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Optimizing fertility Part 1: Evidence-based lifestyle changes

This first article in a two-part series examines how coital practices, diet, body weight, and exercise can affect natural fertility.

ABSTRACT: Infertility is a common condition that is associated with significant psychological burden. Many couples will seek to increase their fertility with lifestyle changes before consulting a specialist. This article is Part 1 of a two-part review of the current literature on optimizing natural fertility. Engaging in intercourse during one's fertile window is the most effective intervention, but diet modifications such as avoiding foods with high pesticide exposure can also make a significant difference. Folic acid supplementation is recommended preconception and during pregnancy, whereas there is poor evidence of fertility benefit from antioxidants. Obesity is associated with both male and female infertility, and moderate exercise is recommended for all patients.

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Infertility is defined as the inability to conceive after 1 year of unprotected intercourse, and it affects approximately 12% to 15% of couples.[1] Given that most couples achieve pregnancy within the first 3 to 6 months of trying to conceive, it is understandable that some patients become discouraged when they encounter unanticipated difficulties with the process.[1] Many couples will go online to find information on how to boost their natural fertility even before meeting with a community physician, and will often do so much earlier than the 12-month mark. Initiating a dialogue with patients about making healthy lifestyle choices to optimize conception may help avert frustration and misinformation. Here in Part 1, we review the current literature on how coital practices, diet, body weight, and exercise can affect a couple's natural fecundability. In Part 2, we review the available evidence on the effects of lifestyle risk factors and environmental toxins on natural fertility.

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Coital practices

Planning intercourse based on a woman's ovulatory cycle is likely the most effective intervention known to optimize her chances of conception. Pregnancy rates are the highest when intercourse occurs within the "fertile window": the 6 days leading up to and including the day of ovulation.[1] One prospective study of 221 healthy women found that the probability of achieving pregnancy ranged from 10% when intercourse occurred 5 days prior to ovulation up to 33% when it occurred on the day of ovulation.[2] The recommendation of the American Society for Reproductive Medicine is to engage in intercourse every day, or every other day, during this period to maximize the chances of conception.[1]

There are a variety of methods to help patients identify their fertile window, including the use of ovulation predictor kits, cervical mucus scores, or basal body temperature. Ovulation predictor kits have a control line and a test line, similar to a urine pregnancy test, and they detect a woman's mid-cycle surge of luteinizing hormone (LH), which is the stimulus for oocyte maturation (resumption of meiosis I to meiosis II) and oocyte release. Follicle rupture occurs 34 to 36 hours after the beginning of the LH surge, and the hormone is detectable in the urine for most of that time. Most digital ovulation kits also detect a urinary metabolite of estrogen, estrone-3-glucuronide (E3G). Popular brands of kits use a smiley face to indicate when E3G levels are high (correlating with a growing dominant follicle), which indicates the fertile window leading up to its

peak—the LH surge and ovulation. The cervix responds to high levels of estrogen by producing clear, slippery "egg-white" cervical mucus that is permeable to sperm movement. After ovulation, the presence of progesterone changes the cervical mucus to a thicker, yellow texture to prevent further access of sperm. Basal body temperature charting is based on the physiological 0.5 °C increase that occurs after ovulation due to progesterone. It is not useful for timing intercourse in a given month because once a woman's temperature rises, her most fertile days have passed. Temperature charting can be reassuring for some women to confirm ovulation and inform future cycles.

With recent advancements, fertility tracking applications for mobile phones have undergone a surge in popularity, with several receiving high-quality scores when critically appraised by clinicians. The best apps according to a 2019 Canadian review were Glow Ovulation, Fertility Friend FF App, Clue Health & Period Tracker, iPeriod Period Tracker Ultimate, and Kindara Fertility Tracker.[3] However, evidence suggests that these applications may be up to only 21% accurate and that using the calendar method to approximate ovulation as 12 to 18 days prior to the next menstrual period may be just as effective.[4] Alternatively, patients may choose to have regular intercourse throughout the month, as there is still considerable variation in peak fertility, even with regular cycles.

There is no scientific basis for engaging in intercourse at any particular time of the day to maximize fecundability or the probability of having a child of a certain sex, nor is there any evidence to suggest that coital or postcoital position affects fertility.[2] Remaining supine does not facilitate sperm transport because sperm have been found within the cervical canal within seconds of ejaculation and in the fallopian tubes within minutes.[5] Sexual arousal stimulates the release of oxytocin from the posterior pituitary, a hormone shown to increase the number of transported sperm; however, there is no known association between orgasm and fertility.[5]

Lubricants have been implicated in decreasing fecundability because in vitro studies have demonstrated possible toxicity of certain substances. In particular, Astroglide, K-Y products, and saliva were detrimental to sperm motility, whereas baby oil, canola oil, and hydroxyethylcellulose-based lubricants were not observed to have an effect and were deemed safe.[6,7] Clinical studies on lubricants do not corroborate this effect, however, and in at least one study, women who used lubricants had similar fecundability to those who did not.[8] Although evidence is limited, it seems reasonable to recommend products with lower levels of toxicity to sperm in vitro.

Dietary recommendations for women who are planning pregnancy may differ from those suggested for the prevention of chronic disease.

Diet

Numerous diet studies have highlighted key recommendations for improving fertility for both women and men. A variety of diets have been associated with improved natural and in vitro fertilization (IVF) pregnancy rates as well as sperm quality. Most "fertility diets" are similar in composition to the Mediterranean diet, which favors seafood, poultry, whole grains, fruits, and vegetables.[9] A recent prospective study of 357 women undergoing IVF showed the best results were achieved with a "pro-fertility" diet, which consisted of folic acid, non-dietary fatty acids (> 800 ug/day), vitamin B12 (> 15.8 ug/day), vitamin D (> 843 IU/day), low-pesticide fruits and vegetables, whole grains, seafood, dairy, and soy foods.[10] This diet was unique because it minimized the intake of fruits and vegetables with known high pesticide exposure: tomatoes, blueberries, kale, chard greens, fresh apples and pears, and potatoes. The proportions of implantation, clinical pregnancy, and live birth were greater in the upper quartile of adherence to the pro-fertility diet than in the upper quartile of adherence to the Mediterranean diet. This suggests that dietary recommendations for women who are planning pregnancy may differ from those suggested for the prevention of chronic disease.

Although there is less literature on diets and male fertility, some studies have raised concern about the effects of soy products on sperm. Higher intake of soy foods and soy isoflavones has been associated with lower sperm concentrations. One study found that men in the highest category of soy food intake (≥ 2 servings per week) had on average 41 million sperm/mL less than men who did not consume soy foods.[11] Yet, among couples who presented to an infertility clinic, soy food intake in men was not correlated with the likelihood of pregnancy.[12] The current research is too limited to make definitive conclusions, but men might choose to minimize their soy consumption while trying for pregnancy.

Nutritional supplementation is also a popular but controversial topic among women who are attempting to conceive. A study conducted on mice demonstrated that lifelong consumption of omega-3 fatty acids prolonged reproductive function into advanced maternal age.[13] Furthermore, even short-term dietary treatment with omega-3 fatty acids was associated with improved oocyte quality. However, these results have yet to be reproduced in human studies.

Folic acid is essential to DNA synthesis, and supplementation is known to reduce the risk of neural tube defects. The Society of Obstetricians and Gynaecologists of Canada recommends 0.4 to 1 mg of folic acid per day, beginning 3 months prior to conception, for women at low-to-moderate risk of having a child with a neural tube defect. Women at higher risk, such as those with a personal or family history of having a child with a neural tube defect, should take 4 mg of folic acid per day.[14] Doses of more than 0.8 mg of folic acid per day have also been associated with lower risk of infertility and pregnancy loss, and higher pregnancy rates with medical fertility treatments.[9]

There is conflicting evidence regarding the effects on fertility of taking antioxidants such as N-acetyl-cysteine, melatonin, L-arginine, myo-inositol, D-chiro-inositol, carnitine, selenium, vitamin E, vitamin B, vitamin C, vitamin D and calcium, CoQ10 (ubiquinol), and

pentoxifylline. A Cochrane review found very low-quality evidence that taking antioxidants improves female fertility, and there is no evidence to suggest that CoQ10 increases the likelihood of pregnancy.[15,16] In a study on subfertile males in couples that were attending fertility clinics, another recent Cochrane review found low-quality evidence that taking antioxidants may improve live birth rates.[17] Overall, there is no clear consensus regarding the effects of antioxidants on fertility given the difficulty encountered when studying micronutrients that are rarely used in isolation.

Body weight

There is a curvilinear relationship between body weight and fecundability, as both underweight and overweight women face greater difficulties conceiving than women of normal weight. One prospective study reported a hazard ratio of body mass index on the probability of conception per cycle of artificial insemination.[18] The authors determined that both very lean and obese women trended to have a lower chance of becoming pregnant, although the effect was greater in obese women. Women with a BMI < 20 kg/m^2 had a hazard ratio of 0.837 (95% CI, 0.662-1.058), while those with a BMI of 25 to 30 kg/m^2 and ≥ 30.0 kg/m^2 had ratios of 0.939 (95% CI, 0.775-1.139) and 0.431 (95% CI, 0.171-1.087), respectively, when compared to the reference group, which had a BMI between 20 and 25 kg/m^2.[18] A North American preconception cohort study found similar results, with decreased fecundability associated with female obesity; however, it did not show evidence that underweight women experienced this same issue.[19] The fecundability ratio of the group of women with a BMI < 18.5 kg/m^2 was 1.05 (95% CI, 0.76-1.46) when compared to women with a BMI between 18.5 and 24.0 kg/m^2.[19]

Obesity is associated with ovulatory dysfunction (RR 3.1, 95% CI, 2.2-4.4) via disruption of the hypothalamic-pituitary-gonadal axis from sex hormones accumulated in adipose tissue.[20] It is believed that this abnormal endocrine environment affects oocyte maturation, which results in poorer oocyte quality and embryo implantation.[21] Overweight women (BMI ≥ 25 kg/m^2) have significantly lower clinical pregnancy (RR 0.90, P < .0001) and live birth rates (RR 0.84, P = .0002) and a significantly higher miscarriage rate (RR 1.31, P < .0001) than women of normal weight.[21] Obesity in males is linked to lower sperm concentrations and abnormal sperm morphology.[22]

Women with a BMI ≥ 25 kg/m^2 should be encouraged to lose weight in order to reduce morbidity and pregnancy complications. This requires a combination of dietary modification, physical activity, and behavioral interventions. A large multicentre randomized trial showed that rates of natural conception were significantly higher in a group of obese women who had undergone a 6-month structured lifestyle intervention compared to those who underwent immediate ovulation induction with letrozole or clomiphene (RR 1.61; 95% CI, 1.16-2.24).[23] And while the lifestyle intervention group was less likely to require fertility treatment, the overall live birth rate at the end of the 24-month trial was similar between the "lifestyle" group and the "immediate fertility treatment" group. The Society of Obstetricians and Gynaecologists of Canada recommends a weight-management strategy focused on appropriate dietary adjustments, increased physical activity, and reduced sedentary behavior.[14]

In the context of improving fertility, exercise appears to have conflicting effects depending on the intensity and a woman's BMI.

Exercise

Exercise is widely known to have numerous health benefits and is often recommended by physicians to reduce morbidity and improve overall wellness. However, in the context of improving fertility, exercise appears to have conflicting effects depending on the intensity and a woman's BMI. A prospective cohort study followed 3628 women of various body habitus, their reported hours of vigorous activity, and their time to pregnancy.[24] It found an inverse association between vigorous physical activity and fecundability among women with a BMI < 25. Those who engaged in ≥ 5 hours of vigorous activity per week had a fecundability ratio of 0.58 (95% CI, 0.45-0.75) when compared to those who did not engage in any vigorous physical activity. Conversely, the study did not find any evidence of an inverse association between fecundability and vigorous physical activity among overweight or obese women; there was actually a weak positive association in this group. Another prospective study found that among women with a BMI ≥ 25, fecundability was 27% higher in those who engaged in vigorous physical activity for ≥ 5 hours per week than in those who exercised < 1 hour per week (95% CI, 1.02-1.57).[19] The American College of Obstetricians and Gynecologists recommends 30 minutes of moderate exercise per day, at least 3 to 4 times per week, both preconception and during pregnancy.[25] Competitive athletes seeking to optimize their fertility should avoid hyperthermia and dehydration and maintain adequate caloric intake to avoid excessive weight loss preconception.

In regard to male fertility, exercise does not appear to affect sperm parameters. In an observational study of men at a fertility clinic, semen volume, sperm concentration, sperm motility, sperm morphology, and total motile sperm were not associated with regular exercise. The exception appeared to be bicycling ≥ 5 hours per week, which was associated with lower sperm concentration (OR 1.92; 95% CI, 1.03-3.56) and total motile sperm (OR 2.05; 95% CI, 1.19-3.56).[26]

Summary

There are many evidence-based methods for optimizing fertility based on lifestyle changes. Patients should understand their individual fertility window, and if possible, have intercourse every 1 to 2 days during that time. If desired, hydroxyethylcellulose-based lubricants can be used in place of other lubricants to minimize the sperm toxicity of other lubricants. Patients should be encouraged to consume fresh fruits and vegetables as a part of a well-balanced diet, and the importance of washing their produce

thoroughly and considering organic options should be discussed. Taking 0.4 to 1 mg of folic acid per day is advised, beginning 3 months prior to conception. A BMI ≤ 25 kg/m^2 is ideal for maximizing fecundability, and there are efficacious lifestyle interventions for overweight women who are experiencing difficulty with achieving pregnancy. Exercise should be regular and moderate, averaging 30 to 45 minutes per day, if possible.

Part 2 of this review provides more information on lifestyle changes that can optimize natural fecundability; it focuses on the effects of caffeine, alcohol, smoking, electronic cigarettes, cannabis, and environmental toxins on fertility. ■

Competing interests

Dr Dunne is a member of the *BCMJ* Editorial Board but did not participate in the review or decision making regarding this article. No competing interests have been declared.

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