

# Optimizing Male Reproductive Health: An Evidence-Based Guide to Enhancing Fertility

## 1. Introduction: Optimizing Your Path to Fatherhood

The journey to parenthood involves numerous factors, and the health of both partners is paramount. Historically, discussions around fertility have often centered predominantly on female factors; however, it is now well-established that male factors play a critical role in conception.<sup>1</sup> Male factors contribute to approximately 30% to 55% of all infertility cases, encompassing issues such as low sperm production, abnormal sperm function, or blockages that prevent sperm delivery.<sup>2</sup> In a significant portion of these cases, up to 50%, the specific cause of male infertility cannot be definitively identified, underscoring the importance of addressing modifiable lifestyle factors that can influence reproductive health.<sup>1</sup>

Proactive lifestyle changes can significantly enhance a man's fertility potential. Modifiable behaviors and practices, including diet, physical activity, stress management, and the avoidance of harmful substances, have a strong correlation with male reproductive outcomes.<sup>4</sup> By making informed choices and adopting healthier habits, men can positively influence their sperm parameters, hormonal balance, and overall sexual function. This proactive approach not only improves the chances of conception but also contributes to broader aspects of male health. Many interventions discussed, such as adopting a nutrient-rich diet, engaging in regular physical activity, and managing stress, offer systemic benefits that extend beyond reproductive capabilities. For instance, factors like obesity, poor dietary habits, and a sedentary lifestyle are linked not only to infertility but also to a range of chronic diseases.<sup>4</sup> Similarly, hormonal imbalances, particularly low testosterone, can affect muscle mass, bone density, mood, and energy levels, in addition to sperm production and libido.<sup>7</sup> Oxidative stress, a key culprit in sperm damage, is also implicated in the aging process and various chronic health conditions.<sup>9</sup> Therefore, addressing these elements in preparation for fatherhood can serve as a powerful motivator, as the efforts yield dual benefits for reproductive and overall well-being.

This report provides a comprehensive, evidence-based guide focusing on three core pillars: diet, exercise, and supplementation. The aim is to offer actionable strategies to improve key metrics of male reproductive health, including sperm quality (encompassing sperm count, motility, and morphology), seminal volume, libido (sex drive), and overall sexual function, such as erectile function. By understanding and implementing these recommendations, individuals can take significant steps towards

optimizing their fertility and preparing for a healthy conception.

## 2. Understanding the Foundations of Male Reproductive Health

Optimizing male fertility requires an understanding of the key biological metrics and processes involved. These include the characteristics of sperm and semen, the intricate hormonal regulation of the reproductive system, and the detrimental impact of factors like oxidative stress.

### Key Metrics: Sperm Quality (Count, Motility, Morphology), Seminal Volume, Libido, and Sexual Function

A comprehensive assessment of male reproductive health involves evaluating several parameters, typically through a semen analysis and clinical evaluation.<sup>12</sup>

- **Sperm Quality:** This is a multifaceted measure comprising:
  - **Sperm Count/Concentration:** Refers to the number of sperm present in a specified volume of semen, typically per milliliter (mL). The World Health Organization (WHO) has established a lower reference limit of 15 million sperm per mL.<sup>13</sup> A count below this threshold is termed oligospermia.<sup>12</sup>
  - **Sperm Motility:** Describes the ability of sperm to move actively and progressively. This is crucial for sperm to travel through the female reproductive tract and reach the egg. The WHO lower reference limit for total motility (any movement) is 40%, and for progressive motility (active, forward movement) is 32%.<sup>13</sup> Impaired sperm motility is known as asthenozoospermia.<sup>14</sup>
  - **Sperm Morphology:** Pertains to the size and shape of the sperm. Normally formed sperm have a higher likelihood of successful fertilization. The WHO lower reference limit for normal forms is greater than 4%.<sup>13</sup> A high percentage of abnormally shaped sperm is termed teratozoospermia.<sup>14</sup>
- **Seminal Volume:** This is the total amount of fluid ejaculated during orgasm. The WHO lower reference limit for ejaculate volume is 1.5 mL.<sup>13</sup> Semen is a complex fluid, with sperm constituting only about 1% to 5% of its volume. The majority of semen is composed of fluids secreted by the seminal vesicles (approximately 65% to 75%) and the prostate gland (approximately 25% to 30%).<sup>12</sup> These fluids provide nourishment and protection for the sperm. Low seminal volume can be indicative of issues such as ejaculatory duct obstruction, retrograde ejaculation (where semen enters the bladder instead of being expelled), or hormonal imbalances.<sup>12</sup>
- **Libido (Sex Drive):** Libido refers to an individual's interest in sexual activity. It is a complex trait influenced by a variety of factors, including hormonal status

(particularly testosterone levels), psychological well-being (stress, depression, anxiety can diminish libido), and overall physical health.<sup>6</sup> A decline in libido can affect the frequency of intercourse, thereby impacting conception opportunities.

- **Sexual Function:** This encompasses the physiological ability to engage in sexual intercourse, including achieving and maintaining an erection (erectile function) and the process of ejaculation. Problems such as erectile dysfunction (difficulty achieving or sustaining an erection) or premature ejaculation can interfere with successful intercourse and fertility.<sup>6</sup>

### **The Hormonal Orchestra: Testosterone, FSH, LH and their roles**

The male reproductive system is intricately regulated by a complex interplay of hormones, often referred to as the Hypothalamic-Pituitary-Gonadal (HPG) axis.<sup>4</sup> Key hormones in this system include:

- **Testosterone:** This is the principal male sex hormone, produced primarily by the Leydig cells within the testes under the stimulation of Luteinizing Hormone (LH).<sup>16</sup> Testosterone plays a vital role in spermatogenesis (sperm production), the development and maintenance of male secondary sexual characteristics (such as muscle mass, bone density, and body hair distribution), and the regulation of libido.<sup>7</sup> Low testosterone levels, a condition known as hypogonadism, can lead to decreased sex drive, erectile dysfunction, reduced sperm production, and other systemic effects.<sup>1</sup>
- **Follicle-Stimulating Hormone (FSH):** Secreted by the pituitary gland (located at the base of the brain), FSH is essential for initiating the process of spermatogenesis within the seminiferous tubules of the testes.<sup>7</sup>
- **Luteinizing Hormone (LH):** Also produced by the pituitary gland, LH acts on the Leydig cells in the testes, stimulating them to produce and release testosterone. This testosterone is then crucial for the continuation and completion of sperm development.<sup>7</sup>

The HPG axis involves a feedback loop: the hypothalamus releases Gonadotropin-Releasing Hormone (GnRH), which signals the pituitary to release LH and FSH. These hormones then act on the testes. Testosterone produced by the testes, along with inhibin (another testicular hormone), feeds back to the hypothalamus and pituitary to modulate GnRH, LH, and FSH release, thus maintaining hormonal balance.

### **Oxidative Stress: A Key Challenge to Sperm Health**

Oxidative stress (OS) is a significant factor impairing male fertility. It arises from an imbalance between the production of reactive oxygen species (ROS) – chemically

reactive molecules containing oxygen – and the body's ability to neutralize these harmful compounds with antioxidants.<sup>9</sup>

Spermatozoa are particularly susceptible to damage from OS for several reasons: their plasma membranes are rich in polyunsaturated fatty acids (PUFAs), which are easily oxidized, and they possess limited intrinsic antioxidant defense mechanisms and repair systems.<sup>9</sup> When ROS levels become excessive, they can inflict considerable damage on sperm components:

- **Sperm DNA:** ROS can cause breaks and modifications in sperm DNA (DNA fragmentation), which can compromise fertilization, embryo development, and increase the risk of miscarriage.<sup>11</sup>
- **Sperm Membranes:** Oxidation of lipids in the sperm membrane can impair its fluidity and integrity, leading to reduced sperm motility and the inability to fuse with the egg.<sup>14</sup>
- **Sperm Proteins:** Damage to critical proteins can affect sperm structure and function.

Oxidative stress is estimated to be a contributing factor in 30% to 80% of male infertility cases.<sup>10</sup> Various lifestyle factors, including smoking, excessive alcohol consumption, poor dietary habits, exposure to environmental toxins, and even intense physical exertion, can increase the production of ROS and exacerbate oxidative stress.<sup>4</sup>

The hormonal system and oxidative stress are not independent entities; they are deeply interconnected. Imbalances in reproductive hormones can contribute to increased oxidative stress, and conversely, high levels of oxidative stress can negatively impact hormone production and function. For example, testosterone itself possesses certain antioxidant properties. Consequently, low testosterone levels, which can be a result of poor lifestyle choices, might diminish the body's overall antioxidant capacity.<sup>23</sup> Conditions like obesity, often stemming from an unhealthy diet and lack of physical activity, are associated with both hormonal dysregulation (such as lower testosterone and altered estrogen levels) and an increase in systemic inflammation and oxidative stress.<sup>4</sup> Psychological stress can elevate cortisol levels, which in turn can suppress testosterone production<sup>17</sup> and also contribute to an oxidative state. Therefore, interventions aimed at balancing hormones, such as appropriate exercise and stress reduction, can indirectly help mitigate oxidative stress. Similarly, adopting an antioxidant-rich diet or using specific antioxidant supplements can protect sperm from oxidative damage and potentially support a healthier hormonal milieu. This highlights the synergistic nature of the comprehensive

lifestyle recommendations that will be discussed.

### **3. Pillar 1: Nutritional Strategies for Enhanced Male Fertility**

Diet plays a fundamental role in shaping male reproductive health. The nutrients consumed provide the building blocks for sperm production, influence hormonal balance, and modulate the body's defense against oxidative stress. Adopting specific dietary patterns and prioritizing certain foods while limiting others can significantly impact sperm quality, seminal volume, and overall fertility.

#### **The Power of Dietary Patterns**

Rather than focusing solely on individual nutrients, research increasingly supports the benefits of overarching dietary patterns.

- The Mediterranean Diet: Evidence and Benefits.

The Mediterranean diet is characterized by a high intake of fruits, vegetables, legumes, nuts, seeds, whole grains, and olive oil as the principal source of fat. It includes moderate consumption of fish and poultry, and low consumption of red meat, processed meats, and dairy products.<sup>16</sup> This dietary pattern is rich in antioxidants (like vitamins C and E, carotenoids, and polyphenols), anti-inflammatory compounds, monounsaturated and omega-3 polyunsaturated fatty acids, and dietary fiber.<sup>4</sup>

Numerous studies have associated adherence to the Mediterranean diet with improved semen parameters, including sperm concentration, motility, and morphology.<sup>16</sup> It has also been linked to an amelioration of erectile dysfunction<sup>24</sup> and, in some cases, particularly when combined with a lower carbohydrate intake, increased testosterone levels.<sup>16</sup> One notable study that modified the diets of subfertile men to follow a low-carbohydrate, organic Mediterranean diet observed significant increases in testosterone levels and decreases in sperm DNA fragmentation after three months.<sup>16</sup>

- Characteristics of a "Prudent" Fertility-Boosting Diet.

Similar to the Mediterranean diet, a "prudent" dietary pattern emphasizes whole, unprocessed foods. It is typically high in whole grains, legumes, fruits, vegetables, fish, and poultry, and low in processed foods, red meat, and sweets.<sup>4</sup> Men adhering to such a diet have been found to have higher counts of progressively motile sperm compared to those following a typical "Western" diet.<sup>4</sup> The emphasis is on nutrient density and minimizing exposure to dietary components that can induce inflammation or oxidative stress.

The beneficial impact of these dietary patterns likely stems from the synergistic effect

of their various components. The "Western diet," high in processed foods, unhealthy fats, and sugars, while low in essential nutrients, promotes oxidative stress and inflammation—two key adversaries of sperm health.<sup>4</sup> Conversely, the Mediterranean and "Prudent" diets are rich in protective compounds that work together to create a more favorable environment for reproductive health. This suggests that focusing on a holistic dietary approach, emphasizing whole and unprocessed foods, is likely more impactful than attempting to address fertility through isolated nutrient supplementation alone, although ensuring adequacy of specific key nutrients remains important.

### Essential Nutrients and Foods to Emphasize

Certain nutrients are particularly vital for male reproductive health:

- **Antioxidant-Rich Foods (Vitamins C, E, Lycopene, Beta-carotene):**  
These compounds are crucial for neutralizing ROS and protecting sperm from oxidative damage.<sup>4</sup> Diets deficient in these antioxidants are linked to increased testicular and seminal oxidative stress, leading to higher rates of sperm DNA fragmentation.<sup>4</sup>
  - **Vitamin C:** Abundant in citrus fruits (oranges, lemons), berries (strawberries, blueberries), bell peppers, broccoli, and kiwi.
  - **Vitamin E:** Found in nuts (almonds, hazelnuts), seeds (sunflower seeds), spinach, broccoli, and vegetable oils like sunflower oil.
  - **Lycopene:** A potent carotenoid found in high concentrations in tomatoes (especially cooked, like in tomato sauce or paste), watermelon, pink grapefruit, and guava.
  - **Beta-carotene:** A precursor to vitamin A, present in orange and dark green leafy vegetables such as carrots, sweet potatoes, spinach, kale, and apricots.
- **Omega-3 Fatty Acids: Sources and Importance.**  
Omega-3 polyunsaturated fatty acids (PUFAs), particularly docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), are integral structural components of sperm cell membranes. They influence membrane fluidity, which is critical for sperm motility and the acrosome reaction (necessary for fertilization).<sup>4</sup>
  - **Sources:** Fatty fish such as salmon, mackerel, sardines, and herring are excellent sources of EPA and DHA. Plant-based sources of alpha-linolenic acid (ALA), which can be converted (though inefficiently) to EPA and DHA in the body, include flaxseeds, chia seeds, and walnuts.<sup>4</sup>
  - Higher intake of omega-3s, often through fish consumption or fish oil supplementation, has been associated with improved sperm morphology, count, and motility.<sup>16</sup> Some research suggests fish oil supplements may also



lead to higher semen volume and testicular size in healthy men.<sup>26</sup> Maintaining a balanced ratio of omega-6 to omega-3 fatty acids is important, as an excess of omega-6 PUFAs (common in Western diets from vegetable oils like corn and soybean oil) can promote inflammation.<sup>22</sup>

- **Key Minerals: Zinc and Selenium.**

- **Zinc:** This trace mineral is indispensable for male reproductive function. It is involved in normal testicular development, spermatogenesis, sperm motility, and the stabilization of sperm chromatin and membranes.<sup>27</sup> Seminal plasma contains high concentrations of zinc, and levels are often found to be lower in infertile men compared to fertile controls.<sup>27</sup>
  - **Sources:** Oysters are exceptionally rich in zinc. Other good sources include red meat (beef, lamb), poultry, shellfish (crab, lobster), beans, nuts (cashews, almonds), seeds (pumpkin, sesame), and dairy products.
  - Zinc supplementation has been shown in some studies to increase semen volume, sperm motility, and the percentage of normally shaped sperm.<sup>27</sup> However, it is crucial to maintain an adequate balance, as both deficiency and excessive zinc intake can be detrimental to sperm health.<sup>28</sup>
- **Selenium:** An essential trace element that functions as a potent antioxidant, primarily as a component of the enzyme glutathione peroxidase, which protects cells from oxidative damage.<sup>29</sup> Selenium is critical for testicular development, spermatogenesis, and sperm motility and function.<sup>29</sup>
  - **Sources:** Brazil nuts are one of the richest dietary sources of selenium (just a few nuts can meet the daily requirement). Other sources include tuna, sardines, halibut, shrimp, beef, turkey, chicken, eggs, and whole grains.
  - Supplementation with selenium, often in combination with vitamin E, has demonstrated improvements in sperm motility and morphology in some studies of infertile men.<sup>29</sup>

- **Vital Vitamins: Folate and Vitamin D.**

- **Folate (Vitamin B9):** Folate plays a crucial role in DNA synthesis and methylation processes, which are fundamental for the production of healthy sperm (spermatogenesis).<sup>3</sup>
  - **Sources:** Abundant in leafy green vegetables (spinach, kale, romaine lettuce), asparagus, Brussels sprouts, legumes (lentils, chickpeas, black beans), avocados, and fortified grains and cereals.
  - Low levels of folate in seminal plasma have been linked to lower sperm concentration and impaired spermatogenesis.<sup>3</sup> Some research suggests that supplementation with folic acid (the synthetic form of folate) in combination with zinc may improve sperm count and quality in subfertile

men, although evidence from larger trials is mixed.<sup>31</sup>

- **Vitamin D:** Traditionally known for its role in bone health, vitamin D is increasingly recognized for its importance in reproductive health. Vitamin D receptors (VDR) and metabolizing enzymes are found throughout the male reproductive tract, including in spermatogonia, Leydig cells (which produce testosterone), Sertoli cells, and mature sperm.<sup>32</sup>
  - **Sources:** The primary source of vitamin D is synthesis in the skin upon exposure to sunlight. Dietary sources are limited but include fatty fish (salmon, mackerel, sardines), egg yolks, cod liver oil, and foods fortified with vitamin D (such as milk, yogurt, orange juice, and cereals).
  - Studies have shown a positive correlation between serum vitamin D levels and semen quality parameters (sperm concentration, motility, and morphology), as well as testosterone levels.<sup>32</sup> Vitamin D deficiency is common and may negatively impact male reproductive function.<sup>32</sup>
- **L-Carnitine in Foods:**

L-carnitine is an amino acid derivative that plays a vital role in energy metabolism within cells, including sperm, by transporting fatty acids into the mitochondria for energy production. It also possesses antioxidant properties.<sup>4</sup>

  - **Sources:** While L-carnitine is often taken as a supplement, it is naturally present in foods, particularly red meat (beef and lamb are rich sources), fish, poultry, and dairy products.

## Dietary Components to Limit or Avoid

Just as certain foods can enhance fertility, others can be detrimental:

- **Processed Foods, Trans Fats, and Excessive Sugars (The "Western Diet").**

The typical "Western" dietary pattern, characterized by high intakes of red and processed meats, refined grains, sweets and sugary drinks, fried foods, and full-fat dairy products, while being low in fruits, vegetables, whole grains, and essential unsaturated fatty acids, is strongly linked to poorer semen parameters and reduced fertility.<sup>4</sup> This type of diet often leads to increased risks of asthenozoospermia (low motility), oligozoospermia (low count), and teratozoospermia (abnormal morphology).<sup>4</sup>

  - **Trans Fats:** These industrially produced fats (found in many margarines, shortenings, fried foods, baked goods, and processed snacks) are inversely related to total sperm count and may negatively affect testosterone production and testicular health.<sup>22</sup>
  - **Saturated Fats:** High intake of saturated fats (prevalent in red meat, processed meats, butter, cheese, and other full-fat dairy products) has been



associated with lower sperm concentration and total sperm count.<sup>22</sup>

- **Excessive Sugar and Refined Carbohydrates:** Diets high in sugar and refined carbohydrates (such as sugary beverages, candies, pastries, white bread, and white pasta) have been linked to reduced sperm concentration and poor sperm motility.<sup>4</sup>
- **Ultra-Processed Foods (UPFs):** These foods, which often contain numerous additives, unhealthy fats, and high levels of sugar and salt, are associated with increased systemic oxidative stress and inflammation. Higher intake of UPFs has shown trends towards lower sperm concentration.<sup>11</sup>
- **Impact of Red and Processed Meats.**  
High consumption of red meat (beef, pork, lamb) and particularly processed meats (sausages, bacon, hot dogs, deli meats) is associated with decreased sperm count, motility, and morphology.<sup>4</sup> This negative impact may be due to their high content of saturated and trans fats, preservatives like nitrates and nitrites, or potential residues of hormones used in animal agriculture.<sup>22</sup>
- **Alcohol and Caffeine: Finding the Right Balance.**
  - **Alcohol:** While occasional, light alcohol consumption may not significantly harm fertility for most men, heavy or chronic alcohol use can have profound negative effects. It can lower testosterone levels, reduce libido, cause testicular shrinkage, and decrease sperm production, count, motility, and morphology.<sup>4</sup> Even daily consumption of moderate amounts can lead to a deterioration in semen volume and sperm morphology.<sup>22</sup> When actively trying to conceive, it is advisable to minimize or avoid alcohol.<sup>5</sup>
  - **Caffeine:** The evidence regarding caffeine and male fertility is somewhat mixed. High caffeine intake is often a component of the "Western" dietary pattern, which is generally linked to poorer male infertility outcomes.<sup>4</sup> Some sources suggest its impact is controversial or less clear-cut.<sup>37</sup> Given the potential for high intake to be associated with other less healthy lifestyle choices, moderation in caffeine consumption is a prudent approach.
- **Pesticide Residues in Food: Considerations and Mitigation.**  
Exposure to pesticides, herbicides, and other agricultural chemicals, primarily through diet, is a growing concern for male reproductive health. Many of these chemicals can act as endocrine disruptors or directly induce oxidative stress.
  - Studies have linked exposure to certain pesticides, such as organophosphates and carbamates, to lower sperm concentration and overall semen quality.<sup>5</sup>
  - Research has specifically found that consumption of fruits and vegetables with higher levels of pesticide residues is associated with lower total sperm count and a lower percentage of morphologically normal sperm.<sup>39</sup>
  - **Mitigation Strategies:** To reduce exposure, it is recommended to wash all

fruits and vegetables thoroughly under running water before consumption. Choosing organic produce whenever possible, particularly for items on the "Dirty Dozen" list (produce known to have higher pesticide residues), can also significantly lower intake.<sup>40</sup> Supporting local and sustainable agriculture may also offer options with lower chemical inputs.

**Table: Foods to Favor vs. Foods to Limit for Male Fertility**

To provide a practical summary, the following table outlines key food groups and their relevance to male fertility:

Nutrient/Food Category	Foods to Favor (Examples)	Foods to Limit/Avoid (Examples)	Rationale/Impact on Fertility
<b>Fruits &amp; Vegetables (Antioxidants, Folate)</b>	Berries, citrus fruits, tomatoes, carrots, spinach, kale, broccoli, bell peppers, avocado, asparagus	Fruits/vegetables with high pesticide residues (if not organic/washed thoroughly)	Provide essential vitamins, minerals, antioxidants (Vit C, E, lycopene, beta-carotene, folate) to combat oxidative stress and support DNA synthesis <sup>3</sup>
<b>Healthy Fats (Omega-3s, MUFAs)</b>	Fatty fish (salmon, mackerel, sardines), walnuts, flaxseeds, chia seeds, olive oil, avocados	Trans fats (fried foods, baked goods, processed snacks), excessive saturated fats from processed sources	Omega-3s are crucial for sperm membrane structure and function; MUFAs are anti-inflammatory <sup>4</sup>
<b>Lean Proteins</b>	Fish, poultry (chicken, turkey), legumes (beans, lentils, chickpeas), eggs, nuts, seeds	Processed meats (sausages, bacon, deli meats), excessive red meat	Provide amino acids for sperm production; fish provides omega-3s; legumes provide fiber and folate <sup>4</sup>
<b>Whole Grains</b>	Oats, quinoa, brown rice, whole wheat bread/pasta, barley	Refined grains (white bread, white rice, sugary cereals,	Provide fiber, B vitamins, and some minerals; help

		pastries)	regulate blood sugar <sup>4</sup>
<b>Dairy (or alternatives)</b>	Plain yogurt, kefir, milk (moderate intake, preferably low-fat or organic if concerned about hormones)	High-fat dairy, sweetened dairy products	Source of calcium, vitamin D (if fortified), and protein. Some concerns about hormones in conventional dairy; moderation advised <sup>4</sup>
<b>Processed Foods</b>	Minimal intake	Packaged snacks, ready meals, fast food, foods with long ingredient lists containing artificial additives, preservatives	Often high in unhealthy fats, sugar, sodium, and low in essential nutrients; contribute to inflammation and oxidative stress <sup>4</sup>
<b>Sugary Items</b>	Minimal intake	Sugary drinks (sodas, sweetened juices), candies, desserts, excessive added sugars in foods	Linked to reduced sperm concentration and poor motility; contribute to obesity and hormonal imbalance <sup>4</sup>
<b>Red &amp; Processed Meats</b>	Lean cuts of red meat in moderation (e.g., grass-fed)	Processed meats (sausages, bacon, hot dogs, deli meats), fatty cuts of red meat	High intake linked to decreased sperm count and motility; may contain unhealthy fats, preservatives, hormone residues <sup>4</sup>
<b>Beverages</b>	Water, herbal teas, green tea (moderate)	Alcohol (especially heavy/daily intake), sugary drinks, excessive caffeine	Alcohol negatively impacts testosterone and sperm parameters. Sugary drinks contribute to poor metabolic health. Moderate caffeine is generally acceptable <sup>4</sup>

## 4. Pillar 2: Exercise for Improved Sperm Parameters, Libido, and Sexual Function

Regular physical activity is a cornerstone of overall health and well-being, and its benefits extend significantly to male reproductive health. Engaging in appropriate types and amounts of exercise can positively influence sperm quality, hormonal profiles, libido, and sexual function.

### The Positive Impact of Regular Physical Activity

Consistent exercise is associated with a range of benefits for male fertility:

- **Improved Semen Quality:** Men who engage in regular physical activity tend to exhibit better semen parameters, including higher sperm concentration, total sperm count, total sperm motility, and a greater percentage of morphologically normal sperm, compared to sedentary individuals.<sup>43</sup>
- **Hormonal Balance:** Exercise can help optimize hormonal profiles, notably by increasing testosterone levels, which is crucial for spermatogenesis and libido.<sup>43</sup> Physically demanding work, such as regularly lifting heavy objects, has also been linked to higher sperm concentrations and circulating testosterone.<sup>48</sup>
- **Reduced Oxidative Stress and Inflammation:** Physical activity can enhance the body's antioxidant defense systems and reduce chronic inflammation, both of which are detrimental to sperm health.<sup>43</sup>
- **Enhanced Cardiovascular Health:** Improved cardiovascular function through exercise leads to better blood circulation throughout the body, including to the reproductive organs. Adequate blood flow is essential for testicular function and the delivery of oxygen and nutrients necessary for sperm production.<sup>45</sup>
- **Weight Management:** Exercise is a key component in achieving and maintaining a healthy body weight. Obesity is a known risk factor for impaired male fertility due to hormonal disruptions and increased inflammation.<sup>44</sup>

### Recommended Exercise Modalities

A balanced exercise regimen incorporating various types of physical activity is generally most beneficial:

- **Aerobic Exercise** (e.g., jogging, swimming, brisk walking, moderate cycling): Activities that elevate heart rate and improve cardiovascular fitness are excellent for overall health. They enhance blood circulation, aid in weight management, can boost testosterone levels, and are effective stress reducers.<sup>45</sup> A general recommendation is to aim for at least 30 minutes of moderate-intensity aerobic exercise on most days of the week.<sup>52</sup>

- **Resistance Training (Strength building):**  
Weightlifting and other strength-building exercises are particularly effective at promoting testosterone production, a hormone essential for sperm creation and male sexual health.<sup>45</sup> Compound exercises that engage multiple large muscle groups, such as squats, deadlifts, bench presses, and rows, are highly recommended.<sup>52</sup> Some research suggests that hypertrophic training protocols (e.g., 10 sets of 10 repetitions at approximately 75% of one-repetition maximum, or 1RM) may lead to more significant acute increases in testosterone.<sup>53</sup> Animal studies also indicate that resistance training can improve sperm count and motility, potentially mediated by increases in testosterone and LH.<sup>54</sup>
- **High-Intensity Interval Training (HIIT):**  
HIIT involves short, intense bursts of exercise followed by brief recovery periods. This modality can be effective for improving cardiovascular health, stimulating testosterone production, and enhancing glucose metabolism.<sup>52</sup> While some studies suggest HIIT can improve metabolic parameters without negatively impacting reproductive health <sup>55</sup>, it's important to note that very high-intensity exercise can act as a significant physiological stressor. If overdone, HIIT could potentially increase oxidative stress, which might have detrimental consequences for the reproductive system.<sup>55</sup>
- **Mind-Body Practices (e.g., Yoga, Tai Chi):**  
Chronic stress is a known adversary to male fertility, negatively impacting sperm health, libido, and sexual function.<sup>6</sup> Mind-body practices are excellent for stress reduction and promoting hormonal balance.
  - **Yoga:** Combines physical postures, breathing techniques, and meditation. It can help lower cortisol levels (a primary stress hormone), improve overall hormonal balance, and create a more favorable internal environment for sperm production.<sup>52</sup> Specific poses like Cobra Pose (Bhujangasana) and Bridge Pose (Setu Bandhasana) are sometimes suggested for fertility.<sup>52</sup>
  - **Tai Chi:** A gentle martial art that involves slow, flowing movements coordinated with deep breathing. It is highly effective for reducing stress and enhancing relaxation.<sup>52</sup>
  - **Kegel Exercises:** While not a traditional exercise modality for overall fitness, Kegel exercises specifically target the pelvic floor muscles. Strengthening these muscles can improve ejaculatory control and erectile strength, contributing positively to sexual function.<sup>52</sup>

### **Finding the Sweet Spot: Intensity, Duration, and Frequency**

The relationship between exercise and male fertility appears to follow a U-shaped curve, meaning that both too little activity and too much (or overly intense) activity

can be detrimental, while moderate, consistent exercise yields the most benefits.<sup>43</sup>

- **Moderate physical activity** is consistently highlighted as beneficial for semen quality and hormonal balance.<sup>43</sup>
- One prospective cohort study found that men engaging in medium-level physical activity had the highest total sperm motility and normal morphology, whereas these values were lower in groups with both reduced and increased activity levels.<sup>43</sup>
- Specific recommendations vary:
  - One study suggested that men performing moderate-to-vigorous exercise for approximately 15 hours per week had a 73% higher sperm count than those exercising for 5 hours or less per week.<sup>47</sup>
  - Another guideline suggests a minimum daily energy expenditure of 200 kilocalories from physical activity.<sup>49</sup>
  - For erectile dysfunction, a 2018 study concluded that 40 minutes of aerobic exercise performed four times per week can lead to improvements.<sup>50</sup>
- The overarching message is that consistency and moderation are key. "More is not always better" is a crucial principle when it comes to exercise and fertility.

### **Risks of Overtraining and Specific Activities to Approach with Caution**

While exercise is generally beneficial, certain practices can pose risks:

- **Overtraining/Excessive Exercise:**

Engaging in strenuous, prolonged, or excessively intensive training regimens can negatively impact male fertility. The mechanisms include hormonal disruptions (leading to lower levels of testosterone, FSH, and LH), increased systemic oxidative stress, elevated sperm DNA damage, chronic inflammation, and dysfunction of the hypothalamic-pituitary-testicular (HPT) axis.<sup>19</sup>

  - In severe cases, overtraining can lead to testicular atrophy and impaired spermatogenesis.<sup>49</sup>
  - There might be a "training volume-threshold" beyond which negative effects become more pronounced; for instance, running more than 100 kilometers per week has been suggested as such a threshold for some endurance athletes.<sup>49</sup>
  - One study involving 16 weeks of intensive cycling training showed significant decreases in seminal volume, sperm concentration, motility, and morphology, although these parameters tended to recover after a period of rest.<sup>58</sup>
- **Scrotal Overheating:**

The testes require a temperature slightly cooler than the core body temperature for optimal sperm production (spermatogenesis).<sup>5</sup> Activities or conditions that



lead to prolonged elevation of scrotal temperature can be detrimental to sperm count, motility, and morphology.

- **Activities of Concern:** Prolonged cycling (especially with an improperly designed or ill-fitting saddle that puts pressure on the perineum and traps heat), frequent or extended use of saunas and hot tubs, wearing tight-fitting underwear or athletic wear that restricts air circulation, and habitually placing heat-generating devices like laptops directly on the lap for long periods.<sup>5</sup>
- **Mitigation:** For cyclists, using a specially designed, ergonomic bicycle seat that reduces perineal pressure and allows for better ventilation is recommended.<sup>44</sup> Choosing loose-fitting, breathable underwear (e.g., cotton boxers) and avoiding prolonged exposure to high-heat environments are also important preventative measures. Competitive cycling and triathlons, due to their intensity and duration, should be approached with moderation by individuals concerned about fertility.<sup>44</sup>

The interplay between exercise and male fertility underscores the importance of balance. The goal is to achieve the physiological benefits of physical activity—such as improved hormonal profiles, reduced oxidative stress, and enhanced blood flow—without tipping into a state of excessive physiological stress, systemic inflammation, or scrotal hyperthermia that could negate these advantages or introduce new problems. The optimal exercise plan is one that is sustainable, enjoyable, and tailored to individual fitness levels, always keeping these potential risks in mind.

**Table: Optimal Exercise Guidelines for Male Reproductive Health**

Exercise Type	Recommended Frequency	Recommended Duration	Recommended Intensity	Key Benefits for Male Fertility	Precautions /Considerations
<b>Aerobic Exercise</b> (Jogging, Swimming, Brisk Walking, etc.)	Most days of the week	30-60 minutes per session	Moderate (e.g., able to hold a conversation )	Improves cardiovascular health, blood flow to testes, testosterone, weight management , stress	Avoid overexertion. Ensure proper hydration.

				reduction <sup>45</sup>	
<b>Resistance Training</b> (Weightlifting, Bodyweight exercises)	2-4 times per week	30-60 minutes per session	Moderate to Vigorous (challenging but with good form)	Boosts testosterone, improves muscle mass (linked to better hormonal profile), sperm parameters <sup>52</sup>	Proper form is crucial to prevent injury. Allow adequate recovery between sessions. Avoid anabolic steroids.
<b>High-Intensity Interval Training (HIIT)</b>	1-3 times per week	10-30 minutes per session	High intensity during work intervals, low during rest	Improves cardiovascular health, testosterone, glucose metabolism <sup>52</sup>	Can be very strenuous; risk of overtraining and increased oxidative stress if done too frequently or intensely. Ensure adequate recovery.
<b>Yoga / Tai Chi</b>	2-5 times per week	20-60 minutes per session	Gentle to Moderate	Reduces stress and cortisol, improves hormonal balance, flexibility, mental well-being <sup>52</sup>	Choose styles appropriate for fitness level. Focus on relaxation and proper breathing.
<b>Cycling (Moderate)</b>	2-4 times per week	30-60 minutes per session	Moderate	Cardiovascular benefits, leg strength <sup>44</sup>	<b>Critical:</b> Avoid prolonged/intense cycling. Use

					an ergonomic/fertility-friendly saddle to prevent scrotal overheating and perineal pressure. <sup>44</sup> Wear loose clothing.
<b>Kegel Exercises</b>	Daily	Few minutes, multiple sets	N/A (muscle contraction)	Strengthens pelvic floor, may improve ejaculatory control and erection quality <sup>52</sup>	Ensure correct muscle identification .

## 5. Pillar 3: Evidence-Based Supplementation for Male Reproductive Enhancement

While a nutrient-dense diet and a healthy lifestyle form the bedrock of optimizing male fertility, targeted supplementation can offer additional support, particularly in addressing specific nutrient deficiencies or providing concentrated doses of beneficial compounds. However, it is crucial to approach supplementation with an informed and cautious perspective.

### A Note on Supplements: Not a Replacement for a Healthy Lifestyle

Supplements should be viewed as complementary to, not a substitute for, a foundation of healthy eating and consistent positive lifestyle choices.<sup>14</sup> Many commercially available fertility supplement formulations may not be supported by robust scientific evidence.<sup>14</sup> Furthermore, supplements can have side effects and interact with medications or other supplements. Therefore, **consultation with a healthcare provider (such as a physician or a registered dietitian specializing in fertility) is essential before initiating any new supplement regimen.** This is particularly important for individuals with pre-existing health conditions or those currently taking medications.<sup>61</sup>

Many supplements aimed at improving male fertility target one of two primary pathways: combating oxidative stress or modulating testosterone levels and hormonal

balance. Antioxidants like CoQ10, Vitamin C, Vitamin E, Selenium, and NAC have a relatively direct and well-understood mechanism in protecting sperm from oxidative damage.<sup>9</sup> Micronutrients such as Zinc and Vitamin D are fundamental to hormonal pathways and spermatogenesis, and supplementation is most clearly beneficial when addressing an existing deficiency.<sup>27</sup> Herbal supplements and compounds like D-Aspartic Acid, while having traditional uses or some supportive research for testosterone or libido, often present more mixed or less robust clinical evidence, particularly for consistent testosterone boosting in healthy individuals.<sup>79</sup> This suggests a potential hierarchical approach: prioritize addressing foundational nutritional needs and mitigating oxidative stress, then consider other supplements with a critical evaluation of the evidence and always under professional guidance.

### Key Supplements to Consider

The following supplements have been studied for their potential roles in male reproductive health:

- **Antioxidants:** These are vital for counteracting oxidative stress, a major contributor to sperm damage.
  - **Coenzyme Q10 (CoQ10):**
    - *Evidence:* Several studies and meta-analyses suggest CoQ10 can improve sperm motility (total and progressive), sperm count, and sperm morphology. It has also been linked to increased serum testosterone and inhibin B levels, alongside decreased LH and FSH.<sup>9</sup> However, some meta-analyses indicate it may not significantly affect semen volume or sperm concentration.<sup>20</sup> Robust evidence for increased live birth or pregnancy rates is still developing.<sup>85</sup>
    - *Mechanism:* CoQ10 is a powerful antioxidant and a vital component of the mitochondrial electron transport chain, essential for cellular energy production, including in sperm.<sup>9</sup>
    - *Dosage:* Commonly studied dosages range from 100 mg to 300 mg per day.<sup>9</sup> Some studies showing benefit used 200 mg daily.<sup>20</sup>
    - *Potential Side Effects:* Generally well-tolerated. Mild insomnia has been reported by some individuals taking 100 mg daily. Higher doses (300 mg daily for extended periods) may potentially lead to elevated liver enzymes. Other reported side effects include nausea, upper abdominal pain, irritability, headache, and fatigue.<sup>62</sup>
    - *Potential Interactions:* CoQ10 might reduce the effectiveness of anticoagulant medications such as warfarin, potentially increasing the risk of blood clots.<sup>62</sup>

- **Vitamin C (Ascorbic Acid):**

- *Evidence:* A well-known antioxidant that protects sperm from ROS damage.<sup>9</sup> When taken in combination with Vitamin E, it may help reduce sperm DNA damage.<sup>10</sup> It has also shown potential in improving outcomes of Intracytoplasmic Sperm Injection (ICSI) in patients with high sperm DNA damage and may counteract testicular toxicity induced by certain medications like citalopram.<sup>10</sup>
- *Dosage:* Typical supplemental doses in studies range from 500 mg to 1000 mg per day.<sup>9</sup>
- *Potential Side Effects:* Generally safe at recommended doses. High doses (exceeding 2,000 mg per day) can cause gastrointestinal issues like nausea, vomiting, diarrhea, and heartburn, and may increase the risk of kidney stones in susceptible individuals.<sup>73</sup>
- *Potential Interactions:* Can increase the absorption of aluminum from medications (e.g., phosphate binders). May interact with chemotherapy drugs (concern it might reduce efficacy), estrogen (may increase levels), protease inhibitors (antiviral drugs, may reduce their effect), statins and niacin (may reduce their beneficial effects on cholesterol), and warfarin (high doses might reduce warfarin's response).<sup>73</sup>

- **Vitamin E (Alpha-tocopherol):**

- *Evidence:* A major lipid-soluble antioxidant that protects cell membranes, including those of sperm, from oxidative damage.<sup>9</sup> Often studied in combination with other antioxidants like Vitamin C (for reducing sperm DNA damage)<sup>10</sup> or selenium (for improving sperm motility, morphology, and in one study, spontaneous pregnancy rates).<sup>29</sup>
- *Dosage:* A common dosage in studies is 400 mg (or 400 International Units, IU) per day.<sup>9</sup>
- *Potential Side Effects:* Generally considered safe in moderate doses. High doses can cause nausea, diarrhea, stomach cramps, fatigue, and headache. There is some concern that long-term high-dose Vitamin E supplementation might increase the risk of prostate cancer and bleeding, particularly in individuals with pre-existing conditions or those on blood-thinning medications.<sup>74</sup>
- *Potential Interactions:* May increase the risk of bleeding when taken with anticoagulant or antiplatelet medications. Can also interact with certain chemotherapy drugs, statins, niacin, and Vitamin K (may reduce Vitamin K's effectiveness).<sup>74</sup>

- **Selenium:**

- *Evidence:* An essential trace mineral crucial for normal testicular

development, spermatogenesis, and sperm motility and function. It exerts its antioxidant effects as a component of the enzyme glutathione peroxidase.<sup>9</sup> Supplementation, often combined with Vitamin E, has shown improvements in sperm motility, morphology, and in some instances, spontaneous pregnancy rates.<sup>29</sup>

- *Dosage:* A commonly studied dose is 200 micrograms (mcg) per day.<sup>9</sup>
- *Potential Side Effects:* Selenium is safe when taken in doses less than 400 mcg per day for short periods. However, high doses or prolonged use can lead to selenium toxicity (selenosis), characterized by hair loss, nail changes, fatigue, irritability, nausea, vomiting, and garlic breath. Long-term intake of doses around 200 mcg/day has been linked in some research to an increased risk of developing type 2 diabetes. Paradoxically, very high selenium levels or supplementation in non-deficient individuals might decrease sperm motility.<sup>71</sup>
- *Potential Interactions:* May increase bleeding risk with anticoagulants/antiplatelets. Can interact with niacin (when taken with simvastatin), barbiturates, warfarin, and immunosuppressants. Selenium supplementation can worsen hypothyroidism in individuals with iodine deficiency; if supplementing selenium in such cases, iodine intake should also be adequate.<sup>71</sup>

○ **N-Acetylcysteine (NAC):**

- *Evidence:* A derivative of the amino acid cysteine, NAC is a precursor to glutathione, one of the body's most important intracellular antioxidants. It has been studied for its potential to improve semen quality by reducing oxidative stress.<sup>9</sup>
- *Dosage:* A typical dosage used in some studies is 600 mg per day.<sup>9</sup>
- *Potential Side Effects:* Common side effects include nausea, vomiting, diarrhea, and dry mouth. NAC has an unpleasant sulfurous odor which some find difficult to tolerate. Rarer side effects can include rash or low blood pressure. When inhaled (as a prescription medication for lung conditions), it can cause mouth swelling or chest tightness.<sup>77</sup>
- *Potential Interactions:* May potentiate the effects of nitroglycerin (used for angina), leading to increased risk of headache and low blood pressure. May interact with immunosuppressants, certain antibiotics (e.g., tetracyclines), and activated charcoal. NAC may also have mild blood-thinning effects and could slow blood clotting.<sup>77</sup>

○ **Lycopene:**

- *Evidence:* A potent carotenoid antioxidant, particularly abundant in tomatoes. It is often included in male fertility supplement formulations due



to its ability to neutralize free radicals.<sup>4</sup> Listed as a beneficial ingredient for male fertility in some reviews.<sup>9</sup>

- *Dosage:* Supplemental doses studied are often in the range of 6-8 mg per day.<sup>9</sup>
- *Potential Side Effects:* Generally well-tolerated when obtained from food or taken as a supplement in recommended amounts. Very high intake, primarily from food sources, can lead to a harmless skin discoloration called lycopopenodermia.
- *Potential Interactions:* Specific interaction data for lycopene supplements is limited, but it is generally considered safe.

- **Vitamins & Minerals:**

- **Zinc:**

- *Evidence:* As previously detailed in the diet section, zinc is critical for testosterone production, sperm formation, and motility.<sup>4</sup> Seminal plasma zinc levels are often lower in infertile men, and supplementation may improve semen volume, sperm motility, and the percentage of normal sperm forms.<sup>27</sup>
- *Dosage:* Supplemental doses in studies have ranged from 25 mg to 66 mg per day.<sup>9</sup> The Recommended Dietary Allowance (RDA) for adult men is 11 mg per day. The Tolerable Upper Intake Level (UL) from all sources (food and supplements) is 40 mg per day.<sup>70</sup> Prolonged intake above the UL should be avoided without medical supervision.
- *Potential Side Effects:* Can cause gastrointestinal upset (nausea, vomiting, diarrhea), and a metallic taste in the mouth. High doses or prolonged intake can lead to copper deficiency (as zinc competes with copper for absorption), which can cause neurological problems. Long-term high-dose zinc supplementation has also been linked to an increased risk of prostate cancer in some observational studies.<sup>69</sup>
- *Potential Interactions:* Can reduce the absorption of certain antibiotics (quinolones and tetracyclines) – these should be taken at different times. May interact with penicillamine (used for rheumatoid arthritis) and thiazide diuretics. Zinc supplements should be taken separately from iron and calcium supplements, as they can interfere with each other's absorption.<sup>69</sup>

- **Folate (Folic Acid):**

- *Evidence:* Essential for DNA synthesis and methylation, processes vital for spermatogenesis.<sup>3</sup> Low seminal folate levels have been associated with low sperm concentration.<sup>3</sup> Folic acid is often studied in conjunction with zinc for male fertility; some studies suggest this combination can improve

sperm count and quality in subfertile men, but results from larger, more recent trials have been mixed or shown no significant benefit.<sup>3</sup>

- *Dosage:* Supplemental doses in studies range from 0.5 mg (500 mcg) to 5 mg per day.<sup>9</sup> The UL for synthetic folic acid from fortified foods and supplements is 1 mg (1,000 mcg) per day.<sup>31</sup>
- *Potential Side Effects:* Generally safe at recommended doses. Doses higher than 1 mg per day may cause stomach upset, nausea, diarrhea, irritability, confusion, skin reactions, and, rarely, seizures. A key concern with high folic acid intake is its potential to mask a vitamin B12 deficiency, which can lead to irreversible neurological damage if unaddressed.<sup>31</sup>
- *Potential Interactions:* Can interact with methotrexate (used for cancer and autoimmune diseases), sulfasalazine (for inflammatory bowel disease), several anti-epileptic drugs (phenytoin, phenobarbital, primidone – may reduce their effectiveness), pyrimethamine (an antimalarial), and chemotherapy drugs like 5-fluorouracil and capecitabine (may increase their side effects).<sup>31</sup>

○ **Vitamin D:**

- *Evidence:* Vitamin D receptors are present throughout the male reproductive tract, and serum Vitamin D levels show a positive correlation with semen quality (concentration, motility, morphology) and testosterone levels.<sup>16</sup> Vitamin D may enhance sperm motility by promoting ATP (energy) synthesis within sperm.<sup>33</sup>
- *Dosage:* There is no single recommended supplemental dose for fertility; it largely depends on an individual's baseline Vitamin D status (deficiency is common). General daily recommendations for adults often range from 600 IU to 4,000 IU. Testing for Vitamin D deficiency is advisable to guide appropriate supplementation.
- *Potential Side Effects:* Vitamin D is safe when taken in typical doses. However, excessive intake (persistently above 4,000 IU per day without medical supervision) can lead to Vitamin D toxicity, resulting in hypercalcemia (abnormally high blood calcium levels). Symptoms of hypercalcemia include nausea, vomiting, muscle weakness, confusion, heart rhythm problems, kidney stones, and kidney damage.<sup>75</sup>
- *Potential Interactions:* Numerous potential interactions, including with aluminum-containing antacids (can increase aluminum absorption), anticonvulsants (can reduce Vitamin D effectiveness), atorvastatin (a cholesterol drug, Vitamin D may affect its metabolism), calcipotriene (a psoriasis medication, risk of hypercalcemia), cholestyramine (can reduce Vitamin D absorption), digoxin (a heart medication, hypercalcemia

increases risk of toxicity), diltiazem and verapamil (blood pressure medications, hypercalcemia can interfere with their action or worsen side effects), orlistat (a weight-loss drug, can reduce Vitamin D absorption), thiazide diuretics (can increase risk of hypercalcemia), and steroids like prednisone (can impair calcium absorption and Vitamin D metabolism).<sup>75</sup>

- **Amino Acids & Derivatives:**

- **L-Carnitine (and L-Acetyl-Carnitine):**

- *Evidence:* These compounds play a crucial role in sperm energy metabolism and possess antioxidant properties, protecting sperm mitochondria.<sup>4</sup> Studies suggest supplementation can improve total and progressive sperm motility and sperm morphology. However, effects on sperm concentration and clinical pregnancy rates are less consistent or not yet firmly established.<sup>14</sup>
- *Dosage:* L-carnitine is often studied at doses of 500 mg to 2 grams per day, while L-acetyl-carnitine is studied at 500 mg to 1 gram per day.<sup>9</sup> They are frequently used in combination.
- *Potential Side Effects:* Generally mild. High doses (more than 5 grams per day) may cause diarrhea. Other rare side effects include increased appetite, a "fishy" body odor, and skin rash.<sup>14</sup>
- *Potential Interactions:* Carnitine may potentially reduce the effectiveness of thyroid hormone replacement. The antiseizure medication valproic acid may lower carnitine levels in the blood. There is a theoretical risk that carnitine could increase the risk of bleeding in individuals taking blood-thinning medications.<sup>61</sup>

- **D-Aspartic Acid (DAA):**

- *Evidence:* The evidence for DAA's effect on testosterone is highly mixed and controversial. Some animal studies and a single early human study in men with initially lower testosterone reported increases in LH and testosterone.<sup>68</sup> However, subsequent human studies, particularly in men who are physically active or resistance-trained, have largely failed to show a testosterone-boosting effect, with some even reporting a decrease at higher doses.<sup>83</sup> Regarding direct fertility effects, one study in sub-fertile men using sodium D-aspartate reported significant improvements in sperm concentration and motility, and a 26.6% pregnancy rate was observed in the partners of the treated men.<sup>90</sup>
- *Dosage:* Studies showing positive effects on sperm parameters or initial testosterone increases typically used around 2.6 to 3 grams of sodium D-aspartate per day.<sup>90</sup> Higher doses (e.g., 6 grams per day) have not proven more effective for testosterone in athletes and may even be

counterproductive.<sup>91</sup>

- *Potential Side Effects:* Some users have reported irritability, headaches, and nervousness.<sup>68</sup> Long-term safety data is limited.
- *Potential Interactions:* Given its proposed mechanism of influencing testosterone and estrogen levels, DAA could theoretically interact with medications that affect these hormones.<sup>68</sup>
- **Herbal Supplements (Evidence quality varies; approach with caution and professional guidance):**
  - **Ashwagandha (*Withania somnifera*):**
    - *Evidence:* An adaptogenic herb used in Ayurvedic medicine. Some studies suggest it may increase DHEA-S (a testosterone precursor) and testosterone levels, particularly in aging, overweight men, or those under stress.<sup>64</sup> It has also been shown to improve sperm count, semen volume, and sperm motility in men with oligospermia.<sup>64</sup> May enhance sexual well-being and help the body combat stress.<sup>63</sup>
    - *Dosage:* Dosages vary widely depending on the preparation. Root powder is sometimes used at 300 mg to 5 grams per day.<sup>63</sup> Standardized extracts like KSM-66 have been studied at 600–675 mg per day<sup>92</sup>, and Shoden beads delivering 21 mg of withanolide glycosides per day.<sup>79</sup>
    - *Potential Side Effects:* Generally well-tolerated. High doses may cause gastrointestinal upset (nausea, diarrhea, vomiting) and drowsiness.<sup>63</sup> Rare cases of liver toxicity have been reported, though these may be linked to contaminants in unregulated products rather than ashwagandha itself.<sup>64</sup>
    - *Potential Interactions:* May interact with medications for diabetes (can lower blood sugar), high blood pressure (can lower blood pressure), immunosuppressants (can stimulate the immune system), sedatives (can increase drowsiness), seizure medications, and thyroid hormone medications (can increase thyroid hormone levels). Should be avoided by pregnant women, and used with caution by individuals with autoimmune disorders, thyroid disorders, hormone-sensitive prostate cancer, or liver problems.<sup>63</sup>
  - **Fenugreek (*Trigonella foenum-graecum*):**
    - *Evidence:* Some studies suggest fenugreek extracts, particularly those standardized for compounds like protodioscin (a furostanolic saponin), may help increase free and total testosterone levels, improve sperm count, motility, and morphology, and enhance libido.<sup>65</sup>
    - *Dosage:* Standardized seed extracts like Testofen or Furosap have been studied at doses of 500–600 mg per day.<sup>65</sup> A product called TrigozimR, containing fenugreek extract along with vitamins and minerals, showed

increased saliva testosterone at doses of 600-1800 mg of the fenugreek component per day.<sup>93</sup>

- *Potential Side Effects:* Common side effects include gastrointestinal issues such as diarrhea, stomach upset, bloating, and gas. Some individuals may experience dizziness, headache, or a characteristic maple-syrup-like odor in their urine or sweat.<sup>65</sup>
- *Potential Interactions:* May lower blood sugar, so caution is needed with diabetes medications (risk of hypoglycemia). May also interact with anticoagulant/antiplatelet drugs (potential increased risk of bleeding) and theophylline (an asthma medication, fenugreek might reduce its absorption).<sup>65</sup>

○ **Maca Root (*Lepidium meyenii*):**

- *Evidence:* A Peruvian plant traditionally used as an aphrodisiac and fertility enhancer. Clinical studies suggest maca may improve sexual desire (libido) in men, an effect that appears to be independent of changes in testosterone levels.<sup>66</sup> There is some evidence, though less consistent, for its benefits in improving erectile function and certain sperm parameters like concentration and motility.<sup>66</sup>
- *Dosage:* For libido enhancement, studies have often used 1.5 to 3 grams of gelatinized maca per day. For erectile dysfunction or sperm parameters, doses around 1 to 1.2 grams of powdered maca per day have been investigated.<sup>66</sup> Daily intake up to 3 grams is generally considered safe for up to 4 months.<sup>66</sup>
- *Potential Side Effects:* Maca is generally well-tolerated. Rare and usually mild side effects can include headaches, gastrointestinal issues (upset stomach), insomnia, or a feeling of jitteriness.<sup>66</sup>
- *Potential Interactions:* Information on interactions is limited. A possible interaction with the antidepressant mianserin has been reported (maca might inhibit an enzyme involved in its metabolism). Caution is advised for individuals with hormone-sensitive conditions (due to traditional use for hormonal balance, though direct hormonal effects are not always seen in studies), or those with kidney, liver, or thyroid problems.<sup>66</sup>

○ **Tribulus Terrestris:**

- *Evidence:* Often marketed as a testosterone booster, but the scientific evidence for this claim is controversial and largely unresponsive, especially in men with normal testosterone levels.<sup>67</sup> Some studies suggest it might offer a slight increase in testosterone in men who are genuinely hypogonadal (low testosterone).<sup>82</sup> There is more promising, albeit still somewhat limited, evidence that Tribulus may improve erectile dysfunction

and enhance sexual satisfaction or desire in some men.<sup>67</sup>

- **Dosage:** For erectile dysfunction or sexual function, studies have typically used doses ranging from 400 mg to 1500 mg per day.<sup>67</sup>
- **Potential Side Effects:** Side effects are usually mild and uncommon but can include stomach pain, cramping, and diarrhea.<sup>67</sup>
- **Potential Interactions:** May interact with lithium (can decrease its excretion), diabetes medications (can lower blood sugar), and blood pressure medications (can lower blood pressure). It is generally advised to avoid Tribulus if there are prostate issues, cardiovascular disease, or liver disease.<sup>67</sup>

**Table: Summary of Key Supplements for Male Fertility**

Supplement	Primary Benefit Area(s)	Typical Dosage Range (from studies)	Key Potential Side Effects	Major Interactions/Precautions
<b>Coenzyme Q10</b>	Sperm Quality (Motility, Count, Morphology), Testosterone	100-300 mg/day <sup>9</sup>	Mild insomnia, GI upset, headache, fatigue; rare elevated liver enzymes (high dose) <sup>62</sup>	Anticoagulants (e.g., warfarin - may reduce efficacy) <sup>62</sup>
<b>Vitamin C</b>	Antioxidant (Sperm DNA protection)	500-1000 mg/day <sup>9</sup>	High doses: GI upset, kidney stones <sup>73</sup>	Aluminum, chemotherapy, estrogen, protease inhibitors, statins/niacin, warfarin <sup>73</sup>
<b>Vitamin E</b>	Antioxidant (Sperm DNA protection, membrane integrity)	400 mg (or IU)/day <sup>9</sup>	High doses: GI upset, fatigue; potential increased risk of prostate cancer, bleeding <sup>74</sup>	Anticoagulants/ antiplatelets, chemotherapy, statins/niacin, Vitamin K <sup>74</sup>
<b>Selenium</b>	Sperm Quality	200 mcg/day <sup>9</sup>	High doses/long	Anticoagulants/



	(Motility, Morphology), Antioxidant		term: toxicity (hair loss, fatigue, GI upset, increased diabetes risk) <sup>71</sup>	antiplatelets, niacin, barbiturates, warfarin, immunosuppressants. Caution with hypothyroidism (if iodine deficient) <sup>71</sup>
<b>N-Acetylcysteine (NAC)</b>	Antioxidant (Glutathione precursor)	600 mg/day <sup>9</sup>	GI upset, dry mouth, unpleasant odor; rare: rash, low BP <sup>77</sup>	Nitroglycerin, immunosuppressants, some antibiotics, activated charcoal; may slow blood clotting <sup>77</sup>
<b>Zinc</b>	Sperm Production, Motility, Testosterone, Seminal Volume	25-66 mg/day (UL 40mg from all sources) <sup>9</sup>	GI upset, metallic taste; high doses: copper deficiency, dizziness, headache <sup>69</sup>	Quinolone/tetracycline antibiotics, penicillamine, thiazide diuretics; separate from iron/calcium. <sup>69</sup> Long-term high doses: prostate cancer risk. <sup>70</sup>
<b>Folate (Folic Acid)</b>	DNA Synthesis, Spermatogenesis	0.5-5 mg/day (UL 1mg synthetic form) <sup>9</sup>	High doses: GI upset, irritability; can mask B12 deficiency <sup>31</sup>	Methotrexate, sulfasalazine, anti-epileptics, pyrimethamine, 5-FU, capecitabine <sup>31</sup>
<b>Vitamin D</b>	Sperm Quality, Testosterone	Dose based on deficiency (600-4000 IU/day common)	Excessive intake: hypercalcemia (nausea, weakness,	Numerous: Al-antacids, anticonvulsants, atorvastatin, digoxin,

		32	kidney issues) <sup>75</sup>	diltiazem, verapamil, orlistat, thiazide diuretics, steroids <sup>75</sup>
<b>L-Carnitine</b>	Sperm Motility, Morphology, Antioxidant	1-2g L-carnitine, 0.5-1g L-acetyl-carnitine/day <sup>9</sup>	Mild GI upset, body odor (high doses) <sup>14</sup>	Thyroid hormone, valproic acid, blood thinners <sup>61</sup>
<b>D-Aspartic Acid</b>	Sperm Quality (mixed evidence for Testosterone)	2.6-3 g/day (sodium D-aspartate) <sup>90</sup>	Irritability, headache, nervousness (some reports) <sup>68</sup>	Potential interaction with hormone-affecting meds; limited long-term safety data <sup>68</sup>
<b>Ashwagandha</b>	Testosterone, Sperm Quality, Libido, Stress Reduction	300mg-5g root powder/extract per day (KSM-66: 600-675mg) <sup>63</sup>	Generally well-tolerated; high doses: GI upset, drowsiness. Rare liver toxicity <sup>63</sup>	Diabetes/BP meds, immunosuppressants, sedatives, seizure meds, thyroid meds. Caution: autoimmune/thyroid disorders, hormone-sensitive prostate cancer, liver problems <sup>63</sup>
<b>Fenugreek</b>	Testosterone, Sperm Quality, Libido	500-600 mg seed extract/day <sup>65</sup>	GI upset, bloating, gas, maple-syrup odor in urine/sweat <sup>65</sup>	Diabetes meds, anticoagulants, theophylline <sup>65</sup>
<b>Maca Root</b>	Libido, Erectile Function, some Sperm Quality benefits	1-3 g/day (gelatinized or powdered) <sup>66</sup>	Generally safe; rare: mild GI upset, headache, insomnia <sup>66</sup>	Limited data; possible mianserin interaction. Caution:

				hormone-sensitive conditions, kidney/liver/thyroid problems <sup>66</sup>
<b>Tribulus Terrestris</b>	Erectile Function, Libido (limited evidence for Testosterone)	400-1500 mg/day <sup>67</sup>	Usually mild: GI upset <sup>67</sup>	Lithium, diabetes meds, BP meds. Caution: prostate issues, cardiovascular/liver disease <sup>67</sup>

## 6. Pillar 4: Crucial Lifestyle Adjustments for Optimal Fertility

Beyond specific dietary choices, exercise routines, and supplementation, several broader lifestyle factors exert a profound influence on male reproductive health. Addressing these areas is crucial for creating an optimal internal environment for fertility. Many of these "detrimental" lifestyle factors—such as a poor diet, smoking, excessive alcohol consumption, exposure to toxins, chronic stress, inadequate sleep, and obesity—converge on common damaging pathways. These pathways predominantly involve an increase in oxidative stress and chronic inflammation throughout the body, as well as disruption of hormonal balance, particularly suppression of the Hypothalamic-Pituitary-Gonadal (HPG) axis and testosterone production.<sup>4</sup> This convergence means that positive changes made in one area of lifestyle can have beneficial ripple effects, improving multiple underlying mechanisms that support fertility. Therefore, a holistic approach that simultaneously addresses these interconnected factors is likely to be more effective in enhancing reproductive potential.

### Achieving and Maintaining a Healthy Body Weight

Body weight, specifically being overweight or obese, is significantly linked to male infertility.

- **Impact:** Obesity is associated with reduced sperm count, lower sperm concentration, decreased sperm motility, impaired sperm morphology, increased sperm DNA fragmentation, and potentially lower ejaculate volume.<sup>4</sup>
- **Mechanisms:** Excess body fat can lead to adverse hormonal changes, including lower levels of total and free testosterone, higher estrogen levels (due to increased aromatase activity in adipose tissue, which converts testosterone to estrogen), and altered levels of inhibin B, FSH, and LH, all of which can impair

spermatogenesis.<sup>1</sup> Obesity also promotes a state of chronic low-grade inflammation and increased oxidative stress, further damaging sperm.

- **Action:** Achieving and maintaining a healthy body weight through a combination of a balanced, calorie-appropriate diet and regular physical activity can improve fertility potential.<sup>44</sup> Even modest weight loss can lead to improvements in hormonal profiles and semen parameters.

## Effective Stress Management Techniques

Chronic psychological stress can take a significant toll on male reproductive health.

- **Impact:** Prolonged emotional stress has been shown to negatively affect semen quality, reduce libido, and contribute to sexual dysfunction, including erectile difficulties.<sup>6</sup>
- **Mechanisms:** Stress activates the body's HPA axis, leading to increased production of cortisol. Elevated cortisol levels can suppress the HPG axis, thereby reducing testosterone production and disrupting the secretion of gonadotropins (LH and FSH) essential for sperm production.<sup>17</sup> Stress also contributes to increased oxidative stress.
- **Action:** Implementing effective stress management techniques is vital. These can include:
  - Mindfulness and meditation practices<sup>99</sup>
  - Yoga or Tai Chi<sup>52</sup>
  - Deep breathing exercises<sup>56</sup>
  - Regular physical activity (a known stress reliever)<sup>56</sup>
  - Engaging in hobbies and enjoyable activities<sup>100</sup>
  - Ensuring a healthy work-life balance and setting boundaries<sup>99</sup>
  - Seeking social support from partners, friends, or support groups<sup>100</sup>
  - If stress is overwhelming, considering professional support from a therapist or counselor.<sup>56</sup>

## The Importance of Quality Sleep (Duration and Consistency)

Sleep is a fundamental physiological process that plays a critical role in hormonal regulation, cellular repair, and overall health, including reproductive function.

- **Impact:** Both poor sleep quality and inadequate or excessive sleep duration have been associated with adverse health outcomes and may negatively impact male fertility.<sup>101</sup>
- **Mechanisms:** There appears to be a U-shaped relationship between sleep duration and male fertility parameters, where both too little sleep (e.g., less than 6 hours per night) and too much sleep (e.g., more than 9 hours per night) may be

detrimental, while 7-8 hours of consistent, quality sleep seems to be optimal.<sup>101</sup> Sleep disorders can disrupt the circadian rhythm of hormone secretion, including testosterone, which typically peaks during sleep. Poor sleep can also affect metabolism, increase inflammation and oxidative stress, and negatively impact mental state, all of which can indirectly influence reproductive function.<sup>101</sup> An individual's natural sleep-wake pattern, or chronotype (e.g., being a "morning person" or "evening person"), may also be associated with bioavailable testosterone levels.<sup>102</sup>

- **Action:** Prioritize sleep hygiene: maintain a consistent sleep schedule (going to bed and waking up around the same time daily), create a dark, quiet, and cool sleep environment, avoid stimulants like caffeine and heavy meals close to bedtime, and limit exposure to electronic screens before sleep.

## Eliminating Harmful Substances

Exposure to certain common substances can significantly impair male fertility.

- **Tobacco Cessation:**  
Smoking tobacco is unequivocally harmful to male reproductive health. It is linked to reduced semen quality across multiple parameters (volume, concentration, motility, and morphology), increased sperm DNA damage, and potential endocrine system disruption.<sup>4</sup> Toxic components of cigarette smoke, such as nicotine and its metabolite cotinine, can cross the blood-testis barrier and directly affect spermatogenesis.<sup>21</sup> Quitting smoking is one of the most impactful steps to improve sperm health.
- **Alcohol: Moderation is Key.**  
While occasional, light alcohol intake may not be problematic for most, heavy or chronic alcohol consumption has well-documented negative effects. It can lead to lower testosterone levels, reduced libido, impaired sperm production (affecting count, motility, and morphology), and even testicular shrinkage.<sup>4</sup> Alcohol can induce oxidative stress in the testes and disrupt the HPG axis.<sup>23</sup> Daily consumption, even in moderate amounts, has been shown to impair semen volume and sperm morphology.<sup>22</sup> When trying to conceive, minimizing or ideally abstaining from alcohol is advisable.<sup>5</sup>
- **Avoiding Illicit Drugs.**  
The use of recreational drugs can severely compromise male fertility.
  - **Cannabis (Marijuana):** Regular use may lower sperm count, reduce semen volume, decrease sperm motility, and lower testosterone levels. THC, the active compound in marijuana, can directly harm sperm production and movement.<sup>5</sup>

- **Opioids (e.g., heroin, prescription narcotics):** Can disrupt the hormonal signals that control testosterone production, leading to low testosterone, decreased sperm quality, and reduced sperm count.<sup>37</sup>
- **Cocaine:** Use may lead to lower sperm numbers and poorer sperm quality.<sup>6</sup>
- **Anabolic Steroids:** Taken to increase muscle mass, these synthetic hormones cause the body to shut down its own natural testosterone and sperm production, leading to testicular shrinkage and infertility.<sup>6</sup> Recovery of sperm production after stopping anabolic steroids can take a significant amount of time, sometimes years, and is not always complete.

### **Minimizing Exposure to Environmental Toxins (BPA, Phthalates, Pesticides, Heavy Metals)**

Modern environments contain numerous chemicals that can act as endocrine disruptors (EDCs) or are otherwise toxic to the reproductive system.

- **Impact:** EDCs can interfere with the body's natural hormone synthesis, release, transport, and action. Exposure to common EDCs like Bisphenol A (BPA), phthalates, various pesticides, and heavy metals (like lead and cadmium) has been linked to impaired spermatogenesis, reduced sperm quality (motility, concentration, morphology, DNA integrity), and altered testicular function.<sup>4</sup>
- **Sources:** These toxins are ubiquitous, found in plastics (BPA in some food can linings and hard plastics; phthalates in soft plastics, vinyl, and personal care products), food packaging, cosmetics, personal care products (fragrances, parabens), pesticides on conventionally grown produce, industrial pollution, and some household cleaning products.<sup>98</sup>
- **Avoidance Strategies:** While complete avoidance is difficult, exposure can be significantly reduced by:
  - Choosing glass or stainless steel containers for food and beverages instead of plastic, especially for hot items or acidic foods.<sup>42</sup>
  - Avoiding plastic containers with recycling codes 3 (PVC, may contain phthalates), 6 (polystyrene), or 7 (other, may contain BPA unless specified BPA-free) for food contact.<sup>42</sup>
  - Never microwaving food in plastic containers or covered with plastic wrap, as heat can cause chemicals to leach into food.<sup>41</sup> Use glass or ceramic instead.
  - Washing fruits and vegetables thoroughly and opting for organic varieties when possible, especially for produce known to have high pesticide residues (e.g., the "Dirty Dozen").<sup>40</sup>
  - Filtering drinking water to remove potential contaminants like heavy metals.<sup>106</sup>
  - Eating fewer processed, canned, and pre-packaged foods, as these can be



sources of BPA (from can linings) and phthalates (from packaging).<sup>41</sup>

- Choosing personal care products (shampoos, soaps, lotions, deodorants) and cosmetics that are labeled "phthalate-free" and "paraben-free." Be wary of "fragrance" or "parfum" in ingredient lists, as these can hide phthalates.<sup>41</sup>
- Avoiding handling thermal paper receipts (like those from cash registers or credit card machines) unnecessarily, as they are often coated with BPA.<sup>41</sup>
- Airing out the home frequently and using "green" or non-toxic cleaning products to reduce indoor air pollutants.<sup>41</sup>
- Avoiding the use of pesticides and herbicides in the home and garden; opt for natural pest control methods.<sup>41</sup>

### Preventing Scrotal Overheating

The testes are located outside the body in the scrotum for a crucial reason: they need to be maintained at a temperature slightly lower (typically 2-4°C) than the core body temperature for optimal sperm production and function.<sup>5</sup> Prolonged exposure to elevated scrotal temperatures can impair spermatogenesis, leading to reduced sperm count, decreased motility, and an increase in abnormal sperm forms.

- **Sources of Heat:** Common sources include frequent or prolonged use of hot tubs, saunas, or very hot baths; prolonged sitting (especially in positions that trap heat, like long-distance driving); wearing tight, non-breathable underwear or clothing; placing laptops directly on the lap for extended periods; and occupational heat exposure (e.g., working in hot environments like kitchens or foundries).<sup>5</sup> Certain activities like prolonged or intensive cycling can also contribute if the saddle design is not optimal or clothing is restrictive.<sup>59</sup>
- **Action:**
  - Limit time spent in hot tubs, saunas, and excessively hot baths.
  - Take breaks from prolonged sitting and avoid keeping laptops directly on the lap for long durations.
  - Wear loose-fitting, breathable underwear (such as cotton boxers) and trousers to allow for better air circulation and temperature regulation.<sup>59</sup>
  - If cycling regularly, consider a fertility-friendly saddle designed to reduce perineal pressure and heat build-up.<sup>60</sup>

## 7. Integrating Your Action Plan: A Roadmap to July and Beyond

Successfully enhancing male reproductive health requires a cohesive approach that integrates dietary modifications, appropriate exercise, judicious supplementation (if indicated), and positive lifestyle adjustments. The benefits of these pillars are often compounded when implemented together, creating a synergistic effect that promotes

an optimal environment for fertility.

### **Synergizing Diet, Exercise, and Supplementation**

These three pillars are not isolated interventions but rather interconnected components of a holistic strategy. For instance:

- A nutrient-dense diet, rich in antioxidants and essential fatty acids, provides the fundamental building blocks for healthy sperm and protects them from oxidative damage. This dietary foundation can be complemented by specific antioxidant supplements if deemed necessary after consultation with a healthcare provider.
- Regular exercise helps to improve hormonal balance (e.g., by boosting testosterone and improving insulin sensitivity), reduce stress, and manage weight. A healthy diet supports exercise performance and recovery. For example, improved insulin sensitivity from exercise is further enhanced by a diet low in refined sugars, which collectively benefits hormonal regulation.
- If exercise is intense, the antioxidants obtained from a good diet and potentially from supplements can help mitigate exercise-induced oxidative stress, ensuring that the physical activity remains beneficial rather than detrimental.

### **Setting Realistic Goals and Tracking Progress**

Embarking on lifestyle changes can feel overwhelming if too much is attempted at once. It is advisable to start with manageable modifications and gradually build upon them.

- **Initial Steps:** Consider adding 2-3 servings of colorful vegetables to daily meals, replacing sugary drinks with water, initiating a routine of 30-minute walks three times a week, or, after medical consultation, introducing one supplement at a time to assess tolerance and effect.
- **Timeline for Sperm Improvement:** The process of spermatogenesis (the development of mature sperm) takes approximately 72 to 90 days.<sup>92</sup> This means that positive lifestyle changes implemented now will begin to reflect in the quality of sperm ejaculated roughly three months later. This timeline is particularly relevant for the goal of trying to conceive in July, providing a tangible window for action and motivation.
- **Tracking Progress:** While subjective improvements in well-being, energy levels, or libido might be noticeable sooner, objective changes in sperm parameters require a semen analysis. Consider discussing a baseline semen analysis with a healthcare provider and potentially a follow-up analysis after 3-4 months of consistent adherence to the new lifestyle regimen to track improvements.

It is important to recognize that while the full cycle of sperm development takes about three months, other aspects of male reproductive health, such as libido and sexual function, may show improvements more rapidly. Factors influencing these aspects, like stress levels, testosterone, and blood flow, can respond more quickly to interventions such as stress reduction techniques, regular exercise, improved sleep, and certain supplements (e.g., Ashwagandha for stress and testosterone support, or Maca for libido).<sup>7</sup> This potential for earlier positive feedback in some areas can be encouraging and help maintain motivation for the longer-term efforts required to enhance sperm quality.

### **The Importance of Patience and Consistency**

Improvements in fertility parameters and overall health are generally not instantaneous. The journey requires patience and, most importantly, consistency. Occasional deviations from the plan are normal and should not lead to discouragement. The key is a sustained, long-term commitment to healthier habits. Small, consistent efforts over time will yield more significant results than sporadic, intense bursts of change.

### **When to Consult a Healthcare Professional or Fertility Specialist**

While this report provides evidence-based guidance, it is not a substitute for personalized medical advice. Consultation with a healthcare professional is crucial in several instances:

- **Before starting any new supplement regimen:** This is especially critical if there are pre-existing health conditions or if any medications are currently being taken, due to the potential for interactions and side effects.<sup>6</sup>
- **If there are pre-existing reproductive health concerns:** Symptoms such as pain or swelling in the testicle area, difficulties with erection or ejaculation, a history of testicular, prostate, or other sexual health problems warrant medical evaluation.<sup>6</sup>
- **If conception does not occur after a reasonable period:** Generally, couples are advised to seek fertility evaluation if they have not conceived after one year of regular, unprotected intercourse. This timeframe may be shortened to six months if the female partner is 35 years of age or older.
- **To investigate specific conditions:** Conditions like varicocele (an enlargement of veins within the scrotum) are a common and often surgically correctable cause of male infertility.<sup>6</sup> Varicocele repair can lead to significant improvements in sperm parameters.<sup>109</sup>
- **For baseline assessments:** A healthcare provider can arrange for a baseline

semen analysis and hormone testing (e.g., testosterone, LH, FSH levels). These tests can provide valuable insights into current fertility status and help tailor interventions more effectively.<sup>12</sup>

## 8. Conclusion: Empowering Your Journey to Parenthood

The path to fatherhood is a significant journey, and taking proactive steps to optimize male reproductive health can profoundly enhance the likelihood of conception and contribute to overall well-being. The evidence strongly indicates that a multifaceted approach, integrating positive changes across diet, exercise, supplementation (where appropriate and guided by healthcare professionals), and broader lifestyle factors, offers the most promising strategy for improving sperm quality, seminal volume, libido, and sexual function.

Key evidence-based strategies include:

- **Adopting a Nutrient-Dense Diet:** Emphasizing patterns like the Mediterranean diet, rich in fruits, vegetables, whole grains, lean proteins, and healthy fats, while minimizing processed foods, unhealthy fats, excessive sugars, and harmful additives. Prioritizing foods high in antioxidants (Vitamins C, E, lycopene), omega-3 fatty acids, zinc, selenium, folate, and Vitamin D is crucial.
- **Engaging in Regular, Moderate Exercise:** Incorporating a mix of aerobic activity, resistance training, and potentially mind-body practices like yoga or Tai Chi can improve hormonal balance, reduce stress, manage weight, and enhance cardiovascular health, all of which support fertility. Avoiding overtraining and activities that lead to scrotal overheating is paramount.
- **Considering Targeted Supplementation:** After consultation with a healthcare provider, specific supplements such as CoQ10, L-carnitine, zinc, selenium, and vitamins D, C, and E may offer benefits, particularly in addressing oxidative stress or known deficiencies. Herbal supplements should be approached with caution and expert guidance.
- **Making Crucial Lifestyle Adjustments:** Achieving and maintaining a healthy body weight, effectively managing stress, ensuring adequate quality sleep, and strictly avoiding harmful substances like tobacco, excessive alcohol, and illicit drugs are fundamental. Minimizing exposure to environmental toxins such as BPA, phthalates, and pesticides through conscious choices is also important.

The journey to improving male fertility is one that requires commitment, patience, and informed choices. Spermatogenesis is a process that takes approximately three months, meaning that the positive changes initiated today will manifest in improved sperm quality in the coming months, aligning well with a timeframe for trying to

conceive. While some improvements, such as in libido or energy levels, may be experienced sooner, the full benefits to sperm parameters will develop over time.

This report aims to empower individuals with the knowledge and tools to make these positive changes. By embracing a holistic approach and working in partnership with healthcare professionals, men can significantly enhance their reproductive potential and embark on the path to parenthood with greater confidence and improved health.

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