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IMPACT OF MODERN LIFE STYLE, ENVIRONMENT AND AGE ON FEMALE FERTILITY

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ABSTRACT

The primary condition that has affected humanity is female infertility. Factors such as infertility resulting from genetic disorders, stressful environments, excessive radiation, inadequate nutrition, changing lifestyles, and elevated electronic discharge have all contributed to the infertility of females. Great personal sorrow and distress are brought on by infertility and childlessness. The majority of this suffering is concealed from view. This is the reason why there isn't an open discussion of this subject. The fundamental cause of the public's lack of sympathy for childless couples is their deplorable ignorance and indifference of the causes and treatments of childlessness. There is a growing trend in the Western World to put off having children. Consequently, many couples may find it difficult to conceive as a result of age's detrimental effects on oocyte quality. Furthermore, lifestyle factors may exacerbate a couple's difficulty in conceiving due mainly to the metabolic influence of obesity; however, the negative impacts of low peripheral body fat, excessive exercise, the increasing prevalence of sexually transmitted diseases, and smoking all have significant negative effects on fertility. Other factors that impede conception are the perceived increasing prevalence of the polycystic ovary syndrome, which is further exacerbated by obesity, and the presence of uterine fibroids and endometriosis (a progressive pelvic inflammatory disorder) which are more prevalent in older women. A tendency for an earlier sexual debut and to have more sexual partners has led to an increase in sexually transmitted diseases.

KEYWORDS: Female infertility, Modern lifestyle, Nutrition, Environment.

1. INTRODUCTION

Couples seeking guidance, hope, and eventually parenthood are increasingly visiting fertility clinics worldwide these days. But being a human being at birth is a blessing, and having children is a double standard. A woman who is unable to bear children in this culture is subjected to unspeakable agony, which transcends all boundaries, castes, creeds, and religions. The conventional view is that being barren is a curse and should be hated. Women lose hope for the future when their fertility is lost due to childlessness.

People who are infertile or childless experience immense personal pain and anguish. Childless couples face social isolation and consequent vulnerability on an emotional level in many parts of the world. Within certain communities, women are subjected to intense pressure to become pregnant, and they frequently experience the worst effects of this pressure.

Like a chronic illness, being childless drains a couple's emotional and financial reserves and requires a significant investment of time, money, and both physical and mental energy. The fast population expansion of today makes fertility control more important and requires monitoring. [1]

Figure 1: Image representing a foetal growth.

2. Infertility

An infertile patient may experience negative effects from their medical condition as well as psychological, physical, mental, and spiritual ones. No pregnancy after a year of unprotected sexual activity is the standard definition of infertility. As said, this measurement is relative. Pregnancy can occur in many couples over time. Two out of every five "infertile" couples will become pregnant in five years. One illness that prevents a person from becoming pregnant is called infertility.

Following an infertility diagnosis, an individual who was designated female at birth (AFAB)

- Six months of trying to get pregnant if you're older than 35.
- One year of trying to get pregnant if you're younger than 35.

Infertility is the state in which a woman experiences repeated miscarriages. Many couples struggle with infertility. The woman is responsible for infertility about one-third of the time. In a further third of the cases, the male is to blame. The remaining cases are either due to both partners or no cause at all.

Not all cases of infertility affect women exclusively. Infertility caused by the woman occurs in only approximately one-third of cases (female factor LL, s). Another third of infertility cases have male factors (the inability to conceive). The causes of the remaining cases are either unidentified or a combination of male and female variables.

Infertility affects 15% of couples. About 20% of these cases are male infertility out of this 15% total. Up to 70% of these cases are caused by female infertility, which is mostly because the female reproductive system involves incredibly complicated processes.

From the perspective of reproductive health, infertility is a condition that does not endanger life or harm an individual's physical integrity. That being said, as most couple's view having children as a primary goal, such a deficiency could have a detrimental effect on an individual's development, leading to frustration and personality weakening. The human being is incredibly inefficient in reproducing when compared to other animals.

In couples with confirmed fertility, the cumulative pregnancy rate is approximately 90% after 12 months and 94% after two years. The fertility rate each cycle is approximately 20%.

It is challenging to establish the evidence for shifts in the prevalence of infertility. There are at least four possible causes for this increase: postponed parenthood, changes in sexual behaviour, the removal of most taboos, and variations in semen quality brought on by alcohol and cigarette use.[2]

2.1 Female infertility

One of the main causes of infertility in women is a common occurrence. A female spouse with a "problem" appears in at least half of all infertility consultation pairs. Only approximately 5% of couples seeking infertility support believed their situation was the result of male infertility in the past, when the female partner was typically held primarily responsible. One of the main causes of infertility in women is a common occurrence. A female spouse with a "problem" appears in at least half of all infertility consultation pairs. Only approximately 5% of couples seeking infertility support believed their situation was the result of male infertility in the past, when the female partner was typically held primarily responsible.

Female infertility may be due to

- Problems with a fertilized egg or embryo being able to survive once it is attached to the lining of the uterus
- Problems with the eggs being able to attach to the lining of the uterus
- Problems with the eggs being able to move from the ovary to the uterus
- Problems with the ovaries producing eggs.[3]

2.1.1 Types of female infertility

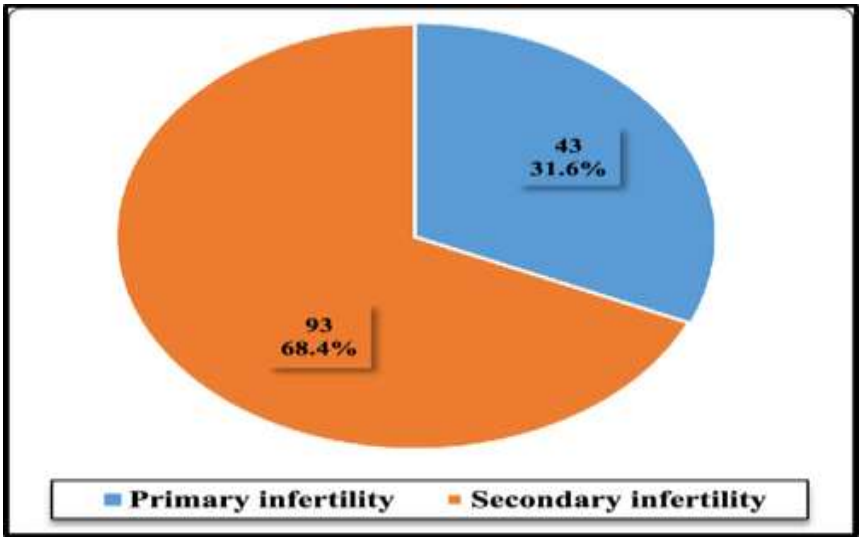

Figure 2: Types of infertility.

Infertility can be classified into three types

- Primary infertility
- Secondary infertility
- Unexplained fertility.

(a) Primary Infertility

Refers to the condition in which a couple has never been able to conceive.

Endometriosis

Impacts approximately 40% of women who have endometriosis and primarily affects women in their 30s to 40s. The discovery of uterine lining outside the body occurs in this situation. Procreation will be difficult for someone with endometriosis. Scarring and adhesions that induce a blockage appear to be the primary causes of endometriosis-related infertility.

Polycystic Ovarian Syndrome (PCOS)

The unfortunate fact about PCOS is that, although it is one of the primary reasons of infertility in women, only a small percentage of cases are properly diagnosed (less than 25% of affected women). The syndrome's symptoms typically don't seem to be related to one another, which is one of the main reasons it goes undiagnosed. Typically, a woman is unaware that she has PCOS until she experiences difficulties becoming pregnant and seeks medical assistance. Weight gain, acne, infertility, irregular or non-existent menstruation cycles, and failure to ovulate are a few signs of PCOS. A number of blood tests are used to diagnose PCOS. It is easily controllable by using hormones that will trigger ovulation and will also help you get pregnant.

Ovulatory disorders

About 40% of female fertility problems are caused by ovulation problems such as irregular periods or falling to ovulate at all. These disorders can be caused by a variety of things such as excessive weight loss, stress, thyroid problems or hormone imbalances.

Premature Ovarian Failure (POF)

The diagnosis of premature ovarian failure (POF) can be quite distressing because it indicates that, although being under 40, you are no longer menstruating. The ovaries' resistance to your body's natural hormones throughout your 20s and 30s, or problems from before birth (such as a chromosomal anomaly that results in faulty ovaries), can be the cause of polycystic ovary

syndrome (POF). POF has also been linked to radiation, chemotherapy, and pelvic surgery. POF is rare in cases where a woman's family history includes it.

Uterine factors

Uterine factors can contribute to infertility in several ways, including:

- ✓ **Uterine fibroids:** Non-cancerous tumours that can distort the uterine lining or interfere with implantation. Symptoms include heavy or irregular vaginal bleeding, pelvic pain, and pain during sex.
- ✓ **Polyps:** Growths in the endometrial tissue that can block the fallopian tubes or prevent implantation.
- ✓ **Congenital abnormalities:** These include conditions like uterine septate, bicornuate uterus, unicornuate uterus, and didelphys.
- ✓ **Adhesions:** Scar tissue that can block the fallopian tubes or interfere with implantation.
- ✓ **Hysterectomy:** A surgical procedure that can cause uterine factor infertility.
- ✓ **Radiation damage:** Can cause uterine factor infertility.
- ✓ **Severe endometriosis:** Can cause uterine factor infertility.
- ✓ **Adenomyosis:** Can cause uterine factor infertility.

Multiple miscarriages

Losing a miscarriage is never easy, but it can be especially distressing when it occurs after months of trying to conceive. Although genetic disorders in the foetus are the primary cause of miscarriage, other factors that may contribute to the miscarriage include abnormal hormone levels, infections, or environmental pollutants.

Luteal Phase defect(LPD)

This can be caused by two things both involving your body’s progesterone development. The first cause of LPD is attributed to your ovaries not secreting enough progesterone. The second reason could be that your endometrium is not responding is not properly prepared for pregnancy, thereby causing either fertility problems or an early miscarriage.

(b) Secondary infertility

Secondary infertility describes situations in which a couple tries for a child at least once but is unable to conceive again. It's critical that you and your partner stay in constant communication so that you are both aware of one other's goals, desires, and willingness to take on parenthood once more.

(c) Unexplained infertility

If you are experiencing infertility, this could be one of the most upsetting things you hear. Indeed, one in five couples will be told that their infertility is inexplicable even after undergoing a battery of tests to determine the cause of their infertility. This does not imply that the cause of your infertility issues is unaccounted for. Instead, the tests that are now available are unable to pinpoint the precise nature of the issue.[4]

2.2 Infertility may be caused due to

- Direct risk factors
- Indirect risk factors

(a) Direct risk factors

The etiology and frequency of infertility are greatly influenced by environmental, cultural, social, and medical policies and practices. Over time, the percentages of infertility reasons have likewise varied. A number of pathophysiological factors contribute to infertility, such as:

- ✓ Endocrine dysfunction leading to ovulatory infertility;
- ✓ Sexually transmitted diseases (STD) that cause tubal infertility;
- ✓ Congenital anomalies of the uterus and autoimmune disease impact conception and pregnancy loss.

Table 1: Distribution of direct risk factors between Primary and Secondary infertile women.

Direct risk factors of Infertility	Primary infertility (n=90)	Secondary infertility (n=21)
Disease of ovary	17	6
Ovulation failure	23	4
Tubular disease	4	3
Uterine disease	12	4
Pelvic inflammatory disease	12	0
Unrecognized	17	4
Multiple factors	5	0

(b) Indirect risk factors

Anaemia, Malnutrition, Poverty, Lifestyle, Stress, postponing parenthood, and Obesity are responsible. There is a causal link between infertility and reproductive health problems like STD, urinary tract infections (UTI), reproductive tract infections (RTI), unhygienic delivery, postpartum infection, and unsafe obstetric and abortion leads to sepsis and pelvic infections.

Table 2: Distribution of indirect risk factors between primary and secondary infertile women.

Indirect risk factors of infertility	Primary infertility (n=90)	Secondary infertility (n=21)
Overweight or obesity	14	15
Anaemia	32	0
Diabetes mellitus	5	4
Unrecognized	34	0
Multiple factors	5	2

The proportions of causes of infertility also have changed over time Several pathophysiological determinants of infertility include:

- Endocrine dysfunction leading to ovulatory infertility.
- Sexually transmitted diseases (STD) that cause tubal infertility.
- Congenital anomalies of the uterus and autoimmune disease impact conception and pregnancy loss.[5]

3. Modern aspects that disturbs the female fertility

A woman's fecundity is her hereditary potential to reproduce based on her monthly likelihood of conception, whereas fertility is the ability of an individual to reproduce itself. A couple's incapacity to become pregnant following a year of unprotected sexual activity is known as infertility. Infertility due to both male and female causes affects about 15% of the global population. Almost equal accounting The prevalence of infertility is increasing, drawing focus away from genetic causes and toward environmental factors. There are many different causes of female infertility, including endometriosis, chromosome abnormalities, lifestyle choices, ovulatory disorders, tubal factors, genetic mutations, and infertility that remains unexplained. Lifestyle issues have garnered significant attention recently, as seen by multiple studies that indicate unhealthy lifestyle choices The physiology of women can be long-term affected by

- Eating habits,
- Stress,
- Drinking,
- Smoking, and
- Obesity.

- According to reports, these lifestyle choices considerably reduce women's chances of becoming pregnant and can have an impact on an individual's overall health and ability to reproduce.

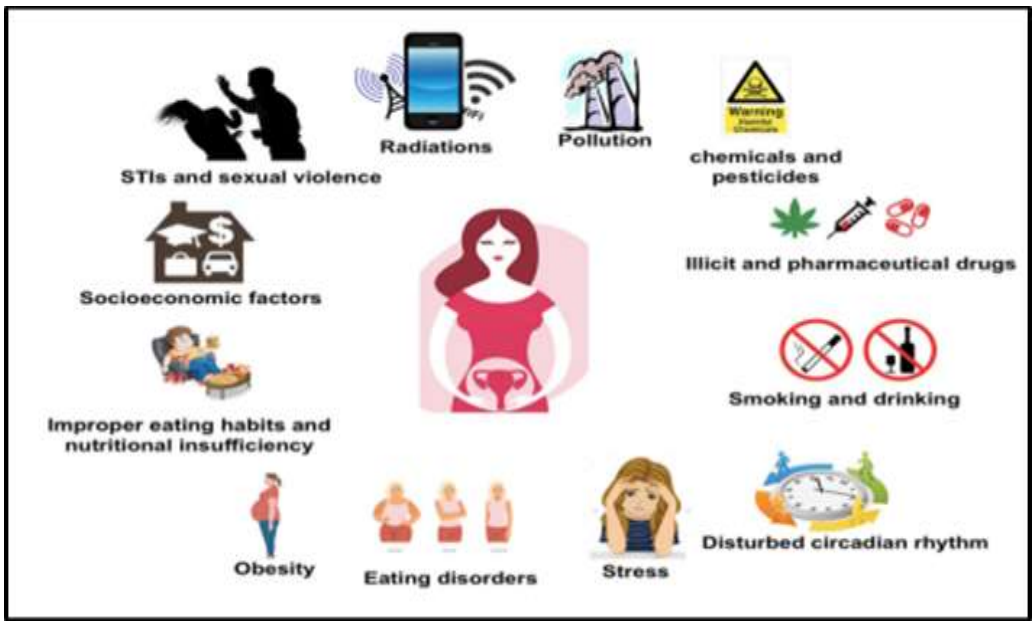

Figure 3: Various lifestyle factors that may affect female fertility.

Delayed child bearing /Starting a family

An important factor in human reproduction is age. This is due to the fact that as people age, both men and women experience several physiological changes. This is made worse by the significant influence of environmental and socioeconomic factors, which, despite advances in science and technology, have not contributed to an increase in reproductive capacity. Men who put off having children or who get older may produce spermatozoa of low quality. While age has an effect on both sexes, mother age has the biggest influence on procreation. All of a woman's future egg cells are present at birth. Over time, they become fewer and of lower quality, and by the time she reaches 35, her fertility has decreased.

The benchmark of natural fertility is typically supplied by the Hutterite people, who lead a relatively basic communal lifestyle that forbids the use of contraception. The incidence of genetic abnormalities and spontaneous abortion also rises with maternal age. They demonstrated a steady fall in the pregnancy rate as female age increased. Wood's study indicates that a 50% reduction in perceived reproductive potential at age 35 could result from delaying family formation and aging. Fecundability refers to the capacity to become pregnant

throughout a menstrual cycle. Women receiving ART who have lower conception rates as they age also experience a similar consequence.

In order to save energy for somatic maintenance and to lessen the challenges connected with aberrant pregnancy outcomes in advancing age, the biological clock that controls the female reproductive life span has existed. Due to rising social behaviour that keeps both genders out of relationships and **childbearing until the late thirties and early forties, combined with economic factors and education and career aspirations,** men and women are frequently unaware of the risk associated with delayed childbearing despite the substantial evidence of declining fertility with age.

When it comes to delayed childbirth, the age at which to start a family, and the counselling of those pursuing fertility treatments, couples and healthcare providers alike must be aware of the biological aspects of aging as it relates to fertility in both sexes. Despite the fact that men can still produce semen at a later age, research has shown that sperm quality, DNA integrity, telomere length, sperm quality, and epigenetic variables are all significantly influenced by increased paternal age. Aging-related alterations have a negative effect on fertility and reproductive outcomes, including congenital birth abnormalities, foetal death, repeated miscarriages, and infertility. Achondroplasia, schizophrenia, bipolar disease, and autism have all been related to paternal age. An imbalance between the formation of reactive oxygen species and the availability of antioxidants in the bloodstream leads to higher levels of oxidative stress in older couples.[6]

3.1 Fertility decline related to age

Age-related fertility drops rises as long as women continue to defer having children until later in life. For all women approaching menopause, declining fertility is a natural physiological process. Given the availability of solutions like oocyte preservation for individuals wishing to have children later in life, patient counselling and education regarding age-related fertility decline is therefore an essential component of family planning. recognizing the overall pattern of age-related fertility. The quantity of oocytes in females is limited at birth. Unlike their male counterparts, females probably don't produce new gametes all through their lives not produce fresh gametes during their existence. Around 20 weeks of pregnancy is when the number of oocytes peaks in utero, and it thereafter steadily declines until about age 32. This age range allows clinicians to provide appropriate counselling before fertility irrevocably

falls, as the number of oocytes decreases at a greater pace until age 37, after which the loss in oocyte numbers is much more rapid.

Human female fertility is impacted with aging. A 35-year-old woman being pregnant might have been unusual in the past, but nowadays, it's not uncommon for women over 35 to become pregnant with their first or second kid. The world over, decreased fertility is a contemporary issue that assisted reproductive technology can't always readily resolve. There are multiple reasons behind the age-related drop in fertility. But the main underlying cause is declining oocyte quantity and quality with aging. A possible deterioration in uterine health, variations in the ovulatory cycle, exposure to environmental pollutants, and an elevated risk of pregnancy problems and miscarriage are other considerations. As a result of atresia, the ovary produces fewer gametes overall, with an initial reduction from the peak quantity of roughly 6–7 million gametes at 20 weeks of gestation to roughly 1–2 million oocytes at birth to 300,000–500,000 at puberty to 25,000 at maturity.

At age 37, and approximately 1,000 at age 51. Menopause typically occurs around 51 years old. During the perimenopause, there are no known ways to stop or reverse this decrease of gametes. Oocyte atresia may be caused by changes in circulating hormone levels, notably a rise in follicle-stimulating hormone and a decrease in anti-mullerian and inhibin B hormones. The precise mechanism underlying this phenomenon is unknown. Furthermore, as people age, their oocyte quality declines. The key to successful reproduction is a high-quality oocyte. Because the genetic makeup of gametes has a direct impact on quality, older women are more likely to have lower gamete levels.

Greater than in males. The prevalence of Down syndrome in moms under 25 is about 2%. But that risk rises to nearly 35% in women 35 years of age or older. The probability of chromosomal abnormalities, particularly aneuploidy, rises with age. When a germ cell has the wrong number of chromosomes, the condition is known as aneuploidy. An oocyte's quality is significantly impacted when such aneuploidy is present.

This in turn impacts fertility, since aneuploidy is one of the most common causes of infertility and a frequent cause of early miscarriages. Approximately 35% of clinically diagnosed miscarriages and 65% to 75% of early failed pregnancies can be related to aneuploidy. When compared to a mother who is younger than 25, the probability of aneuploidy increases tenfold after the mother reaches 40. Meiotic nondisjunction resulting from meiotic spindle

modifications is the main cause of aneuploidy, although nothing is known about how to reverse that process. It is evident that age is relevant. [7]

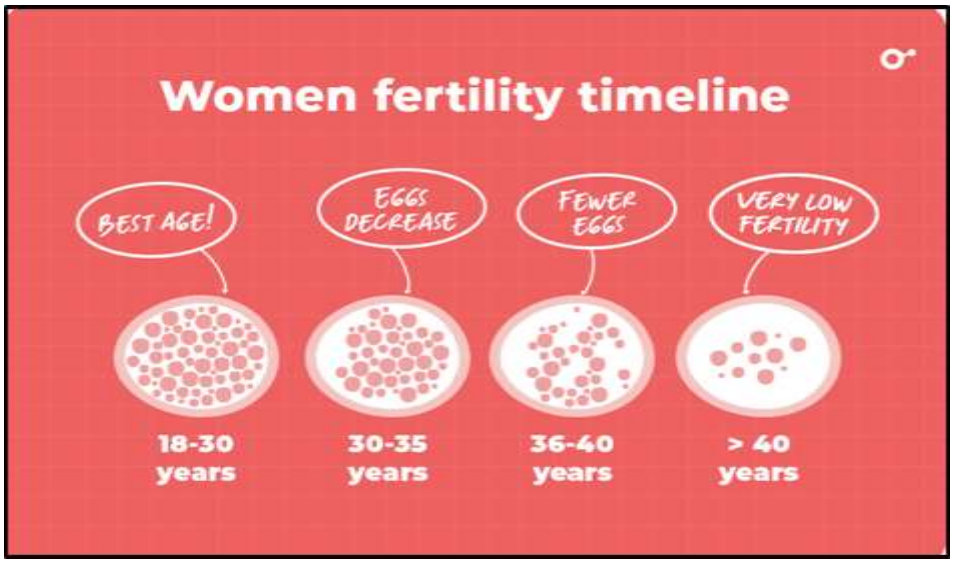

Figure 4: Women fertility timeline based on age.

3.2 Nutrition

A growing issue for couples trying to conceive is infertility. An increasing amount of research indicates a connection between female fertility and diet. In fact, evidence suggests that a diet heavy in added sugars, processed carbs, and trans fats may have detrimental effects on fertility. On the other hand, female fertility is positively affected by a diet that follows the Mediterranean dietary patterns, which are high in plant-based protein, dietary fibre, omega-3 (^{w}-3) fatty acids, vitamins, and minerals. The makeup of the gut microbiota can be disturbed by an unhealthy diet, therefore it is worthwhile to look into whether the frequency of infertility is correlated with the microbiota's composition. However, it seems likely that phytoestrogens increase female fertility possess a favourable impact on the fertility of women. However, there are still a lot of unsolved questions concerning supplements to increase fertility. It is proven that folic acid supplements are advisable for women who are fertile. Also, the majority of people are deficient in iodine and vitamin D, so it's critical to monitor blood concentrations and, if needed, think about supplementation. Consequently, given that nutrition and lifestyle appear to have a big impact on fertility.

The diet of the Mediterranean region. A diet following the Mediterranean diet (MeD) guidelines has been shown to improve both physical and mental health, according to recent studies. Additionally, the MeD has been linked to positive adjustments in the context of fertility, these factors are critical: insulin resistance, metabolic disorders, and the risk of

obesity. Low-fat dairy and poultry, oily fish, fruits, olive oil, unprocessed carbs, and red wine are all consumed in large quantities during the MeD, while red meat and simple sugars are consumed in small amounts. Adherence to the MeD was found to positively correlate with fertility.

Furthermore, research indicates that maintaining a healthy diet can also improve the odds of a live birth for women utilizing assisted reproductive technology (ART). For women who were planning a pregnancy or became pregnant during the study, adherence to a pro-fertility diet, which is comparable to the MeD, was associated with a decreased risk of ovulation disorders-related infertility. Reduced consumption of trans-fatty acids (TFAs), increased consumption of monounsaturated fatty acids (MUFAs) and plant-derived protein, and decreased consumption of artificial protein, low-GI, high-fibre, and interestingly high-fat dairy were the hallmarks of the pro-fertility diet.

The pro-fertility diet women consumed more non heme iron and did so more frequently at least three times per week took multivitamins, namely group B vitamins (folic acid, for example), drank more wine and coffee, and engaged in more physical activity.

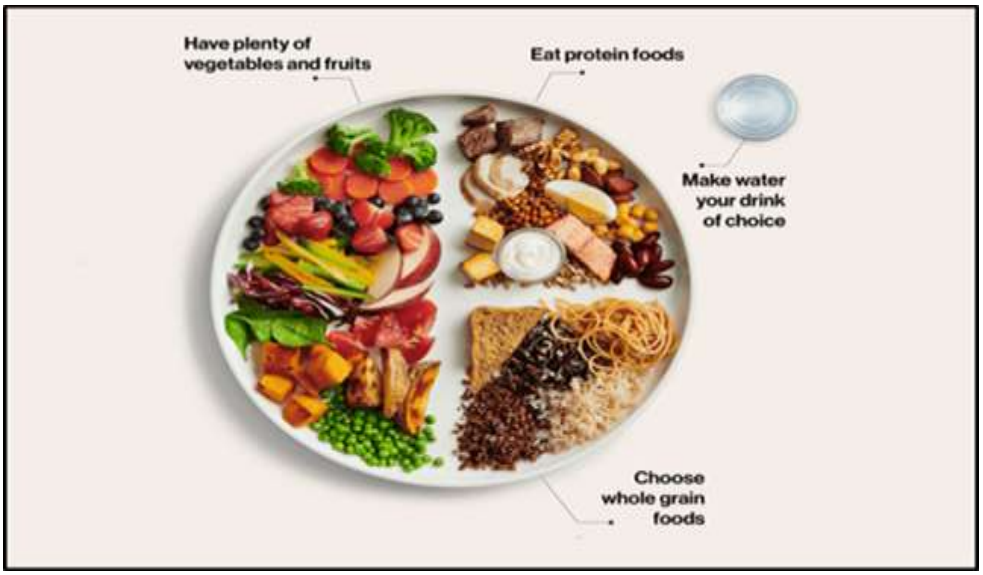

Figure 5: Mediterranean diet.

Rate of embryo cleavage was unaffected by omega-3, vitamin D, and olive oil (which mimicked MeD) supplements given prior to in vitro fertilization. Serum vitamin B-6 and RBC folate showed a correlation with the MeD. Furthermore, the likelihood of conception rose for couples undergoing in vitro fertilization who adhered to the MeD more closely. Although it may be highly debatable in the context of female fertility, it should be highlighted

that moderate wine consumption for women, this equates to one glass of red wine per day is a component of the MeD. Despite the fact that most studies show dose-dependent relationships between alcohol use and fertility, it is important to remember that some pregnancies still happen spontaneously.

The diet in the West, The **Western-style diet (WsD)** is higher in red and processed meat than the MeD because it contains more refined and simple carbohydrates (mainly sugar, sweets, and beverages with added sweetness). Additionally, it is distinguished by a reduced consumption of raw fruits and vegetables, unprocessed cereals, low-fat poultry, and fish. One way to characterize it might be as follows: low intake of vitamins and dietary fibre, and high intake of calories, fat, and glycemic index.IL-1RA dropped with the WsD. levels and the cortisol-cortisone ratio in the follicular fluid, as well as a decrease in blastocyst count. Furthermore, there was a slight increase in the time it took to become pregnant and an association between infertility and higher fast food consumption and lower fruit intake. A study conducted on animals also revealed that the WsD changed ovarian cycles and hormone levels, decreasing progesterone and anti-Müllerian hormone. The research additionally showed that the WsD induced an increase in antral follicles and a delay in the onset of the estradiol surge. Fertility may be adversely affected by a diet strong in animal protein, TFAs, and SFAs yet low in glycaemic index.[8]

Figure 6: Western diet.

3.3 Impact of junk food on female fertility

All metabolic and endocrine disorders are frequently caused by obesity. Excessive fat deposition is referred to as obesity, and it raises the likelihood of each problem. Obesity-

related metabolic illnesses impact our health through the body mass index (BMI), which is computed based on weight, height, and age. Polycystic ovarian syndrome (PCOS), abnormal uterine bleeding (AUB), miscarriage, and infertility are among the metabolic and gynaecological conditions that are closely linked to an elevated body mass index (BMI). Worldwide obesity rates have increased to 26% for women and 18% for teenage girls. The amounts to 18%. The rise in obesity from adolescence to adulthood brought on by junk food has led to the term "global pandemic" since the turn of the twenty-first century. Junk food is characterized as high-fat, high-salt, high-cholesterol, and high-calorie items with minimal nutritious value. In addition, it has a lot of sodium, refined carbs, and preservatives. Chocolate, candies, potato chips, refined carbohydrates, trans fats, salt, and high fructose corn syrup are a few examples. Compared to traditional food, which has high nutrition content, junk food has poor nutrient density, vitamins, or minerals and supplies calories through added sugar, fats, and refined carbs. This is unhealthy food with high quantities of trans fats, refined sugar, and saturated fats, which is the root cause of obesity and has negative effects on the body's physical, mental, and social aspects. Teenage females' diet, a survey found that a substantial percentage of schoolgirls consumed junk food. Depending on the type of junk food consumed, there was an association between intake and obesity that was primarily based on BMI. High calorie, sugar, and salt content junk food can contribute to early cardiovascular diseases (CVD) and other issues in adolescents. Consuming junk food and engaging in less physical exercise can lead to dysmenorrhea, irregular menstrual periods, and premenstrual symptoms, all of which can negatively impact a woman's health and well-being. Menstrual disorders are primarily caused by junk food, psychological stress, and lifestyle variables; BMI is a significant factor in these illnesses I.e. Approximately 70–80% of women may also experience food cravings, changes in appetite, and overeating prior to menstruation. Due to progesterone's effect on appetite and junk food intake when oestrogen is present, these desires are brought on by the menstrual cycle.

3.3.1 Junk food's effects on obesity

With the growing variety and consumption of junk food, the younger population is becoming more and more overweight and obese. This adds to the hazards and challenges in public health. The main causes of this increase are the variety, taste, accessibility, and cost of junk food. Students find it simpler to quench their cravings for junk food due to peer pressure in their daily lives, often without comprehending the negative effects of such foods on their bodies.

But there are other lifestyle decisions that also contribute to obesity, so this is not the only cause of it. One or more of the following:

- ✓ Non-communicable diseases like precocious puberty,
- ✓ Early menopause,
- ✓ PCOS,
- ✓ Infertility
- ✓ Cardiovascular complications,
- ✓ Hypertension,
- ✓ Diabetes mellitus.[9]

3.4 Environment

3.4.1 Air and Noise pollution

Worldwide, environmental pollution has grown to be a serious health risk to people. The majority of common air pollutants are either heavy metals (Pb, Zn, Cu, etc.) or endocrine disruptors (PAHs, polycyclic aromatic hydrocarbons, etc.), which produce reactive oxygen species (ROS) (NO2, O3) or damage DNA by changing gene expression or epigenetic marks. The primary mechanism by which aryl hydrocarbon receptor (AhR), oestrogen, and androgen receptors are activated is that of endocrine disruptors, or PAHs. In the female reproductive system, ovarian follicle development, ovarian steroidogenesis, and ovulation are all regulated by AhR. Oxidative stress, which is caused by air pollutants (NO2, O3) generating ROS, can have an impact on ovarian functioning, ovulation, and folliculogenesis. Increased risk of mutation, apoptosis, hypo- and hyper methylation of genes, and disruption of mitochondrial function are caused by DNA alterations/epigenetic changes resulting from ROS-generated oxidative stress and the possible carcinogenic influence of some air pollutants. Menstrual irregularities caused by benzene exposure, oligo-menorrhea caused by occupational exposure to styrene, xylene, benzene, toluene, and other solvents, and a notable drop in estradiol levels during the luteal and follicular phases but not during the ovulatory phase (pollutants from automobile traffic) have all been reported in a few human studies on female subjects.

Noise pollution has long been disregarded for its detrimental impacts on health, but an increasing number of research have demonstrated how noise pollution affects people's behaviour and physical health.

Noise pollution can cause

- Anger,

- Stress,
- Distraction,
- Agitation,
- Depression,
- Anxiety,
- Sleep disturbances,
- Sexual impotence, and
- Emotional instability.

Regular exposure to noise levels between 65 and 85 dB might result in elevated blood lipid levels, hypertension, heart rate, adrenaline, norepinephrine, and cortisol. The duration and severity of noise pollution can determine whether its effects are easily reversible or irreversible. Although research on the direct impact of noise pollution on fertility is lacking, it is highly likely that the disruption of several physiological factors mentioned above will have a negative impact on HPG axis, menstrual cycle and fertility.

3.4.2 Solvents and Chemical exposure at work

People are also at risk for a range of health problems when they are exposed to different chemicals due to their work environment and lifestyle choices. Reproductive physiology is affected by exposure to solvents used in paints, varnishes, dry cleaning, electronics, and medications. Those who work with chemicals in factories, mines, agriculture, medicines, and other indoor and outdoor environments are inevitably exposed to a variety of toxicants that can have a deleterious effect on fertility. It has been demonstrated that indoor pollution in females during the preconceptional period, caused by the use of wood, coal, and tires for cooking and heating, increases the incidence of neural tube anomalies in children, including anencephaly.

3.4.3 Radiation exposure

As a result of naturally occurring processes, exposure to both ionizing (gamma-rays and x-rays) and nonionizing (electromagnetic, ultrasonic, and radio waves) radiation Exposure to ionizing radiation (x-rays, gamma-rays) and nonionizing radiation (electromagnetic, ultrasound, and radio waves) from natural radiation sources, medical conditions, work environments, and industries can impact tissue at the molecular level by producing heat (electromagnetic waves) or changing the molecular structures of proteins, DNA, and other

biomolecules, as well as by producing free radicals (x and gamma-rays). Gonads react extremely well to radiation. Workplace radiation exposure during pregnancy can have long-term implications, and radiation exposure itself can harm germ cells and perhaps affect the generation of sex steroids. Studies have not discovered any appreciable negative impacts of non-ionizing radiation with regard to unfavourable pregnancy instances. Non-ionizing radiations, such as mobile radiation, are not particularly dangerous. The most harmful of them is ionizing radiation, which can potentially harm DNA, proteins, and cells depending on the exposure's strength, dosage, and length. More than 0.1 Gy (10 rad) of radiation during Pregnancy has been linked to an increased risk of NTDs, mental impairment, implantation failure, and foetal growth limitation. Before receiving radiation or chemotherapy, female cancer patients may choose to retain their fertility through embryo banking, cryopreservation of eggs and ovarian tissue, ovarian transposition, and ovarian suppression/GnRH agonist therapy.[10]

Figure 7: Infertility due to environmental pollution.

3.5 Sexually transmitted diseases, sexual violence

Infections in the female genital tract can be quite uncomfortable and have negative effects on the body and mind. While some female genital tract infections, like gonorrhoea and chlamydia, can result in infertility, others, like candida, bacterial, and trichomonas infections, are just uncomfortable and do not pose a significant health risk. Sexually transmitted infections (STIs) raise the chance of ectopic pregnancy, fallopian tube infertility, and excruciating pelvic discomfort if they are not treated. They can also induce pelvic inflammation and disrupt the female reproductive system. The likelihood of acquiring and

spreading HIV is increased in the presence of STIs. Despite the introduction of antiretroviral therapy (ART), it has been observed that women living with HIV had lower fertility than women living with HIV.

3.5.1 Sexual violence

In addition to causing physical and psychological harm, sexual assault can result in fallopian tube infertility, which is typically undetectable. According to an epidemiological study, women who experienced severe physical and/or sexual abuse as children are more likely to acquire endometriosis. According to a recent study, women who were sexually abused, abandoned, or drug-abused by their parents before the age of twelve were more likely to develop long-lasting amenorrhoea and difficulties becoming pregnant. The likelihood of unwanted pregnancy, antepartum haemorrhage linked to preterm birth, and the increased risk of miscarriage and stillbirth associated with elective abortions have all been linked to intimate partner violence, or IPV, against women. Pregnancy-related violence is more likely when there is an unwanted pregnancy linked to abuse. As a result, abusive partners' controlling behaviour influences the decisions made by both sexes about their reproductive health. All of these studies imply that a woman's fertility may be impacted by traumatic events she had as a kid or as an adult, such as physical or sexual abuse. Future studies are necessary to examine these correlations prospectively and analyse the molecular process by which sexual and physical abuse impacts fertility.

3.6 Smoking

Although not well known, cigarette smoking has been linked to negative consequences on fertility. Congenital heart disease is another risk that it raises. Smoking has been shown to increase DNA damage and decrease sperm quantity, motility, and morphology in males. There is still much to learn about the precise mechanisms underlying how smoking affects the quality of sperm. Numerous chemicals found in tobacco smoke, including hydroxyl radicals, superoxide, cadmium, lead, and nicotine, can have a negative impact on reproductive health. In the Fenton reactions, superoxide and hydroxyl radicals can participate, producing hydrogen peroxide, which in turn causes oxidative stress and damages DNA. Smoking can cause the zona pellucida in female smokers to thicken, which makes it more difficult for sperm to penetrate. Menopause has been reported to occur 1–4 years earlier in smoking women when compared to non-smoking women. Cigarette contains several harmful constituents that have been detected in the follicular microenvironment of smokers such as

cotinine and cadmium thereby altering hormone levels in the luteal phase and could affect the developing follicle. Smoking in women significantly decreases the chance of conception by disrupting ovarian function and depleting its reserve.

Figure 8: Smoking leads to infertility.

Excessive smoking (Both Direct and Indirect) in young female's increases susceptibility to ovulatory disorders and in expectant mothers; it is associated with early pregnancy loss, preterm delivery, low birth weight, and sensitize the child for developing depression in the later stages of life.

One of the main components of tobacco is nicotine, which can readily gain access to breast milk and foetal compartments affecting neurodevelopment of the foetus via various mechanisms. One study has shown that reduced ovarian reserve, fertilization, and pregnancy rate were found in women who smoked compared with non-smokers. Excessive smoking in some cases can also be an indication of psychological stress, which increases the susceptibility to ovulatory disorders in young females. In pregnant mothers, extreme smoking can sensitize the child for developing depression in later stages of life, especially in those who are light or heavyweight at birth.

3.7 Alcohol consumption

The most often misused drug that has been consumed for celebration and leisure since antiquity is alcohol. In addition to harming the brain system, liver, and heart, it also has an impact on reproductive health. The kind, quantity, and duration of alcohol drinking determine

the type of harm caused. Alcohol causes the body to lose a lot of vital nutrients, like calcium, salt, potassium, iron, magnesium, zinc, vitamin B, and so on. Most bodily processes depend on these vitamins and minerals, including reproduction. All forms of alcohol abuse are associated with decreased testosterone and increased oestrogen. Due to its known teratogen properties, alcohol has been shown to reduce fertility.

A small number of studies, however, link high alcohol exposure (> 3 drinks in one sitting) to birth defects, menstrual irregularities, spontaneous abortion, low birth weight, foetal hypoxia, foetal alcohol syndrome (FAS), intrauterine growth restriction (IUGR), postnatal stunted growth, and neural tube defects (NTDs), and developmental disabilities.

According to a different study, alcohol use ranging from one drink per week to five units per day lengthens the time it takes to get pregnant, and spontaneous abortion lowers the rate of implantation and conception by 50%. Alcohol consumption prior to conception raises the chance of oesophageal atresia, congenital cardiac abnormalities, and depression in mothers. During pregnancy, the relative risk of preterm delivery is slightly increased if more than seven drinks are consumed per week.

When postmenopausal women are on hormonal therapy, excessive alcohol consumption lengthens the half-life of oestrogen clearance. Although the precise mechanism of action is yet unknown, it is also thought that elevated oestrogen levels brought on by excessive alcohol use lower FSH levels and have an impact on follicular growth and the ovulation process. Consuming between 75 and 247 millilitres of alcohol can lead to hyperprolactinemia in females, which can disrupt ovulatory processes and result in galactorrhea (excessive milk production).[11]

3.8 Cosmetics

Skincare products are used for purposes other than just keeping skin looking and feeling good. As the care produces positive outcomes, these items actually also give confidence. Women's sex hormones, which are important for reproduction, might be impacted by some chemicals included in skincare products. In skincare products, there are certain substances that are classified as endocrine-disrupting chemicals (EDC). EDCs are often used and absorbed through the skin, the biggest organ in the body, which makes them problematic. The chemicals contained in cosmetic and personal care items have been linked to changes in

women's reproductive hormone levels, according to research from George Mason University in Virginia, USA.

Table 3: Chemical ingredients that may leads to infertility.

Cosmetics	Chief Chemical ingredients	Harmful health effects
Eye shadow	Polyethylene terephthalate, formaldehyde, titanium dioxide, heavy metals, mineral oils, parabens, carbon black, ethyloxylated ingredients, paraffin wax, polyacrylamide, talc, polybutene and octyldodecyl stearoyl stearate, Teflon	Infertility, hormonal disruptions and damage to body's organs, Cancer,
Hair spray	Octinoxate, isophthalates, carboxymethyl cellulose, denatured alcohol, hydrofluorocarbon, plasticizers including esters of citric acid, adipic acid, polyvinylpyrrolidine, polydimethylsiloxane, gum Arabic, alcohols, polyvinyl alcohol, propylene glycol	Hormone disruption, change the cell structure, Allergies, irritation of eyes, nose, throat
Blusher	Ethylparaben, propylparaben, formaldehyde, carbon black, talc, phenoxyethanol, Butylated hydroxyl toluene, parabens, ethanolamine compounds	Irritation, rashes and hormonal disruptions
Body lotion	Methylparaben, propylparaben, polyethylene glycol	Rashes, irritation, hormonal disruptions
Sunscreen	Retinol, retinyl acetate, retinyl palmitate, all-trans retinoic acid, tretinoin, octinoxate	Linked to cancer, developmental and reproductive toxicity
Moisturizer	Butylparaben and isopropylparaben	Early puberty, certain parabens cause breast cancer.

Notwithstanding its ongoing revisions, the 1940 Drugs and Cosmetics Act is designed to guarantee that pharmaceuticals and cosmetics are efficacious, safe, and meet state regulations. Advertisements, discounts, and free samples can impact the effects that chemical compounds cause, but women customers are generally unaware of these risks. This section addresses some of the hazardous health impacts of chemical additions found in cosmetics.

3.8.1 Contents of skincare products that affect fertility

- Retinol
- Accutane
- Hydroquinone
- Phthalates

- Benzophenone
- Bisphenol
- Polyfluoroalkyl substances (PFA).[12]

3.9 Dietary Compounds and Female fertility

In the context of fertility, there is increased interest in lifestyle factors (diet and exercise), psychological stress, socioeconomic factors, BMI, smoking, alcohol, caffeine, and psychotropic substances. Infertility brought on by endometriosis and ovulation issues appears to place a premium on lifestyle factors, such as calorie consumption and food composition in terms of vitamins, Proteins, Lipids and carbohydrates. It's interesting to note that different physical activity levels can have varied effects on fertility.[13]

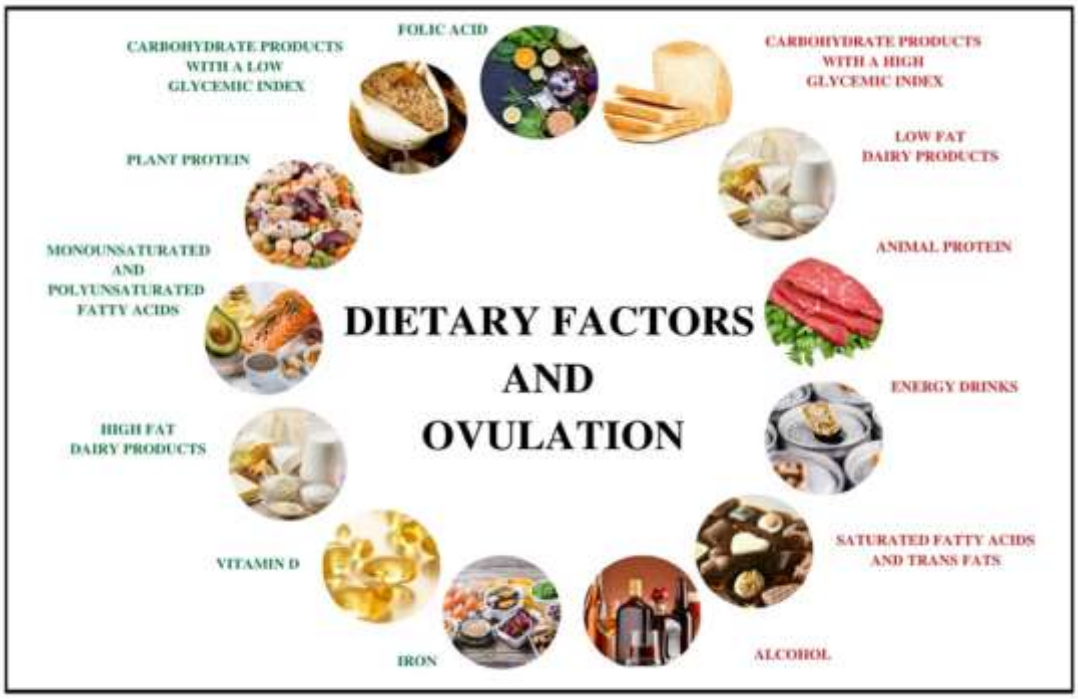

Table 4: The effects of the selected dietary components on female fertility.[13]

Nutrient	Summary	Recommended food sources
Carbohydrates	Added sugars and a high glycaemic index have a **negative effect on fertility**	Vegetables and fruit, whole-grain pasta, whole-grain bread, grains, rice, cereals
Fat	Intake of TFAs and excess SFAs appears to **negatively affect female fertility.** The direct effect of PUFAs on fertility is unclear, while MUFAs appear to have **a positive effect on female fertility**.	Oily Fish, rapeseed oil, Flaxseed oil, olive oil and other plant oil, avocado, nuts, seeds

Proteins	It is vital to include good sources of proteins in the diet. Plant proteins appear to have a positive impact on fertility, while animal protein especially from processed meat a **negative impact**	Legumes, Fish, lean meat, eggs, dairy products (particularly fermented)
Dairy	Studies regarding dairy are inconsistent although dairy should be consumed as a part of healthy diet, it is hard to determine if it should be high-fat or low-fat in order to increase fertility. Taking current studies into the account, high-fat dairy should not be recommended in order to **increase fertility,** as it can have a negative impact on other risk factors for fertility	Low-fat dairy, especially fermented dairy products
Iodine	Iodine is essential for the proper development of the foetus and proper thyroid function. While mild and moderate iodine deficiency is common among women, it is crucial to pay special attention to the supply of iodine by women planning a pregnancy.	Iodized salt, dairy, seafood
Folic acid	It appears that folic acid supplementation, particularly combined with vitamin B-12, may increase the chance of pregnancy and ART success. There is a need for the randomized trials.	Green-leafy vegetables, eggs, poultry
Vitamin D	Serum vitamin D concentrations may be associated with PCOS and endometriosis and affect ART success. In a population of healthy, fertile individuals, there is no significant association.	Fish, eggs, cheese, milk, dairy
Antioxidants	Very-low-quality evidence suggests that antioxidant supplementation may be beneficial for women suffering from infertility. More research is needed to assess the risk of the possible side effects. Inositol, L-carnitine, and NAC require particular attention due to the increasing number of studies positively assessing their impact on parameters related to female fertility.	Fresh fruits (especially berry fruits) and vegetables, vegetable oil, spices (e.g., cinnamon), tea, coffee.

4. CONCLUSION

In the current review, we covered the many lifestyle and environmental factors and how they relate to women's infertility. Many of these factors, including poor nutrition, obesity, stress, EDCs, and toxic chemicals, have an immediate effect on the neuroendocrine system; other factors, like alcohol, tobacco, and caffeine, as well as socioeconomic factors and air and noise pollution, have an indirect effect on fertility and reproductive health. It is indisputable that sustaining physiological equilibrium requires a balanced diet. Inadequate consumption of calories, protein, and nutrients combined with inappropriate eating habits throw off the body's delicate energy balance. This may result in obesity or malnutrition, which would upset the body's energy balance. Studies have shown that the HPG axis is the primary organ system for sensing energy imbalance and nutritional status, which in turn influences GnRH release. It often underestimated how much a balanced diet matters to girls, particularly throughout puberty, as it has an impact on their maturation process. Sexual assault and socioeconomic issues have an effect on a woman's mental state. Despite the fact that those in the lower socioeconomic strata of society have greater fertility rates. Policymakers should take action to reduce the industrial and commercial usage of chemicals and environmental toxicants because of their long-term detrimental effects on public health.

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