

BODY MASS INDEX AND TOBACCO INFLUENCE ON ASSISTED REPRODUCTIVE TECHNOLOGY

INTRODUCTION:

Assisted reproduction techniques prognosis depends on various factors. The main ones are the woman's age, her BMI, obstetric history, toxic factors, the ovarian reserve...

The purpose of this work is to conduct specific bibliographical research on the consequences of **smoking** and **body mass index** on assisted reproduction techniques, and on individual fertility.

HYPOTHESIS:

1. Extreme BMI values –outside the normal range- lead to poor prognoses for ART
2. Smoking has a negative impact on ART.

METODOLOGY

Study based on scientific literature research using Pubmed tool (NCBI).

Key words: BMI, Tobacco, nicotine, fertility, ART, pregnancy, hormones.

BODY MASS INDEX RESULTS:

Adolphe Quetelet invented the formula for the BMI. It's a ratio of adult's weight and height recommended to define obesity. It defines people's nutritional condition.

$$BMI = \frac{Mass (Kg)}{(Height(m))^2}$$

Table 1. BMI Classification

CLASSIFICATION		IMC (kg/m ²)
• Underweight		≤ 18'5
• Normal range		18'5 – 24'9
• Overweight		≥ 25 (25-29'9)
• Obesity:	Class I Obesity	30-34'9
	Class II Obesity	35-39'9
	Class III Obesity (morbid)	40-49'9
	Class IV Obesity (extreme)	≥ 50

DEVIATIONS FROM THE IDEAL BMI

- **Obesity** is a chronic disease characterized by excess of adipose tissue. It's the second cause of early and preventable death. It causes anovulatory sterility and decreases sperm production.
- **Drastic weight loss** or **being underweight** also affects human health. It causes amenorrhea in women and decrease of sperm motility and concentration.

The maintenance of reproductive functions is directly dependent on having a suitable body weight.

Fig.1.

TOBACCO RESULTS:

Smoking is one of the main causes of the diseases with the highest mortality rates in the developed world. Tobacco causes prematurity, miscarriages, perinatal mortality, and fertility problems.

FEMALE ENDOCRINE FACTOR

- Female smokers have a **higher infertility rate** than non-smokers, **take longer to conceive** (6-12 months), have an **increased risk of miscarriage** and ectopic pregnancies
- Tobacco induces intrafollicular oxidative stress
- **Nicotine** damages ovaries, stimulates acetylcholine receptors → **+ DOPAMINA** and inhibits GnRH and aromatase → **- OESTROGENS**

- They have **earlier menopause** (1-4 years)
- Female smokers who undertake ART, require higher doses of gonadotropins for ovarian stimulation
- Oocytes are more prone to chromosomal anomalies
- Tobacco harmful effects are more prominent in older women
- Women who had smoked had double risk of not getting pregnant via ART

MALE ENDOCRINE FACTOR

- Tobacco **alters** the formation of **spermatozooids**, decreases their density, motility and antioxidant activity. However, this values are often within the normal range.
- Infertile smokers have **high levels of oxidative stress**.
- Nicotine and other toxic compounds in tobacco cause **DNA fragmentation**
- Due to GnRH inhibition, testosterone production is affected: **spermatic functions drop** by 22%

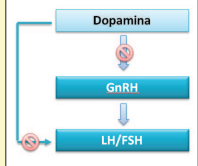


Fig.2.



Fig.3.

MALE ENDOCRINE FACTOR

- **Aromatase** enzyme (in Leydic cells, adipose tissue, brain...) converts androgens to oestrogens.
- Obese individuals have more fat cells. Thus, there is more aromatase activity.

- High levels of oestrogens inhibit the secretion of LH and FSH.
- Sertoli and Leydig cells cannot be stimulated.

- Testosterone levels drop → Spermatozoid production also drops

- Low weight involve a **drop in sperm motility** and a **low sperm concentration**.
(More significant than extreme BMI)

- **- TESTOSTERONE** → Low sperm motility (dose-dependents)

- Men with low sperm motility have **low levels of aromatase**. This enzyme plays an important role in regulating the development, maintenance and maturation of sperm.

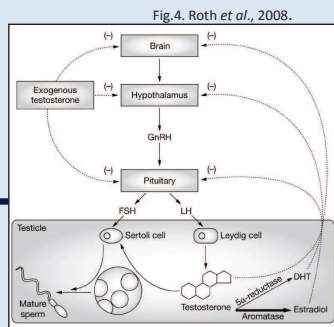


Fig.4. Roth et al., 2008.

FEMALE ENDOCRINE FACTOR

- Women with BMI>25 are at **high risk of sterility by anovulation** (or have irregular ovulation)
- BMI>30 is related to **lower follicular response** in ART, large number of miscarriages, and difficulties in becoming pregnant

- To compensate **+ OESTROGENS**
 - Administrate higher doses of LH and FSH
 - More days of ovarian stimulation
- However, they have low fertilisation rate (above BMI>30, the fertilization rate is 4% lower for each unit increased)

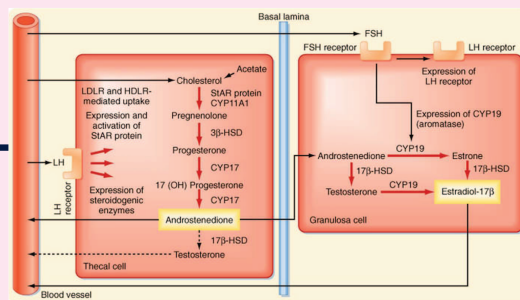


Fig.5.Koeppen & Stanton: Berne and Levy Physiology, 6th Edition, 2008.

- Women with low BMI have few adipocytes → **- LEPTIN**

- Decreases GnRH, LH and FSH secretion
- **Small amounts of estradiol**, irregular ovulation or anovulation.
- A drop in GnRH difficult the embryo implantation and decrease the chances of pregnancy. Fertility treatment can be improved with **GNRH analogues** or gonadotropins.

What if the effects of tobacco and obesity are added together?

If these two situations occur in parallel, **fertility is even more compromised** and it will be even more difficult to obtain good results with ART. **Tobacco exposure during pregnancy** increases future children BMI. According to the other reports, they might have fertility problems.

DISCUSSION:

- Deviations from the ideal BMI and tobacco determine a poor prognosis for ART and also lead to miscarriages
- **Obesity** causes sterility due to **anovulation** and produces **poor embryonic quality**. Obese patients **require higher doses of gonadotropins** in ART
- **Low BMI** leads to **anovulation**. It can be treated with GnRH analogues or gonadotropins. Men with a low BMI have **scant spermatozoid production**.
- **Smoking accelerates menopause** by 1-4 years. Smoker women **take longer to conceive** and require higher doses of gonadotropins. The decrease in **sperm concentration is dose-dependent** on tobacco.
- It is recommended to normalize the BMI and quit tobacco in order to improve health and obtain better results in ART.
- Performing further studies on these prognostic parameters in ART would be interesting in the future.

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