

Potential Environmental Factors Associated with Increased and Growing Rates of Infertility in Qatar

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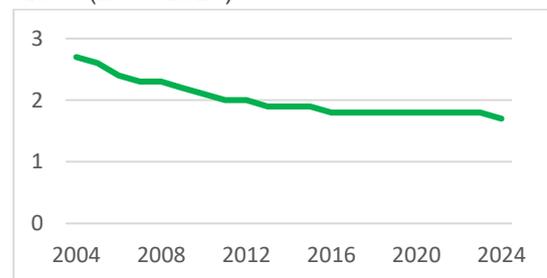
Although infertility is a national priority in Qatar, no previous research has examined couples' awareness regarding the influential roles of diet, lifestyle, and environmental factors on fertility. Since factors associated with people's lifestyles are generally regarded as modifiable, they are suitable for public health intervention. However, evidence indicates that individual behaviour should not be considered in isolation from the wider socioeconomic context; thus, a broad socio-ecological analysis is required to understand infertility. This policy brief aims to raise awareness about key environmental and behavioural factors that may affect an individual's infertility thereby influencing the development of appropriate policy measures for its prevention and treatment interventions.

Lifestyle, diet, health behaviours, and environmental issues are increasingly recognized as important risk factors affecting infertility. Studies have suggested that air pollution affects the fertility of both women and men, particularly as exposure to air pollutants causes defects during gametogenesis that impair fertility¹. Environmental pollutants can also permanently affect male reproductive capacity². A study on women's infertility in the United States found a significant association between the frequency of non-home-prepared meals (NHPMs), including fast food, ready-to-eat foods, and frozen foods, and infertility in a representative sample of U.S. adults³. Excessive consumption of fast food and ready-to-eat foods instead of NHPMs is common among the Qatari population, especially among the younger generation⁴. The absence of research focusing on the rising infertility rate in Qatar is concerning, especially considering the steady decline in fertility rates over the past two decades (See Figure 1). As illustrated in Figure 1, fertility rates among women in Qatar have decreased significantly, from 2.7 births per woman in 2004 to just 1.7 births in 2024. This notable decline underscores the growing challenges Qatar faces regarding reproductive health and the urgent need for further investigation into the factors contributing to infertility.

We know that individual lifestyle choices, especially diet choices, are influenced by wider socio-ecological factors. For example, the preference for chicken over red meat⁵ is likely attributable to increased availability and affordability rather than to taste preference alone. Studies have suggested that the consumption of commercial chickens fed with factory-produced feeds has a direct effect on hormonal irregularities, and poses a risk to health in terms of weight gain, growth, and obesity⁶.

The findings from the aforementioned studies provide evidence that environmental factors tend to impact infertility. Previous studies have lacked a focus on the association between environmental, diet, and lifestyle risk factors and infertility. In the sections below, we discuss these factors separately and in detail.

Figure 1. Fertility Rate among Women in Qatar (2003-2023)



Adapted from WorldBank. <https://databank.worldbank.org/id/36e2531c>

Air Quality

A significant number of studies have claimed that air pollution affects fertility rates. For instance, one study concluded that both animal and human epidemiological studies demonstrate that exposure to air pollutants causes defects during gametogenesis that impair fertility¹. Qatar was ranked as one of the Middle East's most polluted countries in 2020 according to the Air Quality Index (AQI), which include both indoor and outdoor air pollution⁷. This is due to rapid population growth and a building boom that has significantly increased over the past two decades.

Environmental pollutants can negatively and permanently affect male reproductive potential². However, male fertility is supported by the presence of spermatogonial stem cells (0.03% of germ cells) in the seminiferous tubules, which are sufficient to maintain fertility throughout life. In contrast, female fertility is largely determined at birth due to a fixed oocyte pool, with no confirmed stem cells for oocyte replacement. Women produce approximately 400 fertilizable oocytes between menarche and menopause, with over 99.9% of ovarian follicles lost due to atresia throughout life.

Recent research by Wagner et al. (2020), using advanced profiling methods, confirmed the absence of ovarian stem cells in adult ovaries⁸. However, this evidence remains debated and inconclusive. Despite varying opinions, researchers agree that fertilizable oocyte production is a complex process requiring strict cooperation between germinal and somatic follicular compartments and hormone interplay. If this process fails, there is no possibility of conception.

Water Contamination

Water pollution, caused by the discharge of pollutants into bodies of water, poses significant risks to human health, especially reproductive health⁹. The Arabian Gulf is heavily impacted by pollution from industrial activities and urban development, particularly along Saudi Arabia's east coast. Qatar faces severe water stress, with low rainfall, minimal fresh groundwater, and water resources far below the poverty line. Industrial activities, particularly those tied to oil production, are major contributors to water pollution in Qatar. This contamination of water sources poses a significant threat to the environment and to all living beings.

Several studies have indicated that oil and gas extraction negatively affects human fertility, increasing the risk of preterm birth, miscarriages, birth defects, and reduced semen quality¹⁰. The Qatari government needs to pay greater attention to these processes to overcome the infertility problem.

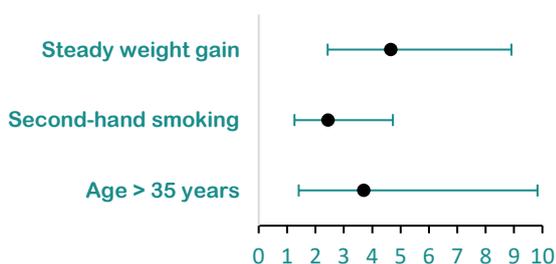
Lifestyle and Climatic Conditions

Modifiable lifestyle factors, including fat-rich diets, smoking, alcohol misuse, sexual behaviour, anxiety, and beliefs, significantly influence overall health and fertility. Studies have shown that these factors negatively impact fertility in both men and women. Stress related to these factors often leads to harmful behaviours such as excessive alcohol and caffeine consumption, smoking, and drug misuse, increasing the risk of infections and sexually transmitted diseases, which can further contribute to infertility^{11,12}.

Lifestyle factors, including vitamin D supplementation, diet, eating habits, and physical activity, play a crucial role in fertility. Vitamin D, in particular, is associated with enhanced fertility and positive pregnancy outcomes, such as improved IVF success rates. In Qatar, however, vitamin D deficiency

is highly prevalent due to socio-cultural influences, such as reduced sun exposure during the hot summer months, limited outdoor activities, and high stress levels. Furthermore, insufficient physical activity contributes to obesity, diabetes, and depression, which collectively impact fertility. These interconnected issues are directly linked to declining fertility rates in Qatar.

Figure 2. Top Three Infertility Risk Factors among Qatari Women: Forest Plot of Odds Ratios



Adapted from Musa, S., & Osman, S. (2020). Risk profile of Qatari women treated for infertility in a tertiary hospital: a case-control study. *Fertility Research and Practice*, 6, 1-17.

Type of Food Consumed

Dietary practices, particularly the consumption of a balanced diet, are crucial for reproductive health. A U.S. study found a significant link between the frequency of NHPMs, such as fast food and ready-to-eat items, and infertility in women³. In Qatar, excessive consumption of fast food and ready-to-eat meals is especially common among younger generations. Research indicates that the feed used for raising commercial chickens can impact hormones, potentially affecting human health. Regular consumption of commercial chicken has been associated with risks such as weight gain, obesity, hormonal imbalances, the progression of PCOS, and infertility⁶. As shown in Figure 2, the top three infertility risk factors among Qatari women are significantly linked to lifestyle and diet, with a notable trend in the increasing consumption of NHPMs. Specifically, steady weight gain is one of the most significant risk factors for infertility among Qatari women, with an odds ratio (OR)

of 4.65. This indicates that women experiencing steady weight gain are more than four times as likely to face infertility compared to those who maintain a stable weight. The increasing prevalence of this risk factor, linked to dietary habits, highlights the importance of addressing lifestyle factors to improve reproductive health outcomes in Qatar.

The findings from the studies mentioned above provide evidence that environmental factors influence infertility. While these studies rely on clinical data, experiments, and case studies, no empirical research has yet been conducted to validate and test their conclusions.

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Policy Recommendations

The following multi-faceted policy measures, aligning with Qatar's national goals are recommended to combat environmental factors that may contribute to the infertility rates:

1. Environmental Regulations:

Air Quality Standards: Implement stricter controls on industrial emissions and vehicle pollutants to reduce infertility risks. Invest in sophisticated air monitoring systems and produce air quality reporting. Make such reporting available to the public.

2. Public Awareness and Education:

Health Campaigns: Launch educational initiatives to inform the public about the effects of pollution, diet, and lifestyle choices on reproductive health. Raise awareness about household toxins found in cleaning products and cosmetics.

3. Healthcare Policies and Research:

- **Screening and Early Detection:** Integrate environmental health screenings into routine medical check-ups to promote early detection of and care for exposure to harmful substances.
- **Research Funding:** Allocate funding for R&D in identifying local environmental contributors to infertility

4. Sustainable Urban Development:

Green Spaces: Implement expansion plans for green spaces in urban areas to reduce air pollution and improve overall mental and physical health.

5. Food and Water Safety:

- **Pesticide Use in Agriculture:** Encourage organic farming practices and regulate the use of harmful pesticides that may affect fertility.
- **Water Quality:** Ensure stringent testing and treatment of drinking water to eliminate contaminants that may disrupt hormones and risk infertility.

6. Workplace Protections:

Exposure Limits: Implement workplace regulations to minimize workers' exposure to harmful chemicals, especially in high-risk industries like oil, gas, and manufacturing.

7. Healthy Lifestyles:

Nutrition Programs: Endorse diets rich in antioxidants and essential nutrients to counteract the negative effects of environmental pollutants on fertility.