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Diet And Fertility: Doctor, What Should I Eat?

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- Human fertility is influenced by several factors
  - Female factors (e.g., ovulation and uterine disorders)
  - Male factors (e.g., abnormal sperm production and function),
  - Medical factors (e.g., pelvic inflammatory disease and cancer),
  - Non-modifiable factors (e.g., genetics, gender, and age),and most importantly
  - Modifiable lifestyle factors (e.g., physical activity, overweight, nutrition, alcohol, smoking, stress, and long-term use of contraceptives)

WHAT IS THE RELATION BETWEEN OBESITY AND FERTILITY?

- Females
  - Obesity can negatively affect women's fertility via menstrual and ovulatory disorders include PCOS
  - Insulin resistance is considered to play an important role in the association between PCOS and obesity
  - Moreover, higher levels of circulating triglycerides and fatty acids, may directly induce androgen production in predisposed women.
  - obesity has a negative impact on the effectiveness of fertility treatments and confers a higher risk of pregnancy complications

WHAT IS THE RELATION BETWEEN OBESITY AND FERTILITY?

- Expert guidance recommends that women with obesity and infertility adopt a healthy lifestyle aimed at losing weight (5% to 10% weight loss in 6 months) before natural or medically assisted conception.
  - Lifestyle interventions promoting weight loss have shown improvement of fertility mainly increasing the chance of spontaneous pregnancy.
  - Three main types of weight-loss interventions can be proposed to patients who are obese
    - modification of lifestyle habits, pharmacologic agents and bariatric surgery.

LIFESTYLE INTERVENTIONS

- The only weight-loss intervention that health organizations recommend is support in adopting healthy lifestyle habits such as diet and physical activity.
  - According to Canadian clinical practice guideline on the prevention and management of obesity, there is strong evidence supporting the importance of lifestyle interventions and programs in a multidisciplinary setting, to encourage and sustain weight loss.
    - Physicians are encouraged to advise their patients on the importance of a healthy and balanced diet, as well as the regular practice of moderate to vigorous physical activities, aiming for 30 to 60 minutes daily.

WHAT IS THE RELATION BETWEEN OBESITY AND FERTILITY?

- Males
  - Increased scrotal temperature, hypogonadism, erectile dysfunction and sperm epigenetic changes, amongothers
  - Directly linked to a decrease in sperm count and lower testosterone levels
  - BMI affect the integrity of spermatozoa's chromatin,
- Obesity and the increase in ROS production that comes with it damages DNA integrity
  - The chronic oxidative stress caused by obesity can also affect the testicles and seminal vesicles, causing systemic inflammation

Dietary Patterns

- Males:
  - MedDiet
    - Increased sperm concentration,
    - Higher levels of testosterone (TT)
    - Lower sperm DNA fragmentation
    - Higher total sperm count
    - Lower sperm motility
  - WestDiet
    - Abnormal semen parameters (abnormal count, progressive motility, and morphology of sperm)

Dietary Patterns

- MedDiet
  - pregnancy and live birth particularly in women <35 years old
  - Increased probability of live birth among women undergoing assisted reproductive technologies (ART)
  - female fertility

FIGURE 3 | The Mediterranean pyramid of nutrition style and weekly organization of meals.

Protein

- Animal proteins (dairy, meat, and seafood)
  - lower ovarian antral follicle counts (AFC) among women presenting for infertility Treatment
  - lower concentrations of TT, follicle-stimulating hormone (FSH), and luteinizing hormone (LH) which affect fertility in young men
  - Anovulation
  - inversely associated with the risk of infertility among women undergoing fertility treatment
  - fish intake by both men and women was associated with shorter time to pregnancy (TTP)

PROTEIN

- Plant protein (soy):
  - Is the main source of phytoestrogens for humans
  - Positively associated with the probability of having a live birth during infertility treatment with ART
  - The association between soy protein intake and fertility remains inconclusive.

FATS

- Females:
  - High intake of TFA was shown to increase the risk of metabolic disorders which negatively affect ovarian functions
  - Couples who consumed eight or more seafood servings per cycle had 47% and 60% greater fecundity respectively than couples who consumed one or less seafood serving per cycle.

FATS

- Males:
  - Spermatogenesis in negatively affected by trans-fatty acids
  - ω-3FAs have a positive association with testicular function (testicular volume) whereas intake of ω-6FAs and TFAs appear to be negatively associated to it.
  - Intake of ω-6FAs was positively related to LH concentrations
  - Intake of MUFAs were inversely associated with circulating free testosterone, TT, inhibin B concentrations, and testicular volume

CARBOHYDRATES (CHO)

- Quantity and quality of dietary CHO influence glucose homeostasis and insulin sensitivity, which may influence ovarian function.

- A common indicator of CHO quality is glycemic index, whereas glycemic load is an indicator of CHO quality, quantity, and amount of dietary fiber; related to the extent to which CHO has been refined (whole or refined grains).

- Females:
  - Total CHO consumption and GL are both associated with higher risks of ovulatory infertility
  - Higher preconception intake of whole grain was associated with a higher probability of live birth. This could be due to their antioxidant properties and impact on glycemia
- Males:
  - High-CHO intake was associated with increased prevalence of abnormal total sperm motility and progressive motility.

ANTIOXIDANTS

- Males:
  - Decreased level of antioxidant causes an increase in oxidative stress which leads to sperm membrane lipid peroxidation, reduced motility, DNA damage of the sperm, poor pregnancy, and reduced ART outcomes.
  - Men's intake of β-carotene and vitamin C was positively associated with fertilization rate
  - Antioxidant supplementation has a positive impact on male fertility, improves semen parameters in infertile men.
- Females:
  - Taking an antioxidant may provide benefit for subfertile women.

VITAMIN B12

- Affects semen quality positively
- Increasing sperm count, motility
- Minimizing sperm DNA damage
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VITAMIN D

- Females:
  - Participates in the modulation of female reproductive functions.
  - Vitamin D receptors are expressed in numerous tissues of the reproductive organs, such as ovaries, endometrium, placenta, pituitary gland, and hypothalamus
  - Vitamin D affects various endocrine processes and the steroidogenesis of sex hormones
  - Vitamin D supplementation can be recommended for women with disorders like polycystic ovary syndrome, insulin resistance, or low anti-Mullerian hormone levels

- Males:
  - Vitamin D positively affects semen quality and vitamin D supplementation might enhance sperm motility in men with vitamin D deficiency, asthenozoospermia (reduced spermmotility), and sub-fertile men from couples enrolled in ART
  - Most human studies suggest that vitamin D deficiency independently affects female and male fertility.

ZN

- Some studies showed that the Zn level in the seminal plasma of infertile males was extensively lower than that of normal males
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- Zn supplementation was shown to drastically elevate sperm quality of infertilemales.
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- This may be due to the importance of this mineral in the synthesis of DNA in sperm.

FE

- Significant inverse correlation between Fe intake from foods and sperm concentration and motility was observed.
- Heme Fe intake was associated with fecundability whereas non-heme Fe intake and supplement use were inconsistent
- Some indication of beneficial effects on fertility among women having a higher possibility of Fe deficiency.

LC

- Females:
  - LC is a naturally occurring amino acid derivative often taken as a supplement for weight loss and helps regulate oxidative status of the female reproductive system
  - LC supplementation improves PCOS and amenorrhea disorders, as well as gonadotropins, sex hormone levels, and oocyte health
  - LC probably enhances female fertility by increasing energy production in oocytes and reducing free radicals to protect against oxidative damage to reproductive cells.

DOCOSAHEXAENOIC ACID (DHA)

- Males:
  - DHA supplementation increases ω-3FAs and DHA concentration in seminal plasma and TAC, and decreased DNA fragmentation
  - Improved sperm concentration and sperm motility
  - Positively associated with higher semen volume, total sperm count, testis size

ALCOHOL

- Males:
  - There is a detrimental effect of alcohol consumption on semen volume and morphology, mainly in daily, consumers.
  - Infertile daily drinkers had worse semen quality
- Females:
  - In the past few decades, a lot of publications have indicated an association between alcohol consumption and the fecundability among women
  - Acute alcohol use increased TT, estradiol, and LH levels, with greater increases seen in women who binge drink.

CAFFEINE AND CAFFEINATED BEVERAGES

- Males:
  - Caffeinated soda intake has an inverse dose-response relation with fecundability in males
  - Caffeine intake might negatively affect sperm DNA and therefore affect male fertility.
  - Male caffeine intake was negatively correlated with live birth after ART.
- In summary, based on the current data, there is inconclusive evidence on the effect of caffeine on semen parameters and male fertility.

CAFFEINE AND CAFFEINATED BEVERAGES

- Females:
  - Intake of caffeine is associated with poorer oocyte and embryo outcome
  - European Food Safety Authority and WHO advise women planning to conceive or pregnant women to limit coffee consumption to a maximum of two to three cups/200~300 mg caffeine per day

SUGAR-SWEETENED BEVERAGES (SSBS)

- Females:
  - Consumption of SSBs is associated with a higher risk of infertility
  - This may be explained by the interference of sugar with reproductive hormones, egg maturation, and ovulation.
- Males:
  - Intake of SSBs affects sperm parameters and is associated with lower sperm concentration.


Any
questions