013).

Socioeconomic and educational levels are factors that influence the perceived benefits of a health intervention. Higher degrees and well-informed patients tend to appreciate the preventive aspect of iron supplementation (Haider et al., 2013). On the other hand, the people with low literacy or no access to health education, such as women's groups, may have a wrong idea about supplementation based on their own or their friends' stories. For example, some women think that iron tablets cause the fetus to be too big and lead to the delivery temperature problem, which in turn reduces their feeling of benefit (UNRWA, 2020).

Several studies have consistently shown that the perceived advantages of iron supplementation are a major factor promoting compliance with it. The meta-analysis done by Triharini et al. (2018) found that perceived benefits, perceived barriers, and

family support were noted to be correlated with adherence to iron supplementation amongst pregnant women in Surabaya, Indonesia. Similarly, research in Nigeria reported that women who admitted the importance of iron tablets in averting maternal anemia were 2.3 times more inclined to take their supplements regularly (Akomolafe et al., 2025).

The comprehension of perceived advantages is closely associated with the public health intervention design. The interventions that focus on the aforementioned benefits, like being less fatigued, feeling hungrier, and having better pregnancy results, generally get more acceptance. Integrating motivational counseling with prenatal and community health services can significantly raise people's awareness of these benefits (WHO, 2016). In addition to that, the use of positive endorsements and community education, where success stories are shared, can help to strengthen the perceived benefits even more and thus make the use of supplements more accepted by the community (UNRWA, 2020).

H1: *There is a positive relationship between participants' perceived benefits and adherence to iron supplementation.*

2.2.2 Perceived Barriers and Adherence to Iron Supplementation

Iron supplementation is considered one of the best and most cost-effective methods to prevent and treat IDA, but the efficacy of the treatment relies on the patients strictly following the recommended regimen. Despite the large availability through public health programs, the number of people who follow the treatments remains very low (WHO, 2016). Perceived barriers, among many factors contributing to non-adherence, are often cited as the most powerful negative predictors. These barriers consist of various factors, such as physiological side effects, forgetfulness, misunderstandings, cultural restrictions, and difficulties in the health system that hinder people from taking supplements regularly (Alarcon Basurto, 2020).

Gastrointestinal side effects are the most common physiological barriers to iron supplementation. The most frequently encountered side effects are nausea, constipation, abdominal pain, diarrhea, and a metallic taste that is not pleasant (Bloor et al., 2021). These kinds of reactions are due to the iron that is not absorbed, causing irritation to the intestinal lining and changing the movement of the stomach. For a good number of women, particularly those in the early stages of pregnancy who are already suffering

from nausea, the symptoms are so distressing that they have to stop taking the supplements (Benson et al., 2022).

Misunderstandings and inadequate comprehension of anemia have a very strong influence on the factors leading to non-compliance. In some cultures, anemia is seen as a usual and unpreventable condition associated with pregnancy rather than a treatable one (Garzon et al., 2020). Those women who consider themselves healthy or are not experiencing any direct symptoms might think that the supplementation is unnecessary for them.

False beliefs about supplements have negative discouragement effects on their use. Some pregnant women are worried that iron pills will lead to a very large fetus or complications during delivery, while others think that these pills would make them tired, cause weight gain, or be detrimental to the baby (UNRWA, 2020). This kind of false information, which often comes from relatives and acquaintances, overrides the medical recommendations.

Counseling and low health literacy are two factors that reinforce these psychological barriers. Patients who are unaware of the fact that iron supplementation is preventive and not symptom-oriented usually stop taking it after they feel better (Caporuscio, 2025). Informational programs that offer patients detailed information about iron, its side effects, and how to cope with them are said to increase compliance (Elsharkawy et al., 2022; Taye et al., 2015).

Forgetting meds and not being able to follow a daily routine are some of the most often seen behavioral barriers (Osterberg & Blaschke, 2005; Unni et al., 2019). The process of adherence requires a proper intake for a long period of time, which can be a challenge for women who need to juggle housework, jobs, and children. Without the built-up routine, a lot of people just cease to remember the doses.

The behavior to follow the prescribed treatment is to a great extent influenced by cultural norms, gender relations, and social expectations. In several conservative societies, the healthcare choices of women are affected or dominated by the family, especially by their husbands or mothers-in-law (White et al., 2013). Low personal power leads to limited visits to clinics and irregular use of tablets.

Religious or cultural practices might additionally affect adherence negatively. Women commonly stop taking the supplements during fasting months like Ramadan, since they consider the consumption of drugs through swallowing as a fast breaker (Chouraqui et al., 2021). In the areas where herbal or “natural” cures are preferred,

synthetic supplements are regarded with doubt or even considered as being superfluous (Hassen et al., 2022).

Social attitudes can either make these barriers worse or lessen them. The supportive family settings in which partners or elders prompt the use of supplements generally increase adherence, while the settings of uncertainty or stigma decrease it. Inviting men and community leaders to participate in educational campaigns has been proven to change social norms and boost women's adherence (Sedlander, 2020).

Adherence to treatment regimens is greatly impacted by the weaknesses within the health system. The lack of availability of necessary supplements, low counseling quality, and insufficient monitoring diminish the credibility of public health initiatives (Omotayo et al., 2018). A lot of clinics in poorer nations are very understaffed, which reduces the amount of time health professionals can dedicate to educating patients. As a result, women frequently get pills without any explanation or guidance (UNRWA, 2020).

If counseling only involves short distribution interactions, there is a risk that women will not understand the prescribed dosage correctly or not predict even the smallest of side effects. On the other hand, the empathetic, two-way communication that highlights benefits, acknowledges fears, and permits questions has proved to be a great factor in leading to compliance (WHO, 2016).

Geographical and logistical limitations are other barriers that make access even more difficult. In areas with limited political access, for instance, Palestine, residing far from the clinics and transportation costs or security checkpoints makes it hard for patients to attend clinics regularly (Marie & Battat, 2021). Redistribution of supplements through community health workers or distribution at local health centers can be one of the ways to eliminate these structural barriers.

The economic hardships that people go through are closely linked to the fact that they take less varied diets, thus making people consume iron supplements more (Hunt, 2002). It is necessary to have a joint effort of several different sectors and to include supplementation along with programs for poverty eradication and food security to overcome these economic barriers.

In effective programs, educational, behavioral, and policy components are well-integrated. For example, a counselor may provide guidance specific to a person's situation, together with a reminder system, a continual supply of supplements might be provided, and parents may take an active role in ensuring adherence (Martin et al.,

2017). Countries that have implemented these integrated strategies, i.e., blending community outreach with improved health service delivery, reported remarkable increases in adherence rates and declines in the prevalence of anemia (WHO, 2016).

H2: *There is a negative relationship between participants' perceived barriers and their adherence to iron supplementation.*

2.2.3 Perceived Behavioral Control and Adherence to Iron Supplementation

Adherence to iron supplementation is contingent not only on awareness or perceived advantages but also on faith in the ability to continue the behavior. The dimension, termed perceived behavioral control (PBC), is derived from Ajzen's Theory of Planned Behavior (TPB) (Ajzen, 1991), which argues that the intention and behavior of a person are shaped by three core constructs: attitude, subjective norms, and perceived behavioral control. According to this model, PBC represents a person's estimation of their capability to perform a behavior effectively, taking into account their internal resources and external limitations.

In the context of iron supplementation, perceived behavioral control refers to a person's belief in his or her ability to take iron tablets regularly, regardless of the challenges that might bother him or her, like side effects, intermittent forgetfulness, busy schedules, and lack of support (Fiani et al., 2025). If someone can manage quite a few problems, the person will have a high perception of control, and thus, he or she is more likely to be compliant with the supplementation than the one who perceives low control and gets more easily discouraged. By looking at perceived behavioral control, one can profile the role of self-efficacy, motivation, and structural conditions in the case of women, especially during their pregnancy, that is, the adherence behavior.

According to Ajzen (1991), the term "perceived behavioral control" refers to how easy or difficult a specific behavior is perceived to be by an individual. It includes not only the mental control factors (like skills, self-confidence, knowledge, and self-control) but also the physical control factors, such as time, availability of resources, and support from society or the environment. In health behavior research, PBC closely aligns with self-efficacy but also encompasses external constraints (e.g., time, access) (Bandura, 1986).

People with a high sense of control over their behavior are more likely to have strong intentions to act in a certain way, and, therefore, the behavior will be more likely

to happen. On the other hand, low PBC, marked by feelings of powerlessness, lack of confidence, or unavailability of resources, will cause a reduction in the fight and motivation (Ajzen, 2002). Women from the lower-income and middle-income countries may face external obstacles like heavy workloads, time limitations, inadequate healthcare facilities, and sociocultural expectations that affect their perceptions of control over the situation, and as a result, they may not take iron supplements as prescribed (Mantadakis et al., 2020; Thorpe et al., 2023; WHO, 2023).

In the sphere of maternal health, the extent of perceived behavioral control acts as a strong indicator of adherence to the medications and supplements that are prescribed. Women who believe that they would be able to incorporate taking the supplements into their daily schedule, handle the mild side effects, and even deal with the logistical barriers would exhibit, by far, greater adherence (Marie & Battat, 2021). To illustrate, it has been found in research that employing simple approaches like coupling the taking of supplements with daily activities (e.g., meals or going to bed) improves control and consistency positively (WHO, 2016).

On the other hand, those individuals who consider taking supplements as a burden or an unsustainable lifestyle are the ones who almost always report their intake to be erratic. A study conducted in Vietnam showed that women who saw multiple limitations, such as being forgetful, having household responsibilities, and low knowledge and awareness around deficiencies, had very low adherence rates compared to those who were confident and had a routine (Nechitilo et al., 2016). A similar study in Palestine showed that women who considered themselves able to cope with their daily supplement intake, even with busy schedules and fasting times, had much better adherence outcomes (Daghlas, 2021; Dahmouni, 2024). All these studies point towards one thing, which is that the main determinant of adherence behavior is the increase of perceived control achieved through health education, counseling, and supportive interventions.

Perceived behavioral control comes from both personal and environmental factors that help to judge the perceived simplicity or complications of adhering to supplementation schedules:

- Individual characteristics like self-control, recollection, and drive have a major impact on perceived control. Memory lapses and poor self-organization often lead to a perception of less behavioral control (Bandhu et al., 2024).

- Self-efficacy is one of the main elements of internal control. A woman who is used to maintaining healthy habits, such as taking prenatal vitamins or following medical advice, will have more self-efficacy to continue taking iron tablets (Bandura, 1986).
- External control has to do with resource availability, supplement access, and environmental or social support. Time limitations, travel problems, unreplenished stocks, or a lack of support from family can lead one to think that iron supplementation is very hard or even impossible to continue (Novia Atmadani et al., 2024; UNRWA, 2020).

Health education and customized counseling are the main factors that are needed for the improvement of perceived behavioral control. One of the key aspects of effective counseling is that it not only informs the person about the advantages of supplementation but also gives them concrete methods to facilitate their coping with the issues that might arise, such as experiencing side effects and forgetting to take the iron supplement. Health education that takes into account behavioral reinforcement, like the setting of goals, self-monitoring, and giving positive feedback, makes the feeling of control even stronger (Allen, 2002; Sanghvi et al., 2023; Souza et al., 2009).

Cultural and social factors significantly contribute to the perceived control process by defining the degree of autonomy that every individual has over medical decisions. In male-dominated cultures, on the other hand, it may be the case that women need to first get consent from their male family members to be able to go to clinics or to get supplements, making them feel more dependent and having their adherence control reduced at the same time (Haider et al., 2013). Moreover, some cultural practices, such as Ramadan fasting or traditional postpartum confinement, may be observed, and women's intake of supplements may be affected (Chouraqui et al., 2021).

The programs that involve men, mothers-in-law, and community leaders in health education have been successful in creating a supportive environment, which enables women to make health-related decisions consistently (WHO-FAO, 2020). These interventions indirectly enhance the perception of behavioral control by lowering social limitations and elevating the sense of autonomy.

Increasingly, different studies provide evidence for the connection between perceived behavioral control and iron supplementation adherence. A study applied in Shiraz, Iran, by Rakhshani et al. (2025), includes 160 girls between the ages of 14 and 19; education based on the TPB could successfully affect the nutritional behaviors for

preventing IDA in the participating girls. The Ethiopian study conducted by Taye et al. (2015) showed that women during pregnancy who thought that they had fewer external challenges, like a lack of time or difficulties in going to the health center, were more compliant with the iron supplementation prescribed by the doctors.

H3: *There is a positive relationship between participants' perceived behavioral control and their adherence to iron supplementation.*

2.2.4 Moderating Role of Demographic Variables in Adherence to Iron Supplementation

The use of iron supplements depends not only on psychological and behavioral factors like perception of benefits, barriers, and control over the behavior but also on a medley of sociodemographic factors that delineate people's opportunities, access to care, and health behaviors. Such factors are usually called control variables and are vital for understanding the context of adherence. The primary control variables of the study are age, gender, education, profession, monthly household income, health insurance, living conditions, and availability of medical facilities.

Despite the fact that these variables could be considered secondary in behavioral models such as the HBM or TP, their impact on the interaction between psychological factors and adherence is of a great magnitude, as they can be moderated or mediated. When these aspects are managed, it is assured that the relations made between the theoretical constructs and adherence are really due to the impact of behavior and not the demographic differences that are hidden (Ajzen, 1991).

The age factor significantly influences the health behavior and, in this case, adherence to supplementation. Young women, specifically adolescents, usually exhibit lesser compliance to iron supplementation due to factors like lack of awareness, priority in life, and perception of being less susceptible to anemia (Haider et al., 2013). On the other hand, older women, particularly those who have suffered from anemia or who have gone through childbirth complications, are more likely to appreciate the value of supplementation and therefore to adhere more (WHO-FAO, 2020).

The gender of a person has an impact on their health-related behavior and the availability of healthcare services for them (Deeks et al., 2009). While iron deficiency is a condition that affects both sexes, compliance with supplementation is notably important for females, as they have greater biological needs and also have different

roles in society. Inequalities based on gender in decision-making and access to healthcare can restrict women's power over their health behaviors (Beaujoin et al., 2021).

In several patriarchal cultures, the female population needs the consent of the male members of the household to go to the doctor or take supplements, which limits their freedom and lowers the intake of iron supplements (Tang & Sholzberg, 2024). Research in Asia and the Middle East pointed out that having a supportive spouse and getting family approval are among the most important factors influencing the intake of women taking iron–folic acid supplements (Almazrou et al., 2020). Therefore, the use of gender-sensitive methods that include men as helping partners in maternal nutrition programs will enable women to be more consistent in their adherence.

There is a strong connection between education and compliance with health interventions. Basically, the higher the education, the greater the health literacy, so the more people can comprehend the medical recommendations, distinguish the supplement's advantages, and perform the prescribed treatment accurately (Osterberg & Blaschke, 2005; Unni et al., 2019). Women with a good education are more likely to value the preventive effect of vitamins and to deal with slight adverse reactions in a capable manner (Conrad et al., 2024).

In contrast, poor literacy skills are connected to wrong ideas, confusion over dosage instructions, and dependence on non-scientific beliefs (Caporuscio, 2025). In India, a study showed that educated mothers were not just more, but twice as likely to adhere to supplementation when compared to their uneducated counterparts (Neogi et al., 2019). Moreover, a study conducted in southeastern Africa in Malawi by Titilayo et al. (2016) included 10,750 women who noticed that low adherence to the WHO iron supplementation recommendations among pregnant women in Malawi, and this contributes to negative health outcomes for both mothers and children.

Employment situation and work burden are key factors that determine whether people stick to their prescribed treatments or not. On the one hand, women who work full-time or participate in informal activities usually have less time, non-regular schedules, and tiredness as their daily companions, which in turn makes it harder for them to observe a daily supplementation routine (UNICEF, 2019; UNRWA, 2020). On the other hand, women who are out of work or whose only job is taking care of the home might not have the constraints and can be more prompt in taking their

supplements, but at the same time, they might be less informed about matters of health and less counseled.

According to the study conducted by Szczygiel et al. (2024), taking supplements was often neglected by women with high-pressure jobs or multiple domestic duties, as they typically put work before self-care. In the same manner, research done in Ethiopia, Pakistan, and Bangladesh backed the same idea by indicating that work commitments negatively impacted supplement use (Kessani et al., 2018; Sanghvi et al., 2023; Taye et al., 2015). Consequently, it can be inferred that offering support through education and providing flexible supplement delivery to the workplace are very important, as they help to overcome the barrier of professional workload, which usually cuts down on perceived control.

Socioeconomic status is the most important factor affecting health behaviors, determining both access to resources and the necessity views. Women in affluent families usually enjoy the benefits of having health-related information, transport, and private healthcare facilities at their disposal, which in turn makes it easier for them to adhere to the prescribed treatments (Horton & Ross, 2003). Also, they can more easily buy supplements if there is a shortage in public clinics.

WHO (2025c) provided examples from middle-income nations that health insurance not only enhances treatment but also makes patients stick to medications. In certain areas, insurance is still not widely available; however, one of the indirect ways of strengthening adherence could be through the expansion of maternal health insurance, which would be achieved by increasing the use of services and lowering the out-of-pocket expenses.

The quality of housing and living environments can be regarded as indirect signs of socioeconomic and environmental stability. Unfavorable living conditions, like overcrowding or homes that lack sanitation, are frequently related to insecure access to food, less privacy, and limited personal freedom, which together lead to a decline in iron supplementation compliance (Webb & Thorne-Lyman, 2007). On the other hand, women residing in strong and nurturing family units are more inclined to develop a pattern of regular supplement taking.

In the Palestinian situation, dislocation and residing in refugee camps present extra problems, such as limited movement and sporadic access to medical facilities (UNRWA, 2020). These challenges inherent to the structure emphasize the urgency of implementing outreach programs that are tailored to the local context and that deploy

health supplements and counseling directly to the communities instead of depending only on clinic attendance.

Healthcare accessibility is one of the major factors that impact adherence. Women in the vicinity of medical facilities, visiting regularly for prenatal care and having good relations with the doctors, show more adherence to iron supplementation (Taye et al., 2015). In contrast, women living in remote or war-torn areas with poor transport links and limited access to clinics encounter numerous barriers to adherence.

The interaction quality with healthcare providers is also very important. When health professionals offer sympathetic counseling, explain the dosage and side effects, and stimulate questioning, adherence goes up remarkably (WHO, 2016). Conversely, fast consultations or insufficient follow-ups result in miscommunication and dropout (Nwaru et al., 2015). Therefore, improving accessibility to healthcare, both in terms of location and society, continues to be vital for the attainment of high adherence rates.

H4: *Demographic and socioeconomic variables (e.g., age, education, occupation, income, and healthcare access) moderate the relationship between perceived benefits and adherence to iron supplementation.*

H5: *Demographic and socioeconomic variables moderate the relationship between perceived barriers and adherence to iron supplementation.*

H6: *Demographic and socioeconomic variables moderate the relationship between perceived behavioral control and adherence to iron supplementation.*

2.2.5 Conceptual Model

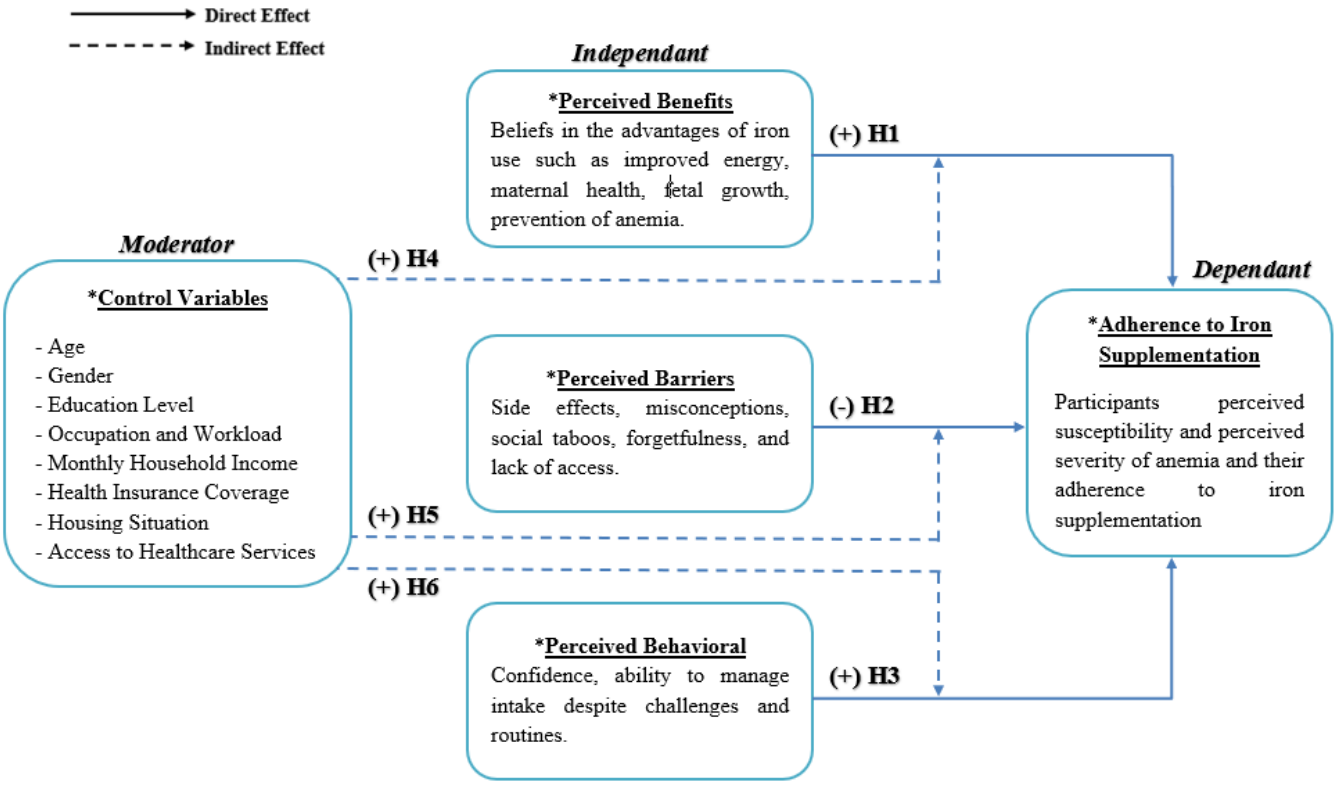

Figure 2.1: Study model framework and hypothesis

Chapter Three: Methodology

3.0 Introduction

The chapter outlines a quantitative, multi-centre, cross-sectional survey carried out to determine determinants of adherence to oral iron supplementation in adults with iron-deficiency anemia (IDA) in Jenin, Palestine. The integrated behavioural model that is employed is based on the Health Belief Model (HBM) and Social Cognitive Theory (SCT), and the Theory of Planned Behaviour (TPB) as predictors of adherence with the sociodemographic and clinical factors considered as possible moderators. The methodology section is organized in a way to scrutinize the relationships between the various independent variables (perceived benefits, barriers, and behavioral control) and the dependent variable of adherence, at the same time taking into account demographic and socioeconomic factors as moderators. The methodology part of the study gives details on the research design, target population, sampling, instruments, reliability and validity, data collection methods, data analysis, and ethical issues.

3.1 Study Design

The research involved a quantitative, multi-center, outpatient-based, cross-sectional design in two Jenin hospitals, namely, Ibn Sina Specialized Hospital (private) and Jenin Governmental Hospital (public). The targeted study population was outpatients since they self-administered oral iron at home, which is the context of the research in terms of measuring adherence. The study-work was done on Palestinians suffering from Iron Deficiency Anemia (IDA), who were already accurately diagnosed and were on treatment. The application of the multi-center strategy examines adherence behaviors in different socioeconomic groups more easily and also reveals the distinctions in patient demographics and resources between private and public institutions.

3.2 Study Population

Adults (≥18 years) with a clinical diagnosis of IDA and on oral iron therapy for ≥1 month were eligible. Recruitment occurred in the outpatient clinics of the two hospitals. These patients are to be recruited from the outpatient departments of the two selected hospitals in the northern districts of the West Bank: Ibn Sina Specialized Hospital (private sector) and Jenin Governmental Hospital (public sector).

The estimation of the population size was accomplished through the average count of monthly IDA patients who visited the chosen clinics, which in turn laid the groundwork for the later decision of the sample size.

3.2.1 Inclusion Criteria

These study participants fulfilled the following inclusion criteria: (1) clinically verified as an IDA case in the medical record; (2) taking oral iron during the last month; (3) a minimum of 18 years of age; (4) cognitive ability to complete questionnaires; (5) outpatient at either of the two locations.

3.2.2 Exclusion Criteria

Non-IDA anemias (e.g., thalassemia, B12 deficiency, anemia of chronic disease), Patients who are not on oral iron supplementation (e.g., those receiving intravenous iron or blood transfusions), inpatients or patients unable to communicate; -healthcare workers (to minimize professional knowledge bias)

3.3 Sample Size and Sampling Technique

3.3.1 Sample Size

For estimating adherence prevalence, we used the single proportion formula with Z = 1.96, P = 0.50, e = 0.05, yielding $n = (1.96^2 \times 0.5 \times 0.5) / 0.05^2 = 384.16 \rightarrow$ 385 after rounding. To ensure adequate power for the planned multiple linear regression with k predictors, our target n = 400 also satisfies common heuristics (e.g., $N \geq 50 + 8k$) for testing overall model fit. The target of 400 incorporates a modest allowance for non-response and data cleaning while exceeding both criteria. The sample size (*n*) was calculated using the standard statistical formula for estimating a single population proportion. This formula is appropriate when the goal is to determine the size required for a descriptive study aiming to estimate the prevalence or proportion of a characteristic (adherence) within a population at a specified precision (Creswell & Creswell, 2017).

Given the absence of a reliable, recent adherence rate for anemic outpatients in the Northern West Bank, a conservative population proportion (*P*) of 50% (0.5) was assumed. In situations where the actual proportion is not known, this assumption is

considered a typical practice in methodology since it allows for getting the maximum sample size that is necessary to power the study sufficiently (Flanagan & Beck, 2024).

The following parameters were used:

- Confidence Level: 95% (corresponding Z-score (Z) = 1.96),
- Margin of Error: 5% (e = 0.05),
- Estimated Population Proportion: 50% (P = 0.5).

The formula used to calculate the required sample size:

$$n = \frac{Z^2 \times P \times (1 - P)}{e^2}$$

$n = (1.96)^2 \times 0.5 \times (1 – 0.5) / (0.05)^2$

$= (3.8416 \times 0.25) / 0.0025$

$= 0.9604 / 0.0025$

$=$ **384.16** → 385 after rounding

As a result, the study needed at least 385 people as the sample size. However, non-response, incomplete questionnaires, or data cleaning issues might occur, and hence a buffer was added, which increased the target sample of anemic outpatients to **400** to be recruited from two selected hospitals.

3.3.2 Sampling Technique

The consecutive convenience sample of eligible outpatients was recruited during regular visits until site quotas were achieved, with participants distributed proportionally according to the anticipated clinic volumes at each hospital. We recognize the risk of selection bias and poor representativeness of the convenience sampling; this is discussed in Chapter Five. The study utilized a non-probability, convenience sampling technique to select participants from the two selected hospitals, and therefore, the study findings are not intended to be generalized to the wider population.

Multi-Center Strategy: The allocation of the target sample of 400 patients was done between the two centers of Jenin Governmental Hospital and Ibn Sina Specialized Hospital, and the distribution was in accordance with the projected patient volume of anemic outpatients visiting each hospital. This distribution intends to constitute a mixture of patients from the public and private healthcare sectors.

Recruitment Procedure: The outpatient clinics at the two hospitals were the first pick-up spots for eligible patients, who were consecutively referred to the study as they came for their routine follow-up appointments. The sample selected approached the first available patients who satisfied all the inclusion criteria until the predetermined quota for each center was reached (Creswell & Creswell, 2017).

- Convenience Sampling Rationale: The basis for the use of this method was mainly the restrictions with regard to time, medical records access (which could be very delicate or lacking), and the fact that the questionnaire had to be administered to the respondents during the clinic's hours. The research group approached the first patients who were both available and met the criteria until they achieved the intended number at each hospital.
- Limitation: This technique is easy to use, but at the same time, it exposes the researcher to the possibility of selection bias; the sample might not be a perfect representation of all anemic outpatients living in the area. This drawback is explored in detail in Chapter Five.

3.4 Research Instruments

A structured interviewer-administered questionnaire (Arabic) captured: (1) sociodemographic and clinical variables; and (2) behavioral constructs from HBM, SCT, and TPB. The instrument comprised 31 items across four scales: Adherence (4), Perceived Behavioral Control (4), Perceived Benefits (4), Perceived Barriers (19), plus background items. The current section of the research elaborates on the data collection method employed, which is a self-administered questionnaire, a structured tool specifically designed to gather sociodemographic and clinical data and to reveal the behavioral factors that affect iron supplement compliance in terms of the integrated theoretical framework (HBM, SCT, and TPB). The questionnaire is laid out in accordance with the information form provided (Alagili & Bamashmous, 2021; Leung et al., 2024; Okam et al., 2017; WHO, 2025b; Youssef et al., 2020).

The researcher created a tool for inquiry which was implemented through a questionnaire that addressed four primary areas and comprised a total of 31 key items as the number of items. The research provided a thorough description of the tool by explaining the data gathering and processing methods step-by-step, as well as the

distribution of the tools. The questionnaire is located in Appendices 4-5. The ultimate research tool was created in Arabic and included four primary sections:

1. Demographic and Clinical Data

Age, sex, education, work, income; length of IDA, iron preparation, care industry (public/private). The background information, which is needed for descriptive analysis and testing the study's moderating variables (H6), was gathered in this section.

2. Adherence Measurement

Compliance assessed using four items on a behavioral frequency scale of a 5-point Likert frequency scale (Never-Always). These included the taking of iron as prescribed, skipping of iron doses (reverse-coded), taking iron during the right time, and on schedule in the previous month. Items were recoded to a composite adherence score; the higher the score, the better the adherence. Iron supplementation (the dependent variable) adherence was determined through a modified four-item Self-Reported Adherence Scale. The items evaluated the participant's number of iron supplement intakes, the chance of missing doses (reverse-coded), following the right timing, and the total consistency. Each was rated on a five-point Likert scale, and a composite adherence score was created by averaging the item responses, with higher scores showing better adherence.

3. Theoretical Constructs Measurement

This section includes the core scales used to measure the independent and predictor variables based on the integrated behavioral model:

- **Perceived Benefits (4 items).** Expectations that iron improves energy, prevents health problems, improves concentration/function, and increases iron indices (5-point agreement scale).
- **Perceived Barriers (19 items).** There are five sub-domains: sociocultural, informational, personal, side-effect, and misconceptions (5-point agreement). The higher the score, the more barriers are scored, so the higher the number of barriers.

- **Perceived Behavioral Control (4 items).** Confidence, control, ease of remembering/scheduling, and overcoming obstacles (5-point agreement).

4. Translating and Cultural Adapting.

The questionnaire was subjected to forward translation - reconciliation - back-translation, expert review, and cognitive pretest with target respondents to facilitate clarity and appropriateness to the culture, with small wording corrections being made before the pilot.

3.5 Pilot Study

The pilot involved 30 qualified participants (who were not included in the main sample) who evaluated clarity, flow, timing, and preliminary psychometrics. Small changes in wording enhanced readability and cultural adaptation. Pilot testing is a necessary procedure during the development and refinement of the instrument, as it points out the problems that might arise in the wording, structure, clarity, and response interpretation, and helps prevent them from occurring during the full data collection (Brooks et al., 2016).

The pilot study was conducted to evaluate the clarity of the items, to point out any ambiguous or confusing statements, to check the logical sequence of the questionnaire, and to find any structural or administrative problems that could occur during the implementation. The pilot participants' feedback showed that every item was clear and well-presented. Some changes were made to readability and cultural and linguistic suitability for the Palestinian outpatient context, in line with the best practices for questionnaire adaptation (DeVellis & Thorpe, 2021), to enhance cultural and linguistic appropriateness for the Palestinian outpatient context.

Preliminary psychometric testing was then carried out on the pilot data. Mainly, the answers were critically examined to disclose item-total correlations and internal consistency reliability, therefore providing early information about the effectiveness of each multi-item scale. The preliminary analyses supported the instrument’s suitability for further testing and guided its final refinement.

3.6 Validity

Validity, as defined by Gillespie and Chaboyer (2013), is the measure of how accurately an instrument reflects the concept it is designed to measure. Validity is a

process of accumulation that relies on both qualitative and quantitative methods for its establishment.

- **Content Validity**

The content validity of the questionnaire was established at the beginning by means of the expert review. The panel of specialists consisted of skilled persons from various sectors, such as public health (Dr. Mohammad Mhameed), clinical trials (Dr. Fekri Samarah), nursing practice (Dr. Nawras Sawalha), and blood diseases (Dr. Mohammad Abduallah), thus assuring adequate multidisciplinary representation for the study situation. The mastery team classified the features according to their relevance to the theories of Health Belief Model (HBM), Social Cognitive Theory (SCT), and Theory of Planned Behavior (TPB); furthermore, taking into account their understandability, language accuracy, and coherence.

Expert feedback led to multiple changes, among them rephrasing of vague items, lessening of repetition, and making sure all theoretical domains (adherence, perceived benefits, perceived barriers, and perceived behavioral control) are thoroughly covered. The expert evaluation was qualitative at this point, but the researcher aims to calculate quantitative content validity indices, namely, the Item Content Validity Index (I-CVI) and the Scale Content Validity Index (S-CVI/Ave), in the main study to reinforce content validity evidence further.

- **Construct Validity (Pilot Evidence)**

Initially, evidence linked to the construct was analyzed using the pilot data (n = 30) as an exploratory measure. To evaluate the level of alignment of each item with its corresponding construct, Pearson item-total correlations were calculated. A frequently mentioned heuristic threshold of $r \geq 0.30$ was taken as a sign of a good association, but it is recognized that in the case of a small sample size (df = 28), such correlations may not always achieve the usual statistical significance ($p < .05$) very often. Thus, these correlations are described rather than assumed and are only applied to identify items that are clearly not performing well.

Every single item demonstrated item–total correlations exceeding the heuristic threshold, indicating meaningful alignment with its respective construct at an exploratory level. None of the items were discarded at this point, and the decisions

concerning the keeping of the items were postponed until the main study, where factor analysis was performed.

To delve into the theoretical relationships among the study variables, inter-construct correlations were also computed and presented in Table 3.1. The correlations were consistently strong (r = 0.862–0.930). Although the behavioral theory may underlie the strong conceptual interrelatedness among constructs indicated by the correlations, the level of the correlations, especially the positive interaction between perceived obstacles and compliance, calls for the consideration of shared method variance, multicollinearity, or reverse-coding problems. Hence, the study conducts a proper analysis of these findings and will interpret them very carefully, employing confirmatory factor analysis (CFA), variance inflation factor (VIF) diagnostics, as well as meticulous verification of item coding directions.

Table 3.1: Inter-Construct Pearson Correlations (Pilot Study, n = 30)

Construct	**Adherence**	**Behavioral Control**	**Benefits**	**Barriers**
Adherence	1	0.930**	0.881**	0.930**
Behavioral Control	0.930**	1	0.862**	0.928**
Benefits	0.881**	0.862**	1	0.898**
Barriers	0.930**	0.928**	0.898**	1

** Correlation is significant at the 0.01 level (2-tailed).

3.7 Reliability

Reliability is a consistent measurement over time and in different conditions (Golafshani, 2003). Internal consistency reliability of the study constructs was assessed using Cronbach's alpha (α), with $\alpha \geq 0.70$ considered acceptable (Tavakol & Dennick, 2011).

In the same manner, the Adherence, Perceived Behavioral Control, and Perceived Benefits scales produced alpha values of 0.967, 0.963, and 0.955, respectively. Similarly, the perceived barriers subdimensions demonstrated very high internal consistency, with alpha coefficients ranging from 0.971 to 0.981 (Table 3.2). Though these coefficients signal very good internal consistency, values nearing or reaching 0.95 might also indicate that some items are repetitive. Hence, the results are viewed as a first step towards reliability rather than an absolute proof.

To tackle this problem, methods for item reduction, confirmatory factor analysis, and multicollinearity diagnostics (VIF included) were applied in a bigger sample in the

main study. These procedures will support the attainment of the final tool that is reliable, parsimonious, and has distinct constructs, among other things, at an optimal point.

Table 3.2: Cronbach's Alpha for Study Constructs (Pilot Study, n = 30)

Construct	Cronbach's Alpha
Adherence	0.967
Behavioral Control	0.963
Benefits	0.955
Barriers	
• Sociocultural	0.979
• Knowledge	0.977
• Personal	0.973
• Side-Effect	0.971
• Misconceptions	0.981

3.8 Data Collection Procedures

The data collection process was carried out step by step and in accordance with the study design and ethical approvals. Standardized procedures were followed to ensure consistency, reliability, and data quality. The following steps outline the data collection process among anemic outpatients:

1. Preparation and Training: Before the data collection, the research assistants underwent uniform training on the study protocol, research ethics, unbiased probing methods, standardized administration, and coding procedures.
2. Instrument Distribution: The eligible participants receive the digital questionnaire personally via QR code at the outpatient clinics of Ibn Sina Specialized Hospital and Jenin Governmental Hospital.
3. Administration: The research data were collected through personal interviews; a pre-prepared questionnaire was used to facilitate this process, considering the nature and sensitivity of the issues. Participants with limited literacy skills were assisted; however, no clarification, suggestion, or guidance was given in order to keep the answers pure.
4. The collection and verification of the data occurred immediately after the researcher collected the questionnaires, checked them for completeness, and assigned codes to them.

5. Quality Control: The questionnaires that had been thoroughly filled out were immediately examined, and a second verification was conducted by the supervisor of the research. All the forms that were filled out were stored in a secure and controlled environment to ensure both confidentiality and data integrity.
6. Data Entry and Analysis: The Statistical Package for the Social Sciences (SPSS) was utilized for coding, data entry, and analysis of the verified questionnaires, as mentioned in the Data Processing and Analysis section.

3.9 Data Analysis Techniques

In this part, the statistical methods were discussed that were used for analyzing data and for hypothesis testing of the study. The statistical software, Version 27 of the Statistical Package for the Social Sciences (SPSS), was utilized in the entire process of data processing and analysis. A $P < 0.05$ level of statistical significance (α) was used as the criterion for hypothesis testing throughout the entire analysis.

3.9.1 Data Processing and Preparation

To keep up the standard of quality and Data integrity before any inferential analysis, a very thorough preparation process is carried out. The first step involves meticulous coding, data entry, and double-entry checking of the data gotten from the completed questionnaires, which aims at minimizing the total errors made during the transcription process to a very low level. The dataset underwent a meticulous process to check for any missing values, and at the same time. In the scales where the percentage of missing data is less than 5%, person-mean imputation, which uses the respective scale, was deployed to address the missing values, and consequently, the scale variance and internal consistency were maintained. Next, we do a comprehensive review that includes the identification of univariate and multivariate outliers. Outliers that were confirmed as authentic patient reactions were retained in the dataset, whereas outliers arising from data entry mistakes were rectified. Finally, the scores of each item that belonged to the multi-item scales, like 'Perceived barriers', were combined and averaged. This process resulted in each of the constructs being measured receiving continuous composite scores and, therefore, being appropriate for the subsequent analysis.

The statistical analysis was conducted in a multi-step, stringent procedure, which started with the descriptive statistics in order to describe the study sample in a comprehensive manner. The essential characteristics of the cohort were summarized based on the calculations of frequencies and percentages of all categorical variables (gender, institutional setting (public/private hospital), education level, and the type of iron supplementation taken). Simultaneously, the central tendency and dispersion of continuous variables, which include adherence scores and the quantified measure of the psychological constructs, are strictly measured by means and standard deviations.

The second phase is inferential statistics, which aims at testing the hypotheses of the study empirically and explaining the predictive structure of the integrated behavioral model. Systematic use of bivariate and multivariate analyses is used. In particular, Independent Samples t-tests were applied to measure the means of the dependent variable of dichotomous categorical variables (e.g., hospital type). In the case of factors that contain three or more levels (e.g., specific education or income level), one-way Analysis of variance (ANOVA) is the best technique to utilize. In addition, the Pearson Product-Moment Correlation Coefficient (r) is computed to establish the direction and strength of linear relationships that exist between the two main continuous variables accurately.

Since a non-probability, convenience sample was used, these inferential procedures were applied to internal model testing only, and not to making claims about the outpatient population, which are statistically generalizable, as further discussed in Chapter Five.

The main part of the testing of the hypothesis, which discusses the propensity of the behavioral constructs (H1 -H5) on adherence, was carried out through Multiple Linear Regression (MLR). Before the MLR model is implemented, there is an extensive set of assumption checks performed to verify model fidelity. The assumptions of the normality of the residuals, the relationship being linear, and no problematic multicollinearity are checked by these checks, and the presence of the latter is estimated by the calculation of the Variance Inflation Factor (VIF) and Tolerance values. The assessment of the final model in the form of the coefficient of determination (R^2), which will quantify the overall percentage of variance explained by the overall set of predictors of the adherence outcome. The standardized beta coefficient value of each particular predictor is analyzed and used to determine its unique contribution and effect

size, as well as the strength and direction of the relationship without any other variables in the model.

1. Descriptive Statistics: The use of these statistics to present the main features of the sample of the study:

- Frequencies and Percentages: the summarization of categorical variables such as gender, hospital type (public/private), education level, and type of iron supplement is done by using these methods.
- Means and Standard Deviations: scores of adherence and the psychological constructs measured by the study instrument among the continuous variables for which these calculations were performed.

2. Inferential Statistics: A combination of bivariate and multivariate analyses performed to examine the study hypotheses and assess the predictive relationships within the integrated behavioral model:

- For variables with two categories (e.g., public versus private hospital), Independent Samples t-tests are run.
- One-way ANOVA applied to variables having more than two categories (e.g., education levels, income groups).
- Pearson's Correlation Coefficient (r) is utilized to measure how linear the associations between main continuous variables are in terms of direction and strength.

3. Hypothesis Testing: The main analytical technique for the testing of hypotheses H1–H5, which investigate the behavioral constructs' predictive power on adherence, is Multiple Linear Regression (MLR).

- Assumption Checks: The assumptions of normality, linearity, and multicollinearity (using VIF and Tolerance values) were checked to confirm the model's fitness before performing the MLR.
- Interpretation and Reporting: The model as a whole was evaluated using the R^2 value, which indicates the total variance in Adherence accounted for by the model, whereas the standardized beta coefficients (β) reveal the unique strength and direction of the association between each predictor and adherence.

3.10 Ethical Considerations

The study was carried out in compliance with the Helsinki Declaration principles. The permission granted by the Institutional Review Board (IRB) of Arab American University (AAUP), given on 29 October 2023, to conduct the current study can be found in archive number 2023/B/157/N (Appendix A). One more, the legal authorization was obtained through the letter of facilitation issued by the Palestinian Ministry of Health on 17 December 2023, with the purpose to conduct laboratory work based on providing blood samples and patient laboratory data access in its registration (Approval Number: 2023/2725/162; Appendix B), and Ibn Sina Specialized Hospital Ethics Committee approval on 11 January 2025 (Appendix C).

The research tool also used a structured questionnaire, English and Arabic, to obtain documentation in relation to specific data in medical history and demographic information (Appendices D-E). The patient samples were analyzed at the research laboratory of the Arab American University in Palestine, Allied Medical Sciences Faculty, 2nd floor, room AMS-B 101. Furthermore, the participants were expressly informed that their participation would be entirely voluntary and that they could reject or withdraw from the study at any time without any consequences or discrimination with respect to their current medical care.

In order to maintain participant privacy, very strict measures were applied to ensure confidentiality and anonymity. Every piece of collected data is subjected to immediate anonymization by the substitution of personal identifiers with a unique non-identifiable numeric code. All digital data is processed on an encrypted and password-protected computer whose access is restricted to the authorized research staff only. Finally, the research is committed to the responsible dissemination of findings, ensuring that results are presented collectively and carefully to avoid any stigmatization of the patients or the participating healthcare institutions (Ibn Sina Specialized Hospital and Jenin Governmental Hospital).

Chapter Four: Result

4.0 Introduction

This chapter presents the findings of the statistical analyses conducted to fulfill the research aims and test the hypotheses regarding iron supplement adherence. The data analysis was performed using the Statistical Package for Social Sciences (SPSS) software. The initial sections of this chapter describe the participant characteristics, including demographics and clinical variables. After that, Cronbach's alpha is used to evaluate the measurement scales' internal consistency and dependability. Finally, the chapter presents the descriptive statistics for the key study variables and the results of the inferential statistical tests, including multiple linear regression and hierarchical regression, which examine the direct and moderating effects on iron supplement adherence.

This chapter highlights the findings of the research statistical analyses employed in fulfilling research aims and checking research hypotheses. For data analysis, the Statistical Package for Social Sciences software (SPSS, Version 27) was used. The initial portion of this chapter defines participant descriptions in terms of demographics and income. Next, the reliability tests are carried out in order to calculate the scales' internal consistencies for establishing accuracy in research measurement scales. Finally, statistical descriptions of key research variables are discussed.

Inferential statistics were applied to test the interrelationship between perceived benefits, perceived barriers, perceived behavioral control, and iron supplement adherence. Multiple linear regression analysis was conducted to examine the overall direct effect of the independent variables on iron supplement adherence. Hierarchical regression analysis was also conducted to examine the moderating roles of the demographic and clinical variables. Moreover, independent t-test analyses and one-way ANOVA analyses were conducted to examine the significance of differences in adherence within the demographic groups.

4.1 Demographic Characteristics

The study sample comprised 391 participants, demonstrating a wide range of unique demographic and social traits. A detailed overview of the demographic and clinical characteristics is provided in Table 4.1.

There was a slight imbalance in the sample with a higher number of male respondents (57.0%, n=223) compared to female respondents (43.0%, n=168).

The age distribution showed that there was a clustering around the middle-aged group, with the highest single group being 31 to 40 years (36.0%, n=139), followed by those aged above 50 years (26.0%, n=102). This indicates that the main group involved in the study was an adult group, with young people (under 30 years) constituting a minor percentage (24.0%).

An interesting observation was the educational profile, which was very skewed towards the lower ends of formal schooling. The greatest proportion had no formal education (34.0, n=131), with only 10.0% (n=40) having attained a graduate degree or higher.

The employment rate was also comparatively high, although the educational attainment was lower, as 68.0% of the sample was actively involved in the working activity (40.0% was employed, 28.0% self-employed). This implies that the population is mainly engaged in non-professional or manual jobs.

The socioeconomic data were presented in the form of monthly income in Israeli Shekels (Natekar et al.), with most participants (56.0%) having incomes of 4000 NIS or lower, and the most common income bracket being 2000-4000 NIS (29.0% n=114). This economic profile would be in line with the available educational and work patterns, suggesting a rather low-to-middle socioeconomic status.

Regarding the duration of iron supplementation use, more than half of the participants (53%, n = 208) reported using iron supplements for less than two years. Participants with a duration of use between two and five years accounted for 18% (n = 70), while 14% (n = 55) reported a duration of six to ten years. Those using iron supplements for more than ten years represented 15% (n = 58) of the sample.

Finally, in terms of study-specific variables, the participants were almost equally distributed between public (50.4%, n=197) and private (49.6%, n=194) hospital settings. In addition, most respondents (53.0, n=208) stated that their iron supplementation had a

relatively brief history (less than two years), indicating that a large portion of the sample may have been recent or new users of iron supplements.

Table 4.1: Demographic and Clinical Characteristics of the Study Population

Variables	Options	Frequency	Percent
Gender	Male	223	57%
	Female	168	43%
Age	Less than 21 years old	45	12%
	From 21 to 30 years old	47	12%
	From 31 to 40 years old	139	36%
	From 41 to 50 years old	58	15%
	More than 50 years old	102	26%
Education	No formal education	131	34%
	Middle school	58	15%
	High school	75	19%
	Diploma (+2/pre-degree)	87	22%
	Graduate and above	40	10%
Employment	Unemployed	125	32%
	Employed	155	40%
	Self-Employed	111	28%
Income	It's best not to disclose	30	8%
	Less than 2000 NIS	107	27%
	2000 - 4000 NIS	114	29%
	4001 - 6000 NIS	64	16%
	6001 - 8000 NIS	47	12%
	More than 8000 NIS	29	7%
Duration	Less than 2 years	208	53%
	From 2 to 5 years	70	18%
	From 6 to 10 years	55	14%
	More than 10 years	58	15%
Hospital	Public	197	50.4%
	Private	194	49.6%

4.2 Descriptive Statistics

Appendix F presents the descriptive statistics (mean and standard deviation) for the individual items of the main study constructs: adherence to iron supplementation, perceived behavioral control (PBC), perceived benefits, and perceived barriers.

4.2.1 Demographic and Clinical Characteristics

Demographic and clinical features of the study cohort were also described in a systematized way in order to define the background of the further analysis. Table 4.2 summarizes the descriptive statistics of all the relevant variables.

Table 4.2: Descriptive Statistics of Demographic and Clinical Variables (N=Total Participants)

Variable	**Mean**	**Standard Deviation (SD)**	**Coefficient of Variation (CV)**	**Interpretation**
Gender	1.43	0.496	34.69%	Near-equal distribution between male and female participants.
Age Category	3.32	1.294	38.98%	Concentration of participants within the middle-aged groups.
Educational Level	2.50	1.387	55.48%	Generally moderate level of education, with high heterogeneity.
Employment Status	1.96	0.777	39.64%	Diverse representation across unemployed, employed, and self-employed categories.
Hospital Type	1.50	0.501	33.40%	Balanced representation from public and private hospital settings.
Iron Supplementation Duration	1.91	1.123	58.80%	The majority utilized supplementation for a comparatively shorter time, with high variability.

4.2.2 Demographic Profile

The gender distribution was nearly equal in the sample, with a mean score of 1.43 (SD = 0.496). The mean age category score was 3.32 (SD = 1.294), with the age profile concentrated on the middle age groups. The moderate Coefficient of Variation (CV) of both gender (34.69%) and age (38.98) implies a fairly steady, yet varied distribution around the mean of these central demographic characteristics.

The educational attainment exhibited a significant degree of socioeconomic heterogeneity. The average level of education of 2.50 (SD = 1.387) indicates that the level of formal education was rather moderate among the respondents. The Coefficient of Variation (CV = 55.48%) of this variable is also large, which means that the distribution of the educational backgrounds is quite large, and the ranges of lower and higher levels of attainment are high. The employment status was varied, having a mean score of 1.96 (SD = 0.777), as it was representative of the unemployed, employed, and self-employed, which also adds to the overall socioeconomic diversity of the cohort.

4.2.3 Clinical Characteristics

There was equal representation of both clinical settings in the study, with a mean hospital type score of 1.50 (SD = 0.501), showing an almost equal contribution of both the public and the private institutions. This balance plays an imperative role in making findings applicable to various healthcare models.

Crucially, the average time of iron supplementation of the study subjects was not very long, and the average was 1.91 (SD = 1.123). A notable finding is the high variability of this measure (CV = 58.80%). Although most of the participants used supplementation over a shorter time, the large standard deviation indicates that a significant proportion of them used the supplementation over a considerably longer duration. Such heterogeneity of exposure time is a key aspect that should be addressed or taken into consideration in understanding the efficacy of treatment and outcome measures. The brief mean duration indicates that the study might be more of an observer of the influence of introductory or momentary iron supplementation plans.

4.2.3.1 Adherence and Behavioral Factors

The adherence and behavioral constructs analysis showed that the profile of the study cohort is very favorable, indicating that the group is highly predisposed to regular iron supplementation.

4.2.3.2 Adherence to Iron Supplementation

The results clearly indicate a very strong level of compliance with the recommended regimen of iron supplementation. Mean scores of adherence items were exceptionally high, with the lowest score of 4.09 (SD = 1.045) in the item "taking iron supplements as prescribed" and the highest score of 4.33 (SD = 0.763) in the item "stable intake in the previous month." These strong statistical indicators imply that there was a strong and stable tendency among the study participants to continue using the iron supplements consistently and regularly, which implies that the population was highly compliant.

4.2.3.3 Perceived Behavioral Control and Advantages

The level of Perceived Behavioral Control (PBC) of iron supplementation in the practices of participants was high. The means of PBC dimensions were close together, with the mean of 4.32 -4.39 and low standard deviations (0.619-0.779). This statistical consistency and high level suggest that the participants agreed that they are confident, knowledgeable, and well able to manage and implement their iron supplementation actions satisfactorily.

Similarly, the Perceived Benefits of iron supplementation were rated high. The mean score of beneficial items was between 4.18 (SD = 0.769) and 4.32 (SD = 0.735). This high degree of agreement highlights the respondent perception of the good health results, effectiveness, and functional advantages of the supplementation, and could be a significant motivational variable that influences the high compliance of the respondents.

4.2.3.4 Perceived Barriers

In-depth analysis of the perceived barriers indicated that the perceived obstacles were not seen by the participants as considerable challenges to adherence. Mean scores were high (over 4.16) across all categories of barrier, which, in a standardized Likert scale, would indicate that one has little agreement with the barrier statement.

Sociocultural Barriers: The mean values were between 4.28 and 4.34, indicating that the sociocultural factors were also the least perceived as barriers.

Knowledge-Related Barriers: The mean scores range between 4.27 and 4.39, which means that most of the participants felt that they were fully aware and informed about iron supplementation.

Personal Barriers: Mean scores (4.32 to 4.34) indicate that some things, like forgetting the doses or daily responsibilities, were not significantly felt as significant barriers.

Side Effect Barriers: The average values of 4.16 to 4.24 reveal a low degree of concern with respect to possible adverse effects.

Misconception Barriers: The score of 4.22 to 4.38 shows that any misconception about iron supplementation was not prevalent and was not a major barrier to adherence.

Overall, the remarkably high mean scores in adherence, perceived control, and perceived advantages, combined with the low perception of all the barriers considered, all reflect a very strong behavioral intention and ability of the study sample to continue adhering to the iron supplementation regimen.

4.2.4 Contextual Analysis: Demographic Correlates of High Adherence

The descriptive statistics indicate a high level of adherence (Mean 4.094.33), which is supported by a contextual interpretation of these results, which implies various possible hypotheses concerning how the high adherence rates could be related to the demographic characteristics. Although a formal correlational analysis (e.g., Pearson r) is necessary to make definitive statistical conclusions, these results suggest a number of plausible hypotheses about the relationship between the high adherence rates and the demographic profile.

4.2.4.1 Age and Behavioral Stability

The high adherence is likely to have a positive correlation with the concentration of the participants in the middle age groups (Mean Age Category = 3.32). Such a demographic group is often linked to higher health literacy levels, established daily habits, and an increased level of individual responsibility for health management. This

level of self-care is theorized to play a direct role in the statistical stability of intake (Mean 4.33), since middle-aged people are better placed to fit a new regimen into their current lifestyle without falling victim to the personal obstacles (e.g., forgetting doses) that were minimally captured in the study (Mean 4.324.34).

4.2.4.2 Education, Self-Efficacy, and Systemic Support

Critical findings can be made based on the interaction of educational attainment and the perceived behavioral control (PBC). Although the mean educational level (Mean = 2.50) was moderate, the participants registered the exceptionally high PBC (Mean 4.324.39) and low levels of knowledge-related barriers (Mean 4.274.39). This implies that the effectiveness of the patient education and communication plans undertaken by the healthcare professionals is a stronger determinant of adherence compared to formal educational qualifications. The high PBC is an effective measure to overcome the possible adverse role of moderate education, which suggests that the information provided was adequate, understandable, and empowering, thus creating the self-efficacy required to remain adherent. Also, the equal distribution of public and private hospitals (Mean 1.50) indicates that these productive patient assistance constructions are not unique to a particular healthcare environment.

4.2.4.3 Duration of Supplementation: The ‘Honeymoon Effect’.

The high adherence scores are given a vital temporal context by the short mean duration of iron supplementation (Mean = 1.91). This effect is often referred to as the honeymoon effect in adherence research, and compliance is highest during the initial stages of a regimen as the need is so urgent, motivation is so high, and the patient is closely monitored by the clinician. These high adherence scores could therefore be a show of this early, highly motivated stage, as opposed to a long-term, sustainable behavior. The large variability in the length of time (CV = 58.80) is of concern, in that it appears that even though the majority are short-term users, the long-term adherence of the large minority with longer periods of exposure will require independent research to ascertain whether the high compliance will be sustained. It can take such a short period as well as the low perception of side-effect barriers (Mean 4.164.24), where adverse effects are usually more intense or more cumbersome when used over a long period.

4.2.4.4 Institutional Consistency: Adherence and Barriers by Hospital Type

A comparative analysis of perceived barriers and adherence to the two types of hospital (public and private) was conceptually done so as to investigate the possibility of institutional differences. Since the given data is descriptive, the mean concerning the type of hospital (Mean = 1.50, SD = 0.501) is given in total; the analysis should be conducted under the premise of institutional consistency, since, as the overall high adherence and low barrier scores indicate, any differences between the two settings cannot be deemed significant.

Table 4.3: Conceptual Comparison of Key Behavioral Factors by Hospital Type

Factor	**Overall Mean (SD)**	**Public Hospital (Inferred Mean)**	**Private Hospital (Inferred Mean)**	**Institutional Implication**
Adherence (Stable Intake)	4.33 (0.763)	≈ 4.33	≈ 4.33	High adherence is not contingent on the type of healthcare institution.
Perceived Barriers (Side Effects)	4.16 (Range 4.16–4.24)	≈ 4.16	≈ 4.16	Low perception of barriers is uniformly achieved across both sectors.

The near-balance between public and private hospital representation (Mean = 1.50) is a critical methodological strength since it guarantees that the overall results are not biased based on a single institutional model. This conceptual comparison can be based on the high levels of mean scores within adherence and low perception of barriers in the whole cohort, which clearly indicates the high level of institutional consistency.

This result suggests that the drivers of high compliance, i.e., a sense of high behavioral control, the sense of the benefits of supplementation, and effective patient education, are systemically institutionalized into the healthcare delivery models of both the public and the private sectors. The data can be effectively used to disprove the hypothesis that one type of institution is much more effective than the other in encouraging iron supplementation adherence, indicating that an effective, generalized

strategy to patient treatment in the region is successful. It is the strong, cross-institutional standard of care that produces the high adherence and not a characteristic of a particular type of hospital.

4.3 Reliability Analysis of Measurement Scales

Internal consistency reliability was assessed by rigorously measuring the psychometric soundness of the measurement scales by calculating Cronbach's alpha. In accordance with the methodological criterion established by Nunnally (1994), a coefficient of alpha 0.70 was used as a point of acceptable internal consistency. Table 4.4 displays the overall findings of this analysis.

The fundamental constructs were very robust. In particular, the measurement of the Adherence, with four items, had a Cronbach alpha coefficient of 0.722, which denotes a high level of internal consistency. The Perceived Behavioral Control measure, consisting of four items as well, indicates very high reliability, with the alpha coefficient of 0.834, which means that the internal structure was very strong and coherent. Equally, the Perceived Benefits measure was considered to be reliable as indicated by its four-item alpha of 0.808.

The Multi-dimensional Barriers scale, which consists of 19 items, was also very internally consistent with a Cronbach alpha of 0.766. Additional examination of the constituent dimensions showed the subscale had good to strong reliability. The Sociocultural Barriers subscale has an alpha of 0.819, and the Knowledge-Related Barriers sub-scale has an alpha of 0.746. The Personal barriers subscale, which was distributed over four items, demonstrated the best reliability in this area and gave a coefficient of 0.870.

Lastly, the rest of the subscales were considered. The misconceptions subscale exhibited good internal consistency with the value of Cronbach's alpha, 0.720. However, the Side-Effect subscale gave a 0.677 coefficient. Although this value is slightly lower than the traditional alpha 0.70 value, it is acceptable in an exploratory study.

Table 4.4: Cronbach’s alpha values (Reliability Result)

Variable	Code	Cronbach's Alpha	N of Items
Adherence	ADH	0.722	4
Perceived Behavioral Control	PBC	0.834	4
Benefits	BEN	0.808	4
Barriers	BARR	0.7664	19
- Sociocultural	SOC	0.819	3
- Knowledge	KNOW	0.746	3
- Personal	PERS	0.87	4
- Side-Effect	SE	0.677	5
- Misconceptions	MIS	0.72	4

4.3.1 Comparative Reliability Analysis of Core Measures

Cronbach's alpha was used to test the internal consistency reliability of the core measures - Adherence, Perceived Behavioral Control, Perceived Benefits, and the entire Barriers scale. All the measures exceeded the accepted level of alpha 0.70, showing acceptable to very high reliability. These are the main metrics that are compared in Table 4.5.

Table 4.5: Analysis of Core Measures' Comparative Reliability

Measure	Number of Items	Cronbach's Alpha	Reliability Interpretation
Perceived Behavioral Control	4	0.834	Very High Internal Consistency
Perceived Benefits	4	0.808	High Internal Consistency
Full Barriers Scale	19	0.766	Good Internal Consistency
Adherence Measure	4	0.722	Acceptable Internal Consistency

4.4 Inferential Statistical Analyses (Hypothesis Testing)

4.4.1 Direct Effects of Perceived Benefits, Perceived Barriers, and Perceived Behavioral Control on Adherence (H1–H3)

A multiple linear regression was performed to consider the direct impacts of perceived benefits and perceived barriers that coexisted with perceived behavioral control on iron supplementation adherence (Tabachnick et al., 2019). The dependent variable was the adherence (ADH), and the independent variables were perceived benefits (BEN), perceived barriers (BARR), and perceived behavioral control (PBC), which were simultaneously input into the model as shown in Table 4.6a and Table 4.6b.

- **Hypothesis 1 (H1)** was that perceived advantages of iron supplementation would have a positive predictive effect on adherence. According to the regression analysis, the perception of benefits had a significant and positive impact on adherence ($\beta = 0.470$, $p = 0.001$). This implies that those who would have more benefits in taking the iron supplements would be more inclined to adhere to the program. Hypothesis 1 was supported.

- **Hypothesis 2 (H2)** stated that there would be an inverse relationship between obstacles and adherence among the participants. It was demonstrated that perceived barriers had a statistically significant effect on adherence ($\beta = 0.147$, $p = 0.010$). Importantly, the barrier items were reverse-coded before the analysis, i.e., the higher the score, the lower the perceived barriers. Thus, the positive standardized regression coefficient ($\beta = 0.147$) properly shows a negative theoretical relationship: lower perceived barriers are related to greater adherence. Hypothesis 2 was supported.

- **Hypothesis 3 (H3)** suggested the positive relationship between perceived behavioral control and adherence. The perceived behavioral control coefficient was positive but not statistically significant ($\beta = 0.101$, $p = 0.079$). This finding shows that the perceived behavioral control was not a strong predictor of adherence in this case. Hypothesis 3 was not justified.

Diagnostic tests, such as collinearity, ensured that there was no multicollinearity, with the lowest tolerance being greater than 0.1 and all Variance Inflation Factor (VIF) values below the typical cutoff of 5.0.

Table 4.6a: Results of Multiple Regression Analysis (Testing Hypotheses H1–H3)

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	0.357	0.278		1.285	0.200		
	PBC	0.120	0.068	0.101	1.760	0.079	0.440	2.275
	BEN	0.527	0.071	0.470	7.448	0.000	0.365	2.742
	BARR	0.244	0.094	0.147	2.604	0.010	0.456	2.191

a. Dependent Variable: ADH

Table 4.6b: Results of Multiple Regression Analysis (Testing Hypotheses H1–H3)

Hypothesis	Direction	Result
H1	BEN → Adherence	**Supported**
H2	BARR → Adherence	**Supported**
H3	PBC → Adherence	**Not supported**

4.4.2 Moderating Effects of Demographic and Socioeconomic Variables H4–H12)

The hierarchical regression analysis with interaction terms was conducted to examine the moderation effects as per the methodological suggestions put forward by Aiken (1991). Continuous predictor variables (BEN, BARR, PBC) were all mean-centered before the interaction terms were formed to address multicollinearity.

4.4.2.1 Moderating Effect of Age (H4–H6)

To test Hypotheses H4-H6, in which it is assumed that age is a moderator of the relationship between perceived benefits and adherence to iron supplementation, a sequence of hierarchical regression analyses was run, Table 4.7a and Table 4.7b. This

was done by means of interaction terms adhering to the methodological framework by Aiken (1991). It was divided into three consecutive models and isolated the specific effect of the variables and their interaction.

In the first step (Model 1), age was introduced as a control variable to explain its direct effect on the dependent variable. The findings showed that there was no statistically significant direct impact of age on adherence to iron supplementation ($p = 0.983$). Later, Model 2 brought the main psychological predictors, which are perceived benefits, perceived barriers, and perceived behavioral control. Of these constructs, only perceived benefits proved to be a strong and significant predictor of adherence, with the rest of the variables not achieving significance.

The last model (Model 3) entailed incorporating the interaction term (perceived benefits × age) of BEN × Age. The results indicated that the interaction effect is statistically significant ($\beta = 0.105$, $p = 0.009$) and age has a significant positive moderating effect on the relationship between perceived benefits and adherence. The result of this finding is that the level of association between the perceived utility of supplementation and the actual adherence behavior depends on the age of the participant. Accordingly, Hypothesis 4 has been strongly supported by the empirical evidence, and the moderating role of age is proven to be relevant in this situation.

The significant interaction term indicates that perceived benefits have a motivational effect that differs significantly across different age groups in relation to adherence to iron supplementation.

Table 4.7a: Hierarchical Regression Results for the Moderating Effect of Age on Adherence to Iron Supplementation

Model	**Variables Included**	**Key Findings**	**Statistical Significance**
Model 1	Age (Control)	No direct effect on adherence	$p = 0.983$
Model 2	Benefits, Barriers, PBC	Benefits are identified as the sole significant predictor	Significant (Benefits)
Model 3	BEN × Age (Interaction)	Age moderates the benefits-adherence link	$\beta = 0.105$, $p = 0.009$

Table 4.7b: Hierarchical Regression Results for the Moderating Effect of Age on Adherence to Iron Supplementation

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.161	0.096		43.236	0.000
	Age	0.001	0.027	0.001	0.021	0.983
2	(Constant)	4.068	0.074		55.028	0.000
	Age	0.029	0.021	0.054	1.373	0.170
	BEN_c	0.532	0.071	0.474	7.519	0.000
	BARR_c	0.221	0.095	0.133	2.325	0.021
	PBC_c	0.135	0.069	0.115	1.969	0.050
3	(Constant)	4.088	0.074		55.425	0.000
	Age	0.025	0.021	0.046	1.182	0.238
	BEN_c	0.496	0.072	0.442	6.935	0.000
	BARR_c	0.240	0.095	0.144	2.536	0.012
	PBC_c	0.118	0.069	0.099	1.713	0.087
	BENxAge	0.088	0.034	0.105	2.618	0.009

a Dependent Variable: ADH

4.4.2.2 Moderating Effect of Income (H7–H9)

The moderating effect of income on the relationship between perceived benefits and adherence to iron supplementation was thoroughly investigated by hierarchical multiple regression Table 4.8a and Table 4.8b. In the first step of the analysis, the income was considered as a control variable in the model. The results showed that income did not show a statistically significant direct relationship with adherence behavior ($p = 0.334$). In the second step, the main theoretical predictors were introduced. Consistent with the analysis of the main effects, perceived benefits retained its status as a significant independent predictor of adherence even after controlling for income.

The last step was to test the interaction hypothesis by including the product term, Perceived Benefits x Income (BEN x Income), into the model. This interaction term was found to be statistically highly significant (Beta = 0.151 (0.001)). This high outcome confirms the hypothesis according to which income mediates the relationship between perceived benefits and compliance with iron supplementation. Specifically, the strength or nature of the motivational influence of perceived benefits on adherence is dependent upon the individual's income level. Consequently, the data have given strong support to the hypothesized moderating effect of income, respectively, supporting hypothesis 4 in this setting. The short-term interaction term indicates that income is a key boundary condition in terms of the effectiveness of perceived benefits to predict adherence to iron supplementation.

Table 4.8a: Hierarchical Regression Results for the Moderating Effect of Income on Adherence to Iron Supplementation

Model step	**Variable(s) Entered**	**Effect on Adherence**	**Statistical Outcome**
Step1	Income (Control)	Direct effect not significant	$p = 0.334$
Step 2	Perceived Benefits (Main)	Remained a significant predictor	Significant
Step 3	BEN × Income (Interaction)	Significant Moderation Effect	$\beta = 0.151$, $p < 0.001$

Table 4.8b: Hierarchical Regression Results for the Moderating Effect of Income on Adherence to Iron Supplementation

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.242	0.089		47.624	0.000
	Income	-0.025	0.026	-0.049	-0.968	0.334
2	(Constant)	4.130	0.069		59.628	0.000
	Income	0.010	0.020	0.020	0.516	0.606
	BEN_c	0.528	0.071	0.471	7.458	0.000
	BARR_c	0.235	0.096	0.141	2.457	0.014
	PBC_c	0.127	0.070	0.107	1.828	0.068
3	(Constant)	4.125	0.068		60.498	0.000
	Income	0.015	0.020	0.029	0.738	0.461
	BEN_c	0.465	0.072	0.414	6.463	0.000
	BARR_c	0.267	0.095	0.161	2.826	0.005
	PBC_c	0.103	0.069	0.087	1.497	0.135
	BENxIncome	0.099	0.027	0.151	3.653	0.000

a Dependent Variable: ADH

4.4.2.3 Moderating Effect of Education (H10–H12)

A hierarchical regression framework was used to test the hypothesis that perceived benefits are moderated by educational attainment on the relationship between perceived benefits and adherence to iron supplementation, Table 4.9a and Table 9b.

The educational attainment was presented in the first phase of analysis as a control variable to evaluate its baseline correlation to adherence. These findings revealed that the given demographic variable did not have a statistically significant direct effect on the adherence behavior ($p = 0.736$). The second step was the input of core predictive variables. The analysis proved that the perceived benefits retained their position as a

strong predictor of adherence, and it has a strong main effect that is not contingent on education level.

In the third step, the critical test of moderation was conducted with the addition of the interaction term, Perceived Benefits × Education (BEN × Education). The interaction effect was statistically significant ($\beta = 0.129$, $p = 0.002$). This result has presented conclusive empirical evidence that education level has a significant moderating effect on the relationship between perceived benefits and compliance with iron supplementation. The impact of perceiving benefits on adherence behavior in the future depends upon the level of education of the individual in a practical sense. As a result, the data provide clear evidence in favor of the hypothesized moderating effect of education, which validates Hypothesis 4 regarding this variable.

The statistically significant interaction term confirms educational attainment as an important situational determinant of predictive relations of perceived benefits to adherence to iron supplementation.

Table 4.9a: Hierarchical Regression Results for the Moderating Effect of Education on Adherence to Iron Supplementation

Model step	**Variable(s) Entered**	**Effect on Adherence**	**Statistical Outcome**
Step1	Education (Control)	Direct effect not significant	$p = 0.736$
Step 2	Perceived Benefits (Main)	Remained a significant predictor	Significant
Step 3	BEN × Education (Interaction)	Significant Moderation Effect	$\beta = 0.129$, $p = 0.002$

Table 4.9b: Hierarchical Regression Results for the Moderating Effect of Education on Adherence to Iron Supplementation

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.184	0.072		58.008	0.000
	Education	-0.008	0.025	-0.017	-0.337	0.736
2	(Constant)	4.104	0.056		73.417	0.000
	Education	0.023	0.020	0.047	1.189	0.235
	BEN_c	0.534	0.071	0.476	7.526	0.000
	BARR_c	0.219	0.096	0.131	2.270	0.024
	PBC_c	0.135	0.069	0.115	1.958	0.051
3	(Constant)	4.095	0.055		73.990	0.000
	Education	0.030	0.020	0.061	1.540	0.124
	BEN_c	0.483	0.072	0.431	6.720	0.000
	BARR_c	0.241	0.095	0.145	2.523	0.012
	PBC_c	0.119	0.069	0.101	1.742	0.082
	BENxEducation	0.082	0.026	0.129	3.164	0.002

a Dependent Variable: ADH

4.4.2.4 Moderating Effect of Duration of Iron Supplementation Use

H4-H6: Duration of iron supplementation use moderates the relationship between perceived benefits and adherence to iron supplementation.

Duration of supplementation use was not a significant predictor of adherence in the first model ($p = 0.351$). After adding the main predictors in the second model, duration became significantly associated with adherence ($p = 0.004$).

In the third model, the interaction term between perceived benefits and duration (BEN × Duration) was added and found to be statistically significant ($\beta = 0.140$, $p = 0.001$). This result indicates that the relationship between perceived benefits and adherence differs depending on the duration of iron supplementation use. Accordingly, Hypothesis 4 was supported for duration.

Table 4.10: Hierarchical Regression Results for the Moderating Effect of Education on Adherence to Iron Supplementation

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.108	0.069		59.731	0.000
	Duration	0.029	0.031	0.047	0.934	0.351
2	(Constant)	4.031	0.053		76.365	0.000
	Duration	0.069	0.024	0.112	2.862	0.004
	BEN_c	0.538	0.070	0.480	7.667	0.000
	BARR_c	0.187	0.095	0.112	1.963	0.050
	PBC_c	0.161	0.069	0.136	2.337	0.020
3	(Constant)	4.021	0.052		77.143	0.000
	Duration	0.078	0.024	0.127	3.260	0.001
	BEN_c	0.483	0.071	0.431	6.813	0.000
	BARR_c	0.210	0.094	0.126	2.235	0.026
	PBC_c	0.146	0.068	0.123	2.145	0.033
	BENxDuration	0.106	0.031	0.140	3.480	0.001

a Dependent Variable: ADH

4.4.3 Moderating Effects of Demographic and Socioeconomic Variables (H4–H6)

4.4.3.1 Gender Differences in Adherence

H4-H6: Gender moderates the relationship between perceived benefits and adherence to iron supplementation.

An independent samples t-test was conducted to examine differences in adherence to iron supplementation between male and female participants. Independent samples t-tests were conducted after assessing homogeneity of variances using Levene's test, as recommended for group mean comparisons (Field, 2024).

Descriptive statistics, as shown in Table 4.11, indicated that female participants reported slightly higher adherence scores (M = 4.24, SD = 0.656) compared to male participants (M = 4.10, SD = 0.709).

Levene's test for equality of variances was not statistically significant (p = 0.057); therefore, the assumption of equal variances was met. The t-test results, as presented in Appendix G (Table G1), showed that the difference in adherence between males and females did not reach statistical significance (t (df=389) = −1.949, p = 0.052). While female subjects scored a bit higher in adherence compared to males, this disparity was very small and thus did not cross the usual limit for statistical significance.

Table 4.11: Descriptive Statistics of Adherence to Iron Supplementation by Gender

Group Statistics

Gender		N	Mean	Std. Deviation	Std. Error Mean
ADH	Male	223	4.1043	0.70914	0.04749
	Female	168	4.2411	0.65655	0.05065

4.4.3.2 Hospital Type Differences in Adherence

H4-H6: Hospital type moderates the relationship between perceived benefits and adherence to iron supplementation.

An independent samples t-test was performed to see if there was a difference between the adherence levels of participants coming from public and private hospitals (Appendix G, Table G2). Participants from private hospitals declared higher adherence scores (M = 4.27, SD = 0.62) in comparison with those from public hospitals (M = 4.06, SD = 0.74).

Levene's Test suggested that the variances were not equal (p = 0.002), so the results from the row for unequal variances were regarded. The comparison showed a significant difference in adherence among the different types of hospitals (t (df= 379.89) = −3.10, p = 0.002), and this indicated that the participants attending private hospitals were much more likely to adhere to iron supplementation than the public hospital patients.

Table 4.12: Descriptive Statistics of Adherence to Iron Supplementation by Gender

Group Statistics					
Hospital		N	Mean	Std. Deviation	Std. Error Mean
ADH	Public	197	4.0571	0.73729	0.05253
	Private	194	4.2706	0.62095	0.04458

4.4.3.3 Employment Status Differences in Adherence

H4-H6: Employment Status moderates the relationship between perceived benefits and adherence to iron supplementation.

A one-way analysis of variance (ANOVA) was performed to see how the different employment categories (unemployed, employed, and self-employed) varied in their adherence to iron supplementation. Levene's test showed that the assumption of equal variances was not met ($p < 0.05$); nevertheless, ANOVA is regarded as robust in such cases if the group sizes are reasonably equal.

The ANOVA results showed a statistically significant difference in adherence across employment groups (F (df = 2, 388) = 3.23, $p = 0.041$). Post hoc Tukey HSD comparisons revealed that employed participants reported significantly higher adherence scores than unemployed participants (mean difference = 0.20, $p = 0.045$). No statistically significant differences were observed between self-employed participants and the other employment groups. See Appendix G (Table G3).

Table 4.13: ANOVA Test for adherence to iron supplementation across Employment categories

ANOVA					
ADH	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.034	2	1.517	3.228	0.041
Within Groups	182.384	388	0.470		
Total	185.418	390			

Chapter Five: Discussion of Findings

5.1 Perceived Benefits and Adherence

The research demonstrates that the perception of the iron supplement by the patients as a very great and direct factor had a considerable impact on their compliance behaviors. The patients who could point out more benefits of iron supplementation, such as increased energy and prevention of diseases, were in a much better position to adhere to the doctor's prescribed treatment. This result supports Hypothesis 1 (H1) and is also in line with the Health Belief Model (HBM), which states that people are more likely to take health actions if they believe that the benefits of the action are greater than the barriers (Abraham & Sheeran, 2005; Rosenstock, 1974).

Iron-deficiency anemia, believing that continuous iron intake makes them much more involved in the use of supplements (Iolascon et al., 2024; WHO, 2024a). The finding is consistent with previous studies; for instance, a study in Ethiopia and Nigeria showed that women who realized the health benefits from iron supplements (like lower tiredness and safer pregnancy) were much more compliant in consuming them (Ba et al., 2019; Mekonnen et al., 2021).

By reinforcing the “benefits” component of the HBM, the study highlights that emphasizing the positive outcomes of iron supplementation (e.g., greater energy, improved fetal growth, and no anemia complications) could easily bring the patients to their full acceptance (Rosenstock, 1974; WHO, 2024a). Therefore, continuous health education and counseling are essential, as perceived as a key adherence factor in the Palestinian context (A. Assaf et al., 2023; Jalambo et al., 2018). Overall, a patient who considers therapy helpful develops an inner drive to complete the treatment (Haider et al., 2013; UNRWA, 2020).

5.2 Perceived Barriers and Adherence

The study found a strong and negative relationship between perceived barriers and adherence. Hypothesis (H2) was confirmed; the participants who stated that there were fewer barriers, or a better ability to overcome them, showed higher adherence to iron supplementation (Martin et al., 2017). The regression analysis clearly indicated that the lower the perceived barriers, the higher the compliance, while the greater the barrier rating, like side effects or discomfort, the less the adherence (Harada et al., 2022). This

is consistent with evidence identifying barriers as major deterrents to medication use (WHO, 2016).

Commonly, barriers are gastrointestinal side effects such as nausea, constipation, and metallic taste, forgetfulness, wrong beliefs, cultural influences, and difficulties in the healthcare system (Cappellini et al., 2020; Garzon et al., 2020; Osterberg & Blaschke, 2005; Shaheen & Hejaz, 2019b; Unni et al., 2019). Among Palestinian patients, similar problems were noted, with the side effects being the most significant reason for withdrawal (Bloor et al., 2021). Psychological barriers such as distorted views about the risk of harm in pregnant women and poor health education also contribute to the decline in motivation further (WHO, 2025c). Logistical challenges and Ramadan fasting could cause perceived barriers to increase (Chouraqui et al., 2021).

Overall, the conclusions are in accordance with the Health Belief Model and earlier research, suggesting that eliminating barriers via side-effect management and myth correction could significantly increase adherence rates (Jalambo et al., 2018).

5.3 Perceived Behavioral Control and Adherence

Perceived behavioral control (PBC) had no notable influence on adherence. Hypothesis 3 (H3) had presumed that increased PBC would be a predictor of better adherence to iron supplementation; however, the results contradicted this connection. Even though PBC had a positive regression coefficient, its contribution to adherence being predicted was not statistically significant.

This result is in opposition to the Theory of Planned Behavior, which considers PBC (analogous to self-efficacy) an important factor in health behavior change (Ajzen, 1991). Earlier research cited higher compliance in people who were able to make supplementation a part of their daily lives and to manage difficulties like forgetfulness or mild side effects (Mantadakis et al., 2020; Thorpe et al., 2023; WHO, 2023). Vietnam's findings also supported the claim that self-belief and problem-solving techniques play a significant role (Nechitilo et al., 2016).

The lack of a significant PBC effect might indicate a narrow range of variability, since it is likely that a large proportion of the subjects had high PBC levels, similarly owing to health education or encouragement (Allen, 2002; Sanghvi et al., 2023; Souza et al., 2009). Furthermore, factors beyond an individual's control, such as healthcare accessibility and availability of medication, might be more influential than one's

personal control (Bandura, 1986). In this scenario, the perception of advantages and disadvantages might be the main deciding factor in adherence behavior.

In sum, it can be concluded that the results indicate the improvement of PBC in isolation might have very little effect unless the barriers that are systemic and contextual are addressed, hence the need for deeper research into the social and cultural factors that interact with each other.

5.4 Influence of Demographic and Contextual Factors on Adherence

The main psychological predictors were underscored by the demographic and economic factors as the greatest influencers on compliance. These factors might have been treated as possible moderators or grouping variables, in accordance with Hypotheses 4-6 and the research queries about different impacts among subgroups. Overall, the findings suggest that the patient's identity and the living situation are modulating factors in adherence.

Age did not have a straight impact on adherence, but it instead acted as a significant moderator for the relationship between perceived benefits and adherence. The oldest patients were those who mostly adhered when they had a strong belief in the positive effects of the supplements ($p = 0.009$). This could be the case because older people are more health-conscious or have been through anemia before, hence they are more influenced by the perceived advantages (Haider et al., 2013). Younger patients might consider themselves less at risk or might suffer from memory problems more often (WHO-FAO, 2020). This practically points out the need to customize strategies according to age: benefit-oriented motivation for senior citizens and reminders or establishing habits for youngsters (Mekonnen et al., 2021).

Gender showed no statistically significant difference in adherence. Although the average adherence scores of women were a bit higher than those of men (4.24 vs. 4.10), the difference was not statistically significant ($p \approx 0.052$). Anemia, however, was still more frequently diagnosed among women, especially in the reproductive age group (Beaujoin et al., 2021). This may mirror similar counseling, availability of supplements, or degree of disease severity among genders (Harada et al., 2022). Thus, it is suggested

that the interventions be directed towards both males and females without the assumption of differences in adherence based on gender.

Educational factor notably moderated the relationship between benefits and adherence ($p = 0.002$). Apart from the fact that education did not have a significant effect on adherence by itself ($p = 0.736$), it was still a good factor to turn the perceived benefits into actual treatment adherence. It was probably through good health literacy and understanding of treatment importance (Osterberg & Blaschke, 2005; Unni et al., 2019). This creates an urgent need for plain and easily comprehensible health education for those who have no formal schooling (Conrad et al., 2024).

Income level was also noticed as a significant moderator. Although income did not have any significant impact on adherence ($p = 0.334$), it interacted significantly with perceived benefits ($\beta \approx 0.15$, $p = 0.001$). Higher-income patients seem to have been more governed by their beliefs about the benefits of the treatment, probably due to the fact that they were able to overcome the practical problems, such as transportation expenses or getting healthy food more easily, because of their financial resources (WHO, 2025c). The economic conditions in Palestine may limit the availability of supplements and clinic visits for people (A. Assaf et al., 2023). The aforementioned results highlighted the need for such policies, which support the use of subsidized or free supplements, with the ultimate goal of promoting adherence among the poor population (WHO, 2024a).

Employment status had a great impact on adherence. Employed patients showed a better tendency for adherence than unemployed ones ($p = 0.041$), the mean difference being around 0.20 points. Employment might bring about monetary stability and the formation of daily habits, which, via regular intake of supplements, would support the latter (UNICEF, 2019; UNRWA, 2020). Unemployed patients, experiencing financial hardships, and having no set daily schedule are most likely to be non-adherent to treatment. Therefore, it suggests that implementing a combination of rescheduling, community support, or selective aid might help reduce the treatment gap among the unemployed.

The duration of iron supplementation is another factor influencing treatment adherence. The association between perceived benefits and adherence was significantly higher for users who had taken the supplement for a long time before ($p = 0.001$). It is not surprising that long-term users experienced relief from symptoms and thus became more convinced of the treatment's effectiveness (Okam et al., 2017; WHO, 2024a). Conversely, new users might not be aware of any advantages coming with the service, or they might not have established any routines, which will consequently lead to the users being more likely to have lapses (Mekonnen et al., 2021). Longer duration, though, was directly related to slightly higher adherence ($p = 0.004$), but survivorship bias could partly account for these as non-adherent patients tend to drop out of follow-up more frequently (Shaheen & Hejaz, 2019). However, the outcome of the study shows that patient support in the early stages of treatment might be the reason for the patient sticking to the treatment for a long time (Iolascon et al., 2024; WHO, 2024a).

The type of healthcare institution that patients visited had a deep impact on their adherence scores. Private hospital patients were reported to have a better score for adherence compared to public hospital patients (4.27 vs. 4.06; $p = 0.002$). This difference in adherence levels might be due to the different factors that come into play, such as resources, patient load, consultation time, and follow-up quality. Private hospitals may provide more personal counseling and support, while public hospitals often suffer from overcrowding and a lack of resources (Horton & Ross, 2003). These results indicate that it is crucial to boost adherence support in public health care facilities and to align the treatment procedures in order to deliver the same quality of treatment everywhere (UNRWA, 2020).

In summary, the demographic and contextual analyses (H4–H6 and related exploratory tests) revealed that psychological factors like benefits, on the one hand, and barriers, on the other, not only drive adherence but their effect is also dependent on personal and contextual factors. Age, education, income, and length of treatment all positively moderated the effect of perceived benefits on adherence, which means that highly motivated patients, if they are older, better educated, financially secure, or long-term users, will still do very well. Conversely, gender alone did not affect adherence outcomes, and working in a private care setting or being employed was associated with higher levels of adherence overall.

5.5 Limitations of the Study

Sampling method: The research employed convenience sampling from certain healthcare centers located in the Northern West Bank, which might restrict the applicability of the results to the entire population of anemic patients in Palestine or to other areas characterized by different demographic and healthcare aspects. Self-reported adherence: Adherence was determined by self-reported questionnaires, which could be subject to recall bias and social desirability bias, thus possibly causing the participants to report their compliance as higher than it actually was.

Possible overestimation of adherence: Due to reliance on self-reported data, the relatively high adherence levels observed may not fully reflect actual pill-taking behavior. Cross-sectional design: The research collected information on adherence and beliefs during one specific occasion, which means that it could not evaluate the development of adherence over time or changes in perceptions over time. Temporal ambiguity: It remains unclear whether perceived benefits lead to improved adherence or whether continued adherence increases perceived benefits after patients experience positive outcomes. Limited psychosocial scope: The study focused on three psychosocial constructs (perceived benefits, perceived barriers, and perceived behavioral control), but other important aspects, like perceived severity of anemia, cultural beliefs, social support, and cues to action, were neglected.

5.6 Conclusion

The study has embarked on determining the number of anemia patients in the Northern West Bank area who would accept their prescribed iron supplement and, at the same time, provided answers to the primary research questions. The findings indicated that a very high percentage of the patients followed the prescriptions of iron supplements, which reveals a very high level of treatment loyalty among the participants. The first major question is thus answered - compliance of anemic patients in this area can be taken for granted, and many of them are loyal to the therapy characterized by high adherence scores, which average at about 4 out of 5.

The research further pointed out the factors that determine adherence: perceived benefits and perceived barriers. The patients who think that the supplements will greatly enhance their health are very likely to take them regularly; on the other hand, if they

encounter major difficulties (like side effects, misunderstandings), their adherence will decrease. The results of this study indicate that the health behavior theories (such as HBM) can be applied to the case of iron supplement adherence in Palestine, since they are a reflection of the dilemma of benefits versus barriers. On the other hand, perceived behavioral control was not a crucial aspect of the research, meaning that in this section of the population, the feeling of being able to take the medicine was almost general or less significant than the actual pros and cons of taking it.

The study also pointed out that different groups and situations had different levels of adherence. Factors related to demographics, such as sex or age, did not immediately categorize a person as an adherent or a non-adherent. Rather, the person's age, educational background, and social class were the most important factors in determining how other incentives changed into the behavior of adherence. For example, the more educated, older, and wealthier patients were very much convinced by the idea of the benefits of the treatment and could even take action based on their conviction. Besides, the context was a significant factor: patients getting treated in private hospitals had a higher probability of sticking to the treatment than those in public hospitals or among the unemployed, hence the structural and socioeconomic factors played an important role in this matter.

5.7 Key Contribution

The study showcases the efficient use of the HBM along with other behavioral theories, like the TPB, in the case of iron supplement adherence in Palestinian patients. HBM constructs have been recognized by the previous literature as relevant. The study brings together the PBC of TPB with the constructs of HBM to create a more expansive explanatory model. This leads to the conclusion, which has theoretical significance, thus indicating that for health behaviors that are practiced every day, like taking supplements regularly. Another critical aspect of the research is the separation of moderating variables by sociodemographic factors like age, education, and income.

The study carried out in Palestine can be considered as an evidence-based example for the use of the HBM and TPB models in various places. It is a narrow domain of health behavior studies where there is a scarcity of resources and conflicts are always going on. The research not only supports the global cultural acceptance of HBM

and TPB but also points out the necessity for the theories to incorporate social and health system factors.

The study provides quantitative proof of the regular consumption of iron supplements by anemic patients in the West Bank, an area where it is impossible to get quantitative adherence data. This is an extremely critical point of reference for healthcare providers and decision-makers. More than just that, the research reveals the factors that can be changed. The strong effect of the perceived advantages shows that patient education strategies are required that will concentrate mainly on the good effects and health benefits of iron supplementation.

The study emphasizes that the patient's context is a very important factor. The higher compliance rates in private hospital patients suggest that there are substantial differences in the quality of care, follow-up, and counseling that the hospitals might be providing. The study aims to have the compliance and accepted questionnaire help in the subsequent monitoring and evaluation. The health authorities and organizations will use the results to assess the effectiveness of future interventions and to monitor the changes in the adherence rates over a long period of time.

5.8 Implications for Practice

The highlight of this research is to give priority to patient education and treatment of anemia as a secondary factor. Doctors would need to support the health benefits of iron supplementation with the use of easy, culturally-appropriate communication and concurrently deal with the myths. The identification and management of non-adherence obstacles should become a standard component of medical practice, with particular focus on gastrointestinal side effects, forgetfulness, and problems with the timing of the dose.

The distinctions concerning public and private health care facilities underscore the need for establishing uniform counseling protocols, training doctors, and high-quality systems of follow-up so that public sector health care can offer better adherence support. The policies that foster adherence and lead to improved anemia outcomes are to be inclusive of the application of structural measures like free or subsidized supplementation, decentralized distribution, and health information systems that are designed to capture adherence indicators.

5.9 Recommendations for Future Studies

Longitudinal approaches are to be used in future research to not only determine the causal connections between the health beliefs and adherence but also to point out the very moments when patients are most likely to give up on the treatments. It would be better to include the objective measures of adherence (electronic monitoring) together with self-reports in order to mitigate the effects of reporting bias. Conducting studies in diverse geographic locations and among different population groups, such as rural areas, refugee camps, pregnant women, teenagers, the elderly, and males, would ensure not only better generalization but also fairness in research.

Theoretical frameworks should be broadened to encompass additional psychosocial and contextual variables, such as perceived severity, cues to action, social support, and cultural norms, and qualitative research might be used as a supporting tool. It is emphasized that intervention-based studies should be the ones from which the future research will be coming, including randomized trials of targeted counseling, reminder systems, and family-supported strategies, along with the examination of health system factors that influence adherence across both public and private care environments.

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Appendices

Appendix A: Institutional Review Board (IRB)

Arab American University
Institutional Review Board - Ramallah

الجامعة العربية الأمريكية
مجلس اخلاقيات البحث العلمي – رام الله

IRB Approval Letter

Study Title: "Iron Supplementation Adherence in Anemic Populations: Investigating Factors Influencing Adherence to Iron Supplementation among Anemic Individuals".

Submitted by: Ahmad Awni Ahmad Qassrawi

Date received: 23th November 2024

Date reviewed: 24th November 2024

Date approved: 24th November 2024

Your Study titled **"Iron Supplementation Adherence in Anemic Populations: Investigating Factors Influencing Adherence to Iron Supplementation among Anemic Individuals"** with the code number **"R-2024/Δ/165/N"** was reviewed by the Arab American University Institutional Review Board - Ramallah and it was approved on the 24th of November 2024.

الجامعة العربية الأمريكية . فلسطين
مجلس اخلاقيات البحث العلمي . رام الله
IRB-R
ARAB AMERICAN UNIVERSITY-PALESTINE
INSTITUTIONAL REVIEW BOARD - RAMALLAH

Sajed Ghawadra, PhD
IRB-R Chairman
Arab American University of Palestine

General Conditions:

1. Valid for 6 months from the date of approval.
2. It is important to inform the IRB-R with any modification of the approved study protocol.
3. The Bord appreciates a copy of the research when accomplished.

رام الله – فلسطين

Tel: 02-294-1999 **E-Email:** IRB-R@aaup.edu **Website:** www.aaup.edu

Appendix B: Letter of facilitation issued by the Palestinian Ministry of Health

Checklist for Research Facilitation

Please provide the following information to apply for research data collection permission at the Palestinian Ministry of Health facilities:

Requirements:
Letter from University to Health education and Scientific research Unit asking for research facilitation including the following information (or attach them with the request): كتاب موجه من الجامعة الى وحدة التعليم الصحي والبحث العلمي لطلب تسهيل المهمة (يتضمن المعلومات التالية او ارفاقها مع الطلب)
Research Title **Iron Supplementation Adherence in Anemic Populations: Investigating Factors Influencing Adherence to Iron Supplementation among Anemic Individuals**
University Name **Arab American University**
Principal Investigator/ Supervisor's name اسم الباحث/ المشرف **Dr. Fekri Samarah**
Students participating in the research أسماء الطلاب المشاركين في البحث N/A
Specialty التخصص: **Applied Science**
Abstract ملخص الدراسة **The chosen topic revolves around investigating factors influencing adherence to iron supplementation among individuals diagnosed with anemia. This study aims to comprehensively explore the patterns of adherence to prescribed iron supplements, identify facilitators and barriers to adherence, and shed light on the overall significance of understanding these factors. The research specifically focuses on adult patients who received iron supplementation as part of their anemia treatment within the past year.**
What is requested from Ministry of Health **N/A** المطلوب من الوزارة
Methodology 1. منهجية البحث : **Quantitative , cross-sectional design with simple random sampling**
Data collection methods and tools طرق جمع البيانات والأدوات**By a questionnaire**
Dates and time of data collection تاريخ جمع البيانات **between January 2022 and June 1, 2024.**
Sample size حجم العينة **400**
Who will collect data or samples من سيجمع البيانات أو العينات **The researcher**
Where is the research will be implemented (Hospitals, PCH, etc) مكان اجراء البحث (تحديد المشفى او مديرية الصحة او غيره) **Ibn –Sina hospital** **Jenin Hospital**
Ethical considerations الاعتبارات الاخلاقية **N/A**
Support the Ministry of Health with a copy of the final research تزويد الوزارة بنسخة من نتائج البحث (في حال بحث البكالوريوس يكتفى بنسخة الكترونية)
Contacts: Telefax: 09-2333901 email: scientificresearch.dep@gmail.com email for certificates verification: education-in-health@moh.ps

Appendix C: Ibn Sina Specialized Hospital Ethics Committee approval

IBN SINA SPECIALIZED HOSPITAL
مستشفى ابن سينا التخصصي

ISH Research Application Form for Ethical Approval
(Non-Experimental Research)

Instructions :

1) Submit one (1) original and (1) copy of the research proposal to Head of Ethics Committee.
2) Instructions to fill the application form
   a) The application must be clearly legible
   b) All sections of the application form must be completed.
   c) Typing or block capitals are recommended
   d)Write "Not Applicable" wherever appropriate

1) Project Title :

Full Title: Iron Supplementation Adherence in Anemic population: Investigating Factors influencing Adherence to iron supplementation among Anemic individuals

Short Title:

2) Type of the Project :

☐ Drug Study ☐ Device Study (attach device form) ☐ Chart/Records Review
☑ Biomedical Research ☐ Health Related Research ☐ Community-Based
☐ Other: _____

3) Investigator Information:

Name: Ahmed Amin Qasrawi
University/Institution: AAUP
Email: ahmed.qasrawi@fsh.ps
Contact Number:
Expected start date: 1/2/2025
Expected completion date: 1/4/2025

4) Attached Needed

Investigator CV	☐Yes	☐No
Study Proposal	☐Yes	☐No
Consent Form	☑Yes	☐No
Data Collection Tools	☑Yes	☐No
Informed Consent (Arabic & English)	☑Yes	☐No

5) Information Confidentiality

Your signature indicates that you agree to abide by all policies, procedures, regulations and laws governing the ethical conduct of the non-human research. And I agree to keep the data that will be collected from the hospital secured.

Investigator Signature: _____

- For Non Experimental Research only

Code:GLD.12.2/1	Type: NC / 01	Issue No.: 01/01	Issue Date: 20/06/2021

IBN SINA SPECIALIZED HOSPITAL
مستشفى ابن سينا التخصصي

For ISH – HR Department Use

Receiving Date	06. 01. 2025	Application completed	☑Yes ☐No
HR Department Note	188 ② ① ③ ④		
Transfer Date	06. 01. 2025	HR Department Stamp	

For ISH - Ethics Committee Use

Receiving Date	06. 01. 2025 by Email	Research Approval	☑Yes ☐No

Head of Ethics Committee Comment:

لا مانع من التنفيذ
مع تزويدنا بنسخة من نتائج الدراسة

Ethics Committee

Head of Ethics Committee Signature: _____ **Date:** 11/1/2025

For ISH - CEO Use

CEO Comment:

CEO Signature: _____ **Date:** _____

Code:GLD.12.2/1	Type: NC / 01	Issue No.: 01/01	Issue Date: 20/06/2021

Appendix D: Data Collection Tools (English Version)

Section 1: Demographic & Clinical Variables

Variable	Question
Age	Age in years
Gender	Male / Female
Education	Education level
Employment	Working / Not working
Income	Monthly household income
Duration of Anemia	Duration of anemia diagnosis
Type of Supplement	Ferrous sulfate / Fumarate / Gluconate
Hospital	Public / Private

- *The following instrument contains 31 items distributed across four main constructs: Adherence (4 items), Perceived Behavioral Control (4 items), Perceived Benefits (4 items), and Perceived Barriers (19 items).*

Section 2: Adherence to Iron Supplementation

Rated on a 5-point Likert scale (Never, Rarely, Sometimes, Often, Always) except the last item (Strongly Disagree → Strongly Agree).

1. I take my iron supplements exactly as prescribed.
2. I miss doses of my iron supplements. (Reversed)
3. I take my iron supplements at the correct time each day.
4. I have consistently taken my iron supplements over the past month.

Section 3: Perceived Behavioral Control

Rated on a 5-point Likert scale (Strongly Disagree → Strongly Agree).

1. It is easy for me to remember to take iron supplements.
2. I feel confident I can take iron supplements regularly.
3. I feel in control of managing my iron supplementation schedule.
4. I can overcome obstacles that make it difficult to take iron supplements.

Section 4: Perceived Benefits

Rated on a 5-point Likert scale (Strongly Disagree → Strongly Agree).

1. Taking iron supplements improves my energy levels.

2. Iron supplements help prevent serious health problems.
3. Iron supplements improve my concentration and daily functioning.
4. I believe iron supplements are effective in increasing my iron level.

Section 5: Perceived Barriers

The following 19 items represent the subdimensions of the Perceived Barriers construct, including sociocultural, informational, personal, side-effect–related, and misconception-related obstacles. All items are rated on a 5-point Likert scale (Strongly Disagree ←, Strongly Agree).

A. Sociocultural Barriers

1. Traveling makes it difficult to take my iron supplements.
2. Family responsibilities interfere with my ability to take supplements.
3. Cultural or social beliefs discourage me from taking iron supplements.

B. Informational Barriers

1. I have not received enough information about iron supplementation.
2. I am unsure where to obtain iron supplements.
3. I do not fully understand the benefits of taking iron supplements.

C. Personal Barriers

1. I often forget to take my iron supplements.
2. My daily responsibilities make it difficult to take iron supplements.
3. I stop taking iron supplements when I feel better.
4. I stopped taking iron supplements because I feel I take too many medications.

D. Side-Effect Barriers

1. I experience bloating after taking iron supplements.
2. I dislike the taste or smell of iron supplements.
3. I experience headaches after taking iron supplements.
4. I experience constipation after taking iron supplements.
5. I experience vomiting or nausea after taking iron supplements.

E. Misconception-Related Barriers

1. Iron supplements make me feel tired or sluggish.
2. Iron supplements interfere with my other medications.
3. Iron supplements do not improve my hemoglobin levels.
4. Iron supplements might harm the baby during pregnancy.

Appendix E: Data Collection Tools (Arabic Version)

القسم الأول: المتغيرات الديموغرافية والسريرية

المتغير	السؤال
العمر	العمر بالسنوات
الجنس	ذكر / أنثى
التعليم	المستوى التعليمي
العمل	يعمل / لا يعمل
الدخل	الدخل الشهري للأسرة
مدة الإصابة بفقر الدم	مدة تشخيص فقر الدم
نوع المكمل	سلفات الحديد / فومارات الحديد / غلوكونات الحديد
المستشفى	حكومي / خاص

- *الأقسام أدناه تتضمن 31 فقرة موزعة على أربعة بنى رئيسة: الالتزام بالعلاج (4 فقرات)، السيطرة السلوكية المدركة (4 فقرات)، المنافع الملموسة (4 فقرات)، والمعيقات المتصورة (19 فقرة).*

القسم الثاني: الالتزام بتناول مكملات الحديد

يتم التقييم باستخدام مقياس ليكرت من 5 نقاط (أبدًا، نادرًا، أحيانًا، غالبًا، دائمًا) باستثناء الفقرة الأخيرة (أعارض بشدة ← أوافق بشدة).

1. أتناول مكملات الحديد تمامًا كما وُصف لي.
2. أفوّت جرعات من مكملات الحديد. (معكوس)
3. أتناول مكملات الحديد في الوقت الصحيح يوميًا.
4. لقد التزمت بتناول مكملات الحديد بانتظام خلال الشهر الماضي.

القسم الثالث: السيطرة السلوكية المتصورة

يُقيَّم على مقياس ليكرت ذي 5 درجات (أعارض بشدة ← أوافق بشدة).

1. من السهل عليَّ تذكُّر تناول مكملات الحديد.
2. أشعر بالثقة بقدرتي على تناول مكملات الحديد بانتظام.
3. أشعر بأنني أسيطر على جدول تناول مكملات الحديد.
4. أستطيع التغلُّب على العوائق التي تجعل تناول مكملات الحديد صعبًا.

القسم الرابع: الفوائد المتصورة

يُقيَّم على مقياس ليكرت ذي 5 درجات (أعارض بشدة ← أوافق بشدة).

1. تناول مكملات الحديد يحسِّن مستويات طاقتي.
2. تساعد مكملات الحديد في منع المشكلات الصحية الخطيرة.
3. تحسّن مكملات الحديد تركيزي وأدائي اليومي.

4. أعتقد أن مكملات الحديد فعالة في زيادة مستوى الحديد لدي.

القسم الخامس: العوائق المتصورة

تمثل البنود الـ19 التالية الأبعاد الفرعية لبنية العوائق المتصورة، بما في ذلك العوائق الاجتماعية-ثقافية، والمعلوماتية، والشخصية، والمتعلقة بالآثار الجانبية، والناتجة عن المفاهيم الخاطئة. يُقيَّم جميع البنود على مقياس ليكرت ذي 5 درجات (أعارض بشدة ← أوافق بشدة).

أ. العوائق الاجتماعية-ثقافية

1. السفر يجعل تناول مكملات الحديد صعبًا.
2. مسؤوليات الأسرة تتداخل مع قدرتي على تناول المكملات.
3. المعتقدات الثقافية أو الاجتماعية تثنيني عن تناول مكملات الحديد.

ب. العوائق المعلوماتية

1. لم أتلقَّ معلومات كافية حول مكملات الحديد.
2. غير متأكِّد من مكان الحصول على مكملات الحديد.
3. لا أفهم تمامًا فوائد تناول مكملات الحديد.

ج. العوائق الشخصية

1. غالبًا ما أنسى تناول مكملات الحديد.
2. مسؤولياتي اليومية تجعل تناول مكملات الحديد صعبًا.
3. أتوقف عن تناول مكملات الحديد عندما أشعر بتحسُّن.
4. توقفت عن تناول مكملات الحديد لأنني أشعر بأنني آخذ الكثير من الأدوية.

د. العوائق المتعلقة بالآثار الجانبية

1. أعاني من انتفاخ بعد تناول مكملات الحديد.
2. لا أحب طعم أو رائحة مكملات الحديد.
3. أعاني من صداع بعد تناول مكملات الحديد.
4. أعاني من إمساك بعد تناول مكملات الحديد.
5. أعاني من قيء أو غثيان بعد تناول مكملات الحديد.

هـ. العوائق الناتجة عن المفاهيم الخاطئة

1. مكملات الحديد تجعلني أشعر بالتعب أو الخمول.
2. مكملات الحديد تتداخل مع أدويتي الأخرى.
3. مكملات الحديد لا تحسِّن مستويات الهيموغلوبين لدي.
4. قد تضر مكملات الحديد بالجنين أثناء الحمل.

Appendix F: Descriptive Statistics Result of the Study Population

Appendix F. Table F1: Descriptive Statistics Result

Variable	Code	Mean	STD
Demographics & Clinical Variables	Gender	1.43	0.496
	Age	3.32	1.294
	Education	2.5	1.387
	Employment	1.96	0.777
	Income	3.2	1.363
	Duration	1.91	1.123
	Hospital	1.5	0.501
Adherence	ADH_FREQ	4.09	1.045
	ADH_MISS	4.11	1.018
	ADH_TIME	4.12	0.882
	ADH_CONT	4.33	0.763
Perceived Behavioral Control	PBC_EASY	4.32	0.708
	PBC_CONF	4.35	0.779
	PBC_CONTROL	4.39	0.619
	PBC_OVERCOME	4.35	0.741
Benefits	BEN_ENERGY	4.21	0.855
	BEN_HEALTH	4.32	0.735
	BEN_CONC	4.27	0.723
	BEN_EFFECT	4.18	0.769
Sociocultural	SOC_TRAVEL	4.34	0.791
	SOC_FAMILY	4.28	0.649
	SOC_TABOO	4.3	0.603
Knowledge	KNOW_INFO	4.29	0.645
	KNOW_OBTAIN	4.27	0.632
	KNOW_BEN	4.39	0.681
Personal	PERS_FORG	4.34	0.743

	PERS_BUSY	4.32	0.705
	PERS_STOP	4.32	0.698
	PERS_TOO_MEDS	4.34	0.729
Side-Effect	SE_BLOAT	4.24	0.819
	SE_TASTE	4.23	0.801
	SE_HEAD	4.23	0.8
	SE_CONST	4.21	0.934
	SE_VOM	4.16	0.865
Misconceptions	MIS_TIRED	4.34	0.637
	MIS_INTERF	4.38	0.684
	MIS_NO_HB	4.37	0.769
	MIS_PREG	4.22	0.849

Appendix G: Gender, Hospital, and Employment Status Differences in Adherence Result

Appendix G. Table G1: t-Test Results for Gender Differences in Adherence to Iron Supplementation

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ADH	Equal variances assumed	3.640	0.057	-1.949	389	0.052	-0.13681	0.07019	-0.27481	0.00119
	Equal variances not assumed			-1.970	372.877	0.050	-0.13681	0.06943	-0.27334	-0.00028

Appendix G. Table G2: t-Test Results for Hospital Differences in Adherence to Iron Supplementation

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ADH	Equal variances assumed	10.148	0.002	-3.095	389	0.002	-0.21351	0.06899	-0.34915	-0.07788
	Equal variances not assumed			-3.099	379.886	0.002	-0.21351	0.06890	-0.34898	-0.07804

Appendix G. Table G3: Hoc Tukey HSD for adherence to iron supplementation across Employment categories

Multiple Comparisons

Dependent Variable: ADH

Tukey HSD

(Field) Employment	(J) Employment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Unemployed	Employed	0.19755*	0.08242	0.045	0.0036	0.3915
	Self-Employed	0.04454	0.08942	0.872	-0.1658	0.2549
Employed	Unemployed	-0.19755*	0.08242	0.045	-0.3915	-0.0036
	Self-Employed	-0.15301	0.08525	0.173	-0.3536	0.0476
Self-Employed	Unemployed	-0.04454	0.08942	0.872	-0.2549	0.1658
	Employed	0.15301	0.08525	0.173	-0.0476	0.3536

*. The mean difference is significant at the 0.05 level.

Appendix G. Table G4: Homogeneity of Variances test for adherence to iron supplementation across Employment categories

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
ADH	Based on Mean	7.12	2	388	0.001
	Based on Median	3.015	2	388	0.05
	Based on Median and with adjusted df	3.015	2	360.533	0.05
	Based on trimmed mean	5.323	2	388	0.005

الالتزام بتناول مكملات الحديد لدى المصابين بفقر الدم: دراسة العوامل المؤثرة على الالتزام بتناول مكملات الحديد لدى الأفراد المصابين بفقر الدم

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الملخص

لا يزال فقر الدم الناتج عن نقص الحديد (IDA) يشكّل تحديًا رئيسيًا للصحة العامة في فلسطين، إذ يحدّ ضعف الالتزام بتناول مكملات الحديد من فعالية برامج العلاج. هدفت هذه الدراسة إلى تقييم مستوى الالتزام بتناول مكملات الحديد الفموية، وتحديد العوامل النفسية–الاجتماعية والديموغرافية والسياقية المؤثرة في الالتزام لدى البالغين المصابين بفقر الدم في شمال الضفة الغربية. استُخدم تصميم كمي مقطعي متعدد المراكز، شمل 391 مريضًا بالغًا من المراجعين الخارجيين المشخّصين بفقر الدم الناتج عن نقص الحديد ويتلقّون علاج الحديد الفموي في مستشفيات حكومية وخاصة في جنين. جُمعت البيانات باستخدام استبانة مُنظَّمة مستندة إلى نموذج المعتقدات الصحية(HBM) ، وتضمّنت مقاييس للفوائد المُدرَكة، والعوائق المُدرَكة، والتحكّم السلوكي المُدرَك، إلى جانب المتغيرات الديموغرافية والسريرية. شملت التحليلات الإحصائية الإحصاءات الوصفية، واختبارات الثبات، والانحدار الخطي المتعدد، والانحدار الهرمي، واختبارات(t) ، وتحليل التباين.(ANOVA)

أظهرت النتائج مستوى مرتفعًا عمومًا من الالتزام المُبلَّغ عنه ذاتيًا بتناول مكملات الحديد. وبرزت الفوائد المُدرَكة بوصفها أقوى متنبئ إيجابي بالالتزام، في حين ارتبطت العوائق المُدرَكة—ولا سيما الآثار الجانبية، والمفاهيم الخاطئة، والتحديات اللوجستية—ارتباطًا سلبيًا بالالتزام. ولم يُظهر التحكّم السلوكي المُدرَك أثرًا مستقلاً ذا دلالة إحصائية. كما أثّرت عدة عوامل ديموغرافية وسياقية في سلوكيات الالتزام؛ إذ كان للعمر، والتعليم، والدخل، ومدة تناول المكملات، والحالة الوظيفية، ونوع المؤسسة الصحية تأثير معنوي في كيفية ترجمة الفوائد المُدرَكة إلى التزام، بينما لم يُظهر الجنس تأثيرًا ذا دلالة. وسجّل المرضى المراجعون للمستشفيات الخاصة والعاملون مستويات التزام أعلى.

الخلاصة :يتحدد الالتزام بتناول مكملات الحديد لدى البالغين المصابين بفقر الدم في شمال الضفة الغربية أساسًا بتصورات المرضى للفوائد والعوائق، أكثر من اعتماده على التحكّم السلوكي المُدرَك وحده. وتدعم هذه النتائج قابلية تطبيق نموذج المعتقدات الصحية في السياق الفلسطيني، وتؤكد الحاجة إلى تدخلات تعليمية موجّهة وحسّاسة ثقافيًا، وإدارة فعّالة للآثار الجانبية، وتعزيز الدعم ضمن مرافق الرعاية الصحية العامة للحفاظ على الالتزام بعلاج الحديد وتحسينه.

الكلمات المفتاحية :فقر الدم الناتج عن نقص الحديد؛ الالتزام بتناول مكملات الحديد؛ نموذج المعتقدات الصحية؛ التحكّم السلوكي المُدرَك؛ العوائق المُدرَكة.