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Explore Risk Factors' Role in Developing Iraqi Females' Infertility

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Abstract. Infertility is a public health issue, affecting 10–15% of Iraqi women of reproductive age. This review summarizes major risk factors contributing to female infertility in Iraq, with emphasis on local evidence. Key factors include polycystic ovary syndrome (21–53%), tubal disorders (3–61%), ovulatory dysfunction (8–56%), obesity, and pelvic infections. Endocrine abnormalities such as hyperprolactinemia (~6%) and thyroid dysfunction (0.7–4%) were also identified. Regional differences reflect disparities in healthcare access, lifestyle, and exposure to infectious diseases. Infertility in Iraq is a multifactorial condition influenced by lifestyle, endocrine, structural, and infectious causes. Effective management requires a multidisciplinary approach, including lifestyle modification, infection control, and early diagnostic services. Future Iraqi studies should investigate molecular and genetic pathways to improve prevention and treatment.

Keywords: Infertility, Risk factors, Hormonal disorders, PCOS, Iraq.

INTRODUCTION

Infertility is a growing global health concern, affecting an estimated 8–12% of couples of reproductive age, with female factors contributing to nearly half of these cases [1, 2]. The World Health Organization (WHO) defines infertility as the failure to achieve pregnancy after 12 months or more of regular unprotected intercourse [3]. While infertility is a universal condition, its prevalence and risk determinants vary considerably across regions due to demographic, environmental, genetic, and lifestyle factors [4].

In Iraq, infertility represents a significant reproductive health burden, with reported prevalence ranging between 10–15% among married women of childbearing age [5, 6]. Several studies from different Iraqi governorates have identified diverse risk factors, including polycystic ovary syndrome (PCOS), tubal disorders, pelvic inflammatory disease (PID), hormonal imbalances such as hyperprolactinemia and thyroid dysfunction, as well as lifestyle-related contributors such as obesity and smoking [7, 8]. Importantly, the distribution of these risk factors shows regional variation within Iraq, reflecting differences in healthcare access, infection control, and lifestyle patterns [9]. This review aims to explore the role of major risk factors in the development of infertility among Iraqi women. Specifically, it seeks to summarize the available local evidence on sociodemographic, lifestyle, hormonal, infectious, and anatomical contributors, while highlighting their prevalence, mechanisms of action, and regional variations across Iraq. By integrating findings from recent Iraqi studies with global literature, this review intends to provide a comprehensive understanding of infertility determinants in Iraqi females, thereby supporting clinicians, researchers, and policymakers in developing more targeted diagnostic and preventive strategies.

RISK FACTORS FOR FEMALE INFERTILITY IN IRAQ

Infertility is a multifactorial condition resulting from a wide range of biological, anatomical, and lifestyle-related influences. Globally, nearly 10–15% of couples are affected, with female factors contributing to about half of the cases

[10]. The classification of risk factors is essential to understanding both the etiology and management of infertility, as it encompasses hormonal, ovulatory, structural, infectious, and unexplained categories [11]. In Iraq, infertility represents a growing public health challenge, with reported prevalence rates ranging from 10% to 15% among women of reproductive age [12, 13]. Recent local studies have highlighted that risk factors vary considerably across regions, reflecting differences in healthcare access, cultural practices, and environmental exposures. Therefore, reviewing these factors within the Iraqi context provides critical insights into their relative contributions and offers guidance for improved diagnostic and therapeutic strategies (Table 1).

SOCIODEMOGRAPHIC FACTORS

Sociodemographic characteristics play an important role in infertility, as age, socioeconomic status, and cultural practices strongly influence reproductive health outcomes. Globally, advanced maternal age is recognized as a key determinant of infertility, with a marked decline in fertility potential after the age of 35 years [14]. Iraqi local studies have emphasized the significance of these factors. Ahmed & Othman [15] reported that the majority of infertile women in Kirkuk were within the 25–36 years age group, indicating that infertility affects women during their peak reproductive years. It was observed that low educational attainment and rural residence were associated with higher infertility rates in the Najaf government [16]. Similarly, a study in the Babylon government study highlighted the role of consanguineous marriage, which accounted for a substantial proportion of infertile couples, reflecting cultural traditions that may increase the risk of genetic and reproductive disorders [17]. Moreover, socioeconomic challenges and limited access to specialized infertility care were reported as additional barriers, particularly in rural settings [12, 13]. Collectively, these findings suggest that beyond biological causes, sociodemographic conditions significantly shape the burden and distribution of infertility among Iraqi women [18].

HORMONAL FACTORS

Hormonal disorders are among the leading contributors to female infertility worldwide, often resulting in ovulatory dysfunction, menstrual irregularities, and impaired follicular development [11]. In Iraq, several studies confirm the prominent role of these disorders. Ahmed and Othman [15] reported hormonal disturbances in 15.2% of infertile women in Kirkuk, while Hussam et al. [19] found 3.48% in Baghdad. Within this group, polycystic ovary syndrome (PCOS) is the most frequent cause, ranging from 21% in Babylon [17] to 53.3% in Diyala [20]. Other endocrine factors include hypothyroidism (0.7–4%), hyperprolactinemia (5.9%), hypogonadism (2.1%), and hormonal deficiency (49.9%) [12, 19, 21]. These findings reflect both the diversity and high burden of endocrine disorders in the Iraqi population.

OVULATORY AND MENSTRUAL FACTORS

Regular ovulation is essential for fertility, and disturbances in the hypothalamic-pituitary-ovarian axis can lead to infertility [22]. In Iraq, ovulatory and menstrual problems are highly prevalent. Menstrual disorders were found in 33% of cases in Kirkuk [15] and 66% in Najaf [16]. Ovulation problems varied considerably, from 8% in Diyala [20] to 56.1% in Baghdad [19], with 13% in Babylon [17]. Reduced ovarian reserve was observed in 20% of women in Thi-Qar [24]. These findings emphasize ovulatory dysfunction as a central contributor to infertility in Iraqi women, Kirby Bauer disk diffusion method

STRUCTURAL AND ANATOMICAL FACTORS

Structural abnormalities of the female reproductive tract, including tubal occlusion, uterine malformations, and fibroids, are well-known contributors to infertility worldwide [24, 25]. In Iraq, tubal disorders show wide variation, with prevalence ranging from 3.2% in Kirkuk [15] to 61.7% in Baghdad [26], while intermediate values of 5–15% were recorded in Diyala, Baghdad, and Najaf [17, 21, 28]. Uterine factors were less frequent, reported at 1.4–7.4%, but fibroids were particularly common in Babylon, affecting 26% of infertile women [17]. Endometriosis and endometrioma were reported in 2–12% and \~1% of cases, respectively [17, 28]. These findings suggest that structural causes remain clinically significant in Iraqi infertility.

INFECTIOUS FACTORS

Infections of the reproductive tract, if untreated, can result in pelvic inflammatory disease (PID), tubal occlusion, and subsequent infertility [29]. In the Iraqi context, infections are a major concern. Pelvic inflammatory disease accounted for 10% of infertility in Najaf [16], while microbial infections were reported in 34.3% of infertile women in Baghdad [27]. In addition, fallopian tube–related disorders associated with infection were reported in 4–10% of cases in Thi-Qar and Babylon [17, 23]. These findings highlight the ongoing burden of infection-related infertility in Iraq.

UNEXPLAINED INFERTILITY

Despite advances in diagnostics, a proportion of infertility cases remain unexplained, which globally accounts for about 10–20% of cases [10]. In Iraq, unexplained infertility was reported in 6% of cases in Thi-Qar [23] and 10% in Baghdad [27]. These unexplained cases point to the limitations of routine investigations in Iraq and the need for advanced diagnostic modalities such as genetic and immunological testing.

THE CONTRIBUTORY FACTORS

In addition to the major categories of infertility determinants, several other contributory factors have been identified in Iraqi studies. Metabolic and lifestyle factors, particularly obesity and insulin resistance, exacerbate hormonal disturbances and ovulatory dysfunction. While frequently studied under PCOS, these risk factors also contribute independently to infertility by disrupting glucose and lipid metabolism [19, 30].

TABLE 1. Risk factors of female infertility in Iraq (Based on local studies)

Risk Factor	References	Year(s)	Prevalence impact Ratio (%)
Hormonal disorder	Ahmed & Othman [15]; Hussam et al. [19]	2016; 2023	15.2%; 3.48%
Miscarriage history	Ahmed & Othman [15]; Al-Najjar [16]; Jasim et al. [17]	2016; 2023; 2024	25.8%; 48%; 5%
Tubal disorder (blockage)	Ahmed & Othman [15]; Al-Ani et al. [20]; Salman et al. [27]; Al-Najjar [16]; Hussam et al. [19]	2016; 2021; 2022; 2023; 2023	3.2%; 15%; 5.6%; 8%; 61.79%
Uterine factors	Ahmed & Othman [15]; Al-Ani et al. [12]; Salman et al. [27]	2016; 2021; 2022	5%; 7.4%; 1.4%
Ovarian cystectomy	Ahmed & Othman [15]	2016	8%
Menstrual disorder	Ahmed & Othman [15]; Al-Najjar [16]	2016; 2023	33%; 66%
Ovulation problems	Hussam et al. [19]; Jasim et al. [17]	2023; 2024	56.12%; 13%
Hormone deficit	Hussam et al. [19]	2023	49.92%
Small size of the uterus	Hussam et al. [26]	2023	36.2%
Ovulation dysfunction	Al-Ani et al. [20]	2021	8%
Hypothyroidism	Al-Ani et al. [12]; Saeed et al. [21]	2021; 2021	0.7%; 4%
Hyperprolactinemia	Al-Ani et al. [12]	2021	5.9%
Endometrioma	Al-Ani et al. [12]	2021	1%
Hypogonadism	Al-Ani et al. [12]	2021	2.1%
Pelvic inflammatory diseases	Al-Najjar [16]	2023	10%
Ectopic pregnancy	Al-Najjar [16]	2023	2%
Microbial infections	Salman et al. [27]	2022	34.3%
Endometriosis	Saeed et al. [23]; Jasim et al. [17]	2021; 2024	2%; 12%
Uterine cyst	Saeed et al. [21]	2021	8%
Fallopian disorder	Saeed et al. [28]; Jasim et al. [17]	2021; 2024	10%; 4%
Ovarian reserve	Saeed et al. [21]	2021	20%
Unexplained	Saeed et al. [23]; Salman et al. [27]	2021; 2022	6%; 10%
Fibroid	Jasim et al. [17]	2024	26%
PCOS	Al-Ani et al. [20]; Saeed et al. [21]; Salman [13] et al.; Al-Najjar [16]; Jasim et al. [17]	2021; 2021; 2022; 2023; 2024	53.3%; 33.2%; 46%; 30%; 21%

Genetic and congenital anomalies, though less common, represent another source of infertility. Reports of small uterine size (36.2%) and congenital uterine anomalies underscore the role of developmental factors in impaired fertility [26].

Iatrogenic causes such as ovarian cystectomy, documented in 8% of infertile Iraqi women [11], can compromise ovarian reserve and reduce fertility potential, particularly when surgical interventions are repeated or performed at a young age. Finally, a proportion of cases remains categorized as unexplained infertility, accounting for 6–10% in local surveys [13, 28]. This underscores the need for advanced molecular, hormonal, and immunological studies, such as investigations into VEGF expression and autoimmune markers, to better clarify hidden causes. Collectively, these additional factors highlight the multifactorial nature of infertility in Iraq and the necessity of integrating clinical, metabolic, surgical, and molecular perspectives in both diagnosis and management.

PATHOPHYSIOLOGICAL INSIGHTS

Infertility is not only defined by the presence of risk factors but also by the underlying biological mechanisms that impair ovulation, fertilization, or implantation [31]. In the Iraqi context, the most prevalent contributors include polycystic ovary syndrome (PCOS), hormonal disturbances such as hyperprolactinemia, and pelvic infections, each exerting distinct but interrelated pathophysiological effects (Table 2).

Polycystic Ovary Syndrome (PCOS) and Obesity

Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorder associated with infertility among Iraqi women, with prevalence ranging between 21% in Babylon [17] and 53.3% in Diyala [20]. The syndrome is characterized by insulin resistance, compensatory hyperinsulinemia, and hyperandrogenism, which impair follicular maturation and lead to anovulation. Insulin resistance stimulates ovarian theca cells to produce excess androgens, disrupting the hypothalamic-pituitary-ovarian (HPO) axis and reducing the quality of ovulation [10]. Obesity amplifies this dysfunction by increasing visceral adiposity, which worsens insulin resistance and alters adipokines such as adiponectin and leptin. Iraqi studies have shown that women with PCOS frequently present with overweight or obesity, further linking metabolic imbalance to infertility [11, 19, 32].

Hormonal Disorders: Hyperprolactinemia and Thyroid Dysfunction

Hormonal disturbances beyond PCOS also play a central role in infertility. Hyperprolactinemia, documented at 5.9% in Diyala [20], disrupts reproductive endocrinology by suppressing GnRH pulsatility, leading to decreased luteinizing hormone (LH) and follicle-stimulating hormone (FSH) secretion, thus preventing ovulation [33]. Locally, Iraqi data confirm that women with hyperprolactinemia experience significant ovulatory dysfunction and menstrual irregularities [12]. Similarly, thyroid dysfunction, especially hypothyroidism, identified in 0.7–4% of Iraqi infertile women [12, 21], contributes to infertility by altering gonadotropin release, impairing luteal function, and affecting endometrial receptivity [34].

Pelvic Inflammatory Disease (PID) and Reproductive Tract Infections

Infections of the genital tract represent a major but preventable cause of infertility. Pelvic inflammatory disease (PID) induces salpingitis, fibrosis, and tubal occlusion, directly blocking gamete transport and increasing ectopic pregnancy risk [35]. Iraqi studies underscore this burden: Pelvic Inflammatory Disease (PID) was observed in 10% of infertile women in Najaf [16], while microbial infections were reported in 34.3% of cases in Baghdad [27]. Fallopian tube abnormalities secondary to infections were also documented in Thi-Qar and Babylon at 4–10% prevalence [17, 23]. These findings illustrate how infections remain a prominent cause of tubal factor infertility in Iraq, aggravated by limited access to early treatment and preventive care.

TABLE 2. Pathophysiological Insights of major infertility risk factors in Iraqi females.

Factor	Pathophysiological Mechanism	Impact on Fertility	Local Evidence (Iraq)
PCOS & Obesity	Insulin resistance → hyperinsulinemia → ↑ androgen production → anovulation	Irregular cycles, anovulation, reduced oocyte quality	Al-Ani et al. [12]; Jasim et al. [17]; Hussam et al. [19] Mohammed and Haddad [32]

Hyperprolactinemia	↑ Prolactin → inhibition of GnRH pulsatility → ↓ LH & FSH secretion	Ovulatory dysfunction, amenorrhea, infertility	Al-Ani et al. [12]
Hypothyroidism	Altered thyroid hormones → impaired gonadotropin secretion → luteal phase defect	Menstrual irregularity, implantation failure	Saeed et al. [23]; Al-Ani et al. [12]
Pelvic Infections / PID	Chronic infection → tubal inflammation & fibrosis → tubal blockage/ectopic pregnancy	Tubal factor infertility, ↑ ectopic pregnancy risk	Salman et al. [27]; Al-Najjar [16]

As illustrated in Fig. 1, insulin resistance and compensatory hyperinsulinemia contribute to PCOS by increasing androgen production, decreasing SHBG, and disrupting ovulation.

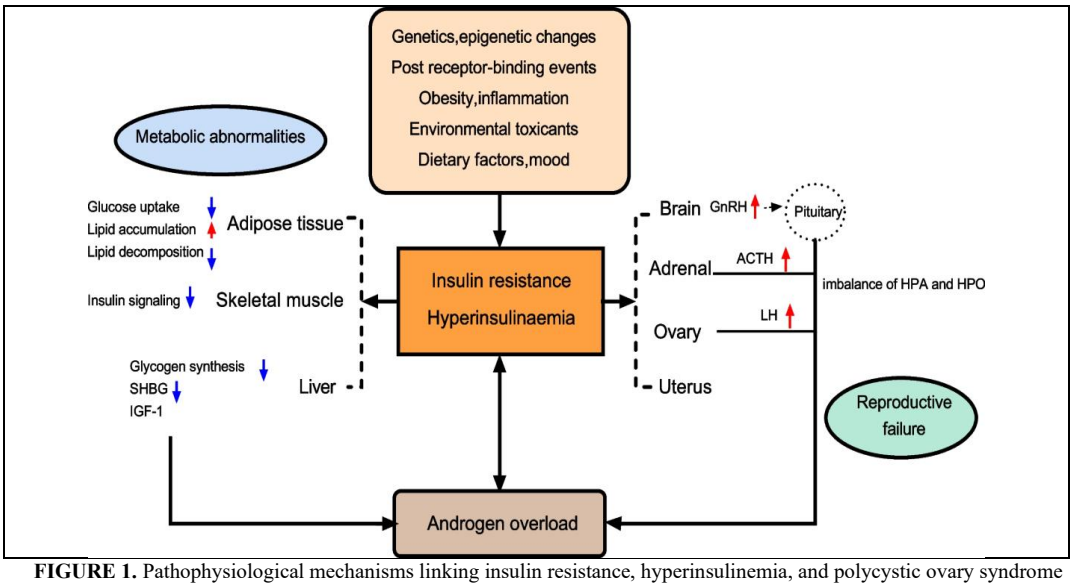

FIGURE 1. Pathophysiological mechanisms linking insulin resistance, hyperinsulinemia, and polycystic ovary syndrome (PCOS)-related infertility [36].

PUBLIC HEALTH & CLINICAL IMPLICATIONS

Infertility among Iraqi women is not only a clinical concern but also a pressing public health and social issue. The most prominent contributors, obesity, recurrent pelvic infections, and hormonal disturbances, are deeply intertwined with broader health determinants. Obesity, highly prevalent among Iraqi women, particularly those diagnosed with PCOS, is associated with insulin resistance, menstrual irregularities, and ovulatory dysfunction [11, 19]. Beyond reproductive outcomes, obesity heightens the risk of chronic diseases such as type 2 diabetes and cardiovascular disorders, magnifying its public health burden. Similarly, recurrent pelvic infections represent a major local challenge, with studies reporting prevalence rates up to 34.3% in Baghdad [27] and 10% in Najaf [16]. These infections cause irreversible tubal damage, leading to blocked fallopian tubes, ectopic pregnancies, and secondary infertility.

From a health systems perspective, these findings emphasize the need for preventive strategies. Lifestyle modification campaigns focused on diet, physical activity, and weight management are essential to reduce obesity-related infertility. Likewise, reproductive health education addressing hygiene, prevention of sexually transmitted infections, and timely medical consultation could significantly lower infection-related infertility. Early screening programs for endocrine disorders, PCOS, thyroid dysfunction, and microbial infections should be integrated into primary healthcare services to ensure earlier diagnosis and improved treatment outcomes [12]. Specialized infertility centers in Iraq have made advances in diagnostics and assisted reproductive technologies (ART). However, access remains uneven, with women in rural or low-income settings facing barriers due to financial constraints and lack of awareness. Strengthening referral systems, decentralizing infertility services, and providing subsidized care could help bridge these gaps.

Importantly, infertility in Iraq also carries a significant psychological and sociocultural burden. In a society where fertility is highly valued, childlessness can lead to stigma, marital strain, and emotional distress. Women often face disproportionate blame for infertility, even when male factors are involved [17]. These psychosocial dimensions underscore the need for incorporating counseling services, mental health support, and community-based awareness programs within infertility care.

Finally, broader socioeconomic changes in Iraq, including urbanization, improved living standards, and shifts toward delayed childbearing, sedentary lifestyles, and dietary transitions, are shaping the epidemiology of infertility. These transitions increase exposure to risk factors such as obesity, metabolic disorders, and stress-related hormonal imbalances. Addressing infertility in Iraq thus requires a multisectoral public health response that integrates medical, psychological, and social interventions.

CONCLUSION

Female infertility in Iraq is largely driven by factors such as polycystic ovary syndrome, hormonal disturbances, obesity, and recurrent pelvic infections. These risks highlight the need for a deeper understanding of the biological mechanisms that disrupt fertility. Future research should focus on molecular and hormonal markers, including Vascular Endothelial Growth Factor (VEGF) and immune-related factors, to improve diagnosis and treatment strategies. On a broader scale, national programs are required to combine prevention, early screening, and accessible therapeutic options, ensuring that both clinical care and public health efforts work together to reduce the burden of infertility among Iraqi women.

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