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A review: Relationship between Inhibin B level and some trace elements in female infertility

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A B S T R A C T

The granulosa cells of the female ovary generate the transforming growth factor (TGF-) superfamily member, inhibin B. Instead of being a possible indicator of male and female poverty, it serves as a motivator for change. As part of the utero-placental unit's paracrine ovarian and testicular regulators, it is now known to have several paracrine functions. This study investigated the relationship between inhibin B levels and a few trace components in women who were infertile.

1. INTRODUCTION

The environment was seriously harmed by the war in Iraq, both before and after 2003, and infertility is a disorder of the reproductive system where a clinical pregnancy cannot be obtained after at least a year of unprotected sexual activity. Many chemical and radioactive materials were handled and destroyed by unskilled workers, resulting in numerous mishaps, deaths, and cases of cancer or infertility among the survivors. Very few studies have explicitly examined the relationship between conflict and infertility [1,2].
A significant number of factors, such as obesity rates, cardiovascular diseases, hormone-dependent tumors, developmental issues, chronic childhood illnesses, early puberty, altered gender ratios, altered maternal ages, infections of the reproductive system, diet, addictions, and stress, contribute to the fact that fifteen percent [15%] of childbearing couples experience infertility, which is widely recognized as a serious public health issue. It usually arises from toxic accumulation in the body as well as psychological or emotional stress [3,4,5]. Transforming growth factor- (TGF-) superfamily dimeric polypeptide hormones are called inhibitors. Inhibin B, a paracrine regulator of the ovarian and testicular systems, has several paracrine effects on the uteroplacental axis and is not a potential indicator of poverty for either sex [6,7,8].
Minerals that constitute less than 0.01% of an individual's total weight or that are required in doses between 1 and 100 mg daily are referred to as "trace elements" (TEs). Zinc (Zn), copper (Cu), chromium (Cr), cobalt (Co), selenium (Se), and iodine (I) are among the trace elements essential for human health. The human body also requires trace elements like molybdenum (Mo) and manganese (Mn). Proteins, transcription factors, and fundamental metabolic processes, including enzymatic reactions as components of complexes, all depend on trace elements for their proper operation [9,10].

For life to exist, inorganic trace elements such as iron (Fe), copper (Cu), zinc (Zn), and selenium (Se) must be consumed on a daily basis in very small amounts, usually less than 100 mg. Selenium, as a trace element, is essential to human health and biological function. In areas with significant soil deficiencies, supplementation is advised as part of public health policy, since growing evidence indicates that this element is essential for healthy animal and human growth and reproduction [11,12].

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Severe hypozincemia increases the risk of infertility in both sexes, as zinc is essential for healthy spermatogenesis [13,14]. Copper (Cu) is an essential mineral found naturally in a wide variety of foods and dietary supplements. It serves as a cofactor for a number of enzymes involved in physiological processes, such as iron metabolism and energy generation [15].

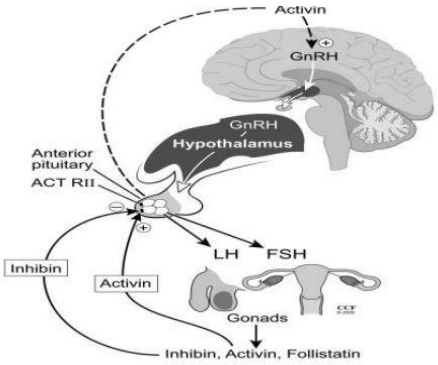
Effect of inhibin B in female infertility

Inhibin-B, on the other hand, shows an increase in the early follicular phase, followed by a drop, a brief peak immediately after the spike in luteinizing hormone (LH), and finally reduced values in the luteal phase. This pattern demonstrates that Inhibin-B, a granulosa cell product, participates in follicular growth and supports the hypothesis that serum concentrations reflect follicular function and oocyte quantity [16,17].

There are multiple controls over the production of inhibin B throughout life. The fact that inhibin B levels peak postpartum and are only weakly associated with a rise in serum follicle-stimulating hormone (FSH) suggests that Sertoli cell proliferation is most likely occurring during this developmental stage. Inhibin B levels decrease in response to FSH stimulation and remain low until adolescence when they rise again due to FSH's simultaneous control of spermatogenesis and growth [18,19,20].

Because inhibin B selectively decreases FSH, a high amount of this hormone may be the reason for the elevated LH/FSH ratio seen in certain individuals. Additionally, inhibin may directly promote androgen synthesis in theca cells. More healthy follicles may result in higher serum levels of inhibin B, indicating the severity of ovarian dysfunction in a patient [21].

International journals have published a number of studies on serum inhibin B and its connection to male reproductive health. Inhibin's usual endocrine role is to stop activin from promoting the release of FSH. By binding to the same receptor as adrenocorticotrophic releasing type 2, inhibitor B inhibits the release of FSH and LH (ACT RII). Preliminary research suggests that activins may increase the amount of gonadotropin-releasing hormone (GnRH) released by the hypothalamus, as seen in Scheme (1) [3].



Scheme 1. Outlined the inhibin B regulation schematic process [3].

The objective of this study was to evaluate the sensitivity, specificity, positive predictive value, and negative predictive value of serum inhibin B in the diagnosis of male infertility using the gold standard for semen analysis in the industry [22, 23]. Low levels of inhibin B are linked to reduced ovulation, decreased pregnancy rates, and an increased chance of miscarriage. Inhibin B does appear to be related to fertility [24, 25].

About 85% of menstrual cycles are ovulatory after the first year of usage, and systemic adverse effects are uncommon. Antral follicle count and serum concentrations of FSH, inhibin B, or anti-Mullerian hormone can be used to determine ovarian reserve. Vascular alterations are also linked to aging, and numerous investigations have shown an age-related decrease in ovarian artery blood flow [26, 27].

A more sensitive indicator of ovarian age than FSH is the drop in serum inhibin B concentration, which occurs before the rise in serum FSH [28]. Women receiving progesterone for polycystic ovarian syndrome showed a decrease in inhibin B. Inhibin and activin are differentially expressed in endometrial cells and leukocytes during the menstrual cycle, in women using progestin-only contraception [29].

Inhibin B, a dimeric glycoprotein secreted by antral follicles that represents antral follicle count. Consequently, the concentration of inhibin B in serum is thought to be a direct indicator of ovarian reserve. Compared to women who utilize LNG-IUS, hysterectomized women experience the onset of menopausal symptoms earlier and a rise in serum FSH concentrations earlier [30].

When organizing treatment for menorrhagia in older women, this is important to consider for fertile women [31]. As women age, their serum prolactin levels decrease; this drop is most pronounced following menopause. Hyperprolactinemia in women has been associated with amenorrhea and galactorrhea [32].

An increasingly common health issue affecting female reproductive health is obesity [33]. Anovulation, infertility, and menstrual disorders are significantly more common in overweight women compared to others of reproductive age. In obese patients, altered pulsatile gonadotropin secretion is a well-established mechanism [34].

Despite the lack of concrete data, inhibin B has been proposed to negatively regulate FSH secretion [35]. Inhibins work locally by promoting follicle growth, reflecting the reserve of tiny antral follicle growth. As women's BMI increases and age advances, their inhibin B levels decrease [36]. A larger blood volume or a more intricate hypothalamic regulation may cause a sample dilution effect, which would explain how a higher BMI may reduce inhibin B. Patients with relatively high BMIs tend to have lower FSH levels, indicating a possible hypothalamic cause. Effect of BMI on FSH levels in serum.

When acute human chronic gonadotropin was administered, the link between LH and inhibin B raised rather than lowered serum inhibin B levels [37, 38].

Inhibin B concentration decreased 12 months after total abdominal hysterectomy, but serum FSH levels remained unchanged. Inhibin B levels dropped rapidly in both groups, and they weren't detectable until two years before the menstrual cycle ended [39].

Depending on the duration of device wear, the rate of ovulation may decrease. The localized suppression of the endometrium is the major biological effect of this IUD. Progesterone and estrogen receptors are downregulated [40]. It is still unknown which mechanism causes decreased ovarian function following a hysterectomy. Impaired blood supply to the ovary following a hysterectomy is corroborated by edema and congestion shown in histology. This may cause endocrinological abnormalities, thickening of the tunica albuginea, stromal cell hyperplasia, and a marked reduction in follicular reserve [41]. Inhibiting ovulation, lowering FSH and LH levels, and preventing LH surges are the mechanisms by which DMPA works. DMPA has no effect on estradiol, but it raises progesterone levels in those using this contraception. Progestin in DMPA circulates as an active free steroid that binds very little to sex hormone-binding globulin and albumin [42].

The influence of some trace elements on female infertility

For basic metabolic functions in the human body, such as enzymatic reactions, trace elements are required. A sufficient intake of certain trace elements, such as copper, zinc, calcium, magnesium, and iron, is necessary for optimum health, especially for the reproductive systems of women [43]. A large body of research on the female reproductive system highlights the impact of zinc on the formation, activation, and function of oocytes. Essential trace elements for both animal and human reproduction, vital for safeguarding human health, include cobalt (Co), copper (Cu), selenium (Se), and zinc (Zn). There is a weak connection between the success of in vitro fertilization (IVF) and the presence of crucial trace elements, most notably EEA [44]. Since manganese is essential to cattle fertility, feeding them low manganese rations lowers the likelihood of conception. Iodine deficiency affects ovarian and thyroid function. Zinc deficiency hampers spermatogenesis and female reproduction. Even though forages are rich in iron, low availability can negatively impact ruminant reproductive health in various situations [45]. Nutritious elements like zinc, copper, and selenium constitute proteins, enzymes, and hormones that control a variety of bodily functions, including the immune system's response. Zn, Cu, and Se are examples of dietary components involved in regulating several processes, including the immune system's response, through proteins, enzymes, and hormones. They are required for DNA synthesis, mitochondrial oxidative phosphorylation, and myoglobin synthesis. Copper is an important enzymatic component for proper protein binding [46]. Furthermore, several studies assert that chromium is the primary catalyst for carcinogenesis and link workplace exposure to chromium to an elevated risk of respiratory system cancers, including cancers of the nose, sinuses, and lungs. Mendelian randomization and meta-analysis were examined; Lin and Yang found a relationship between the incidence of ovarian cancer and blood zinc levels. However, there was no increased risk of ovarian cancer associated with copper. In another study, high serum selenium levels were associated with cervical cancer. Selenium levels increase after cervical cancer therapy, suggesting it as a preventative factor [47]. In a recent study, Sarahi et al. examined the relationship between endometriosis and environmental exposure to substances that disrupt hormones. Researchers discovered a connection between endometriosis and copper and chromium, although in a single study. There was inconsistent information about the relationship between nickel and this ailment, and no evidence that cadmium, lead, or mercury were associated with the condition [48].

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Arabic Abstract

أمراض العقم هي تلك التي لا يمكن فيها تحقيق الحمل السريري بعد سنة على الأقل من النشاط الجنسي المنتظم وغير المحمي. تؤثر هذه الحالات في المقام الأول على الجهاز التناسلي. تولد الخلايا الحبيبية في المبيض الأنثوي عامل النمو المتحول (TGF-) وهو عضو في فصيلة إنهيبين ب. وبدلاً من أن يكون مؤشرًا محتملاً لفقر الذكور والإناث، فهو بمثابة محفز للتغيير. وحدة نظير الصماوي في وحدة الرحم والمشيمة هي منظمات المبيض والخصية، ومن المعروف الآن أن لديها عددًا من وظائف نظير الصماوي. بحثت هذه الدراسة في العلاقة بين مستويات إنهيبين ب وبعض المكونات النزرة لدى النساء المصابات بالعقم.