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IMPACT OF INCREASED PROLACTIN LEVELS ON SEMINAL FLUID PARAMETERS AND MALE INFERTILITY IN WHITE NILE STATE IN SUDAN

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ABSTRACT

Background: Male infertility is a global health issue with diverse etiologies and pathogenesis, this study investigates the impact of Prolactin levels on seminal fluid parameters in infertile men, to develop effective treatment strategies for male infertility. **Subjects and Methods:** The study recruited 200 participants, including 100 infertile males and 100 healthy fertile males, from the infertility center of Kosti, Rabak Teaching Hospitals in White Nile State, Sudan. Blood samples were collected from each participant, and the levels of prolactin were measured, semen analysis was also performed to assess sperm count, motility, and morphology. **Results:** The results showed that infertile males had significantly higher levels of prolactin, (18±1.42 ng/ml) compared to the healthy controls (10.4±2.95 ng/ml), $p<0.001$. Pearson's correlation analysis revealed a significant negative correlation between prolactin levels and sperm count, motility, and morphology. **Conclusion:** The findings suggest that alterations in prolactin levels may contribute to male infertility, and these hormonal parameters could be used as potential biomarkers for infertility assessment.

KEYWORDS: Hyperprolactinemia, sperm motility, Asthenozoospermia.

INTRODUCTION

Infertility and its management pose significant global health challenges with various social aspects, and roughly 85% of couples have a known cause.[1] It is defined as the inability of a couple to conceive after one year of regular unprotected intercourse, with male factors accounting for at least half of all cases.[2] Research by Jafari et al. in 2015 suggested an increased rate of male-related infertility at 40.9%.[3], while other studies reported a range of 20-70% for male-related infertility.[2] Male infertility can have profound psychological effects on individuals and couples, leading to stress, anxiety, depression, and a sense of inadequacy. The rise in male infertility is attributed to a combination of physiological, anatomical, genetic, and environmental factors such as smoking, alcohol consumption, changes in sexual behavior, and diet, leading to diverse etiologies and patterns globally.[3]

Prolactin is a hormone produced by the pituitary gland that plays a role in various physiological functions, including lactation, reproduction, and immune regulation.[4] In men, elevated levels of prolactin, a condition known as hyperprolactinemia, can have negative effects on fertility. Hyperprolactinemia has been associated with decreased sperm concentration, motility, and morphology, which can contribute to male infertility.[5] High prolactin levels may also lead to oxidative stress and DNA damage in sperm, further impacting fertility. Hyperprolactinemia can be caused by various factors, including pituitary tumors (prolactinomas), medications, stress, and certain medical conditions.[6] Identifying and addressing the underlying cause of elevated prolactin levels is important in managing male infertility associated with hyperprolactinemia. Treatment options for hyperprolactinemia-induced male infertility may include medications to lower prolactin levels, surgical removal of prolactinomas, or other interventions to restore hormonal balance and improve fertility outcomes.[7]

Male infertility is a prominent global health issue that necessitates careful management. Exploring the factors associated with male infertility is crucial for healthcare providers and policymakers to develop suitable strategies for its treatment. While the impact of Prolactin on female reproduction is well-documented, it has not been extensively researched in the context of male infertility. Given the unknown and diverse etiology and pathogenesis of male infertility, this study aims to evaluate the influence of Prolactin on seminal fluid parameters in infertile men.

Subjects and Methods

This study recruited healthy volunteers and infertile males from the infertility center of Kosti, Rabak Teaching Hospitals in White Nile State, Sudan, between September 2022 and December 2023. The study consisted of two hundred participants, with one hundred infertile males forming the case group and one hundred apparently healthy fertile males who served as the control group. Approval was obtained from the Ethics Committee at Kosti teaching hospital, and informed consent was also obtained from the participants. Data collection involved the use of a structured questionnaire. Exclusions were made for newly married males married for less than one year, males with prostate cancer, erectile dysfunction, venereal diseases, HIV, psychological issues, diabetes (type I & II), congenital anomalies of the genital organs such as hypospadias, Klinefelter's syndrome, hypogonadotropic hypogonadism, Y-chromosome microdeletion or abnormality, obstructive azoospermia, history of treatment with cytotoxic drugs, irradiation, and sulfasalazopyrine.

From each participant, 5 ml of venous blood was collected into lithium heparin blood containers, then labeled and the plasma was separated and immediately tested for Prolactin (PRL). The participants were then instructed to refrain from

ejaculating for at least 72 hours before providing a sample for semen analysis. The container was labeled with the patient's details, and the time and date of collection.

The levels of plasma prolactin were estimated using full automated Tosoh analyzer. It depends on Immunoassay technique by using antibodies to detect particular antigens. The semen fluid parameters (sperm count, sperm motility and morphology index) were assessed by ICASA computer system.

Statistical analyses were carried out using the SPSS version 27, after tabulation of data and calculation of the means, the t-test was used to compare means of the study parameters between groups. Pearson's correlation was used to find the correlation between hormone levels and different parameters of semen analysis. Finally, ROC curve analysis and AUC was calculated to evaluate levels of PRL in discrimination between positive and negative cases of infertility. For all statistical analysis, *P* values of < 0.05 was considered significant.

RESULTS

The present study was conducted to compare the levels of PRL between infertile men and apparently healthy controls, furthermore, we investigate the correlations between PRL and different parameters of semen analysis.

Elevated Prolactin levels were observed in infertile men (18±1.42 ng/ml) compared to their peers of controls (10.4±2.95 ng/ml.), ($p<0.001$) as shown in table-1.

Table-1: Age, BMI, Hormone levels, and Semen analysis parameters in the study groups.

	Infertile (N = 100)	Controls (N = 100)	P value
	Mean ± SD	Mean ± SD	
Age (Yrs.)	35.4±0.86	35.4±0.86	0.097
BMI (Kg/m^2)	25.50±3.27	24.20±2.65	< 0.01
Prolactin (ng/ml)	18±1.42	10.4±2.95	< 0.001
Volume (ml)	3.1±1.6	4.0±1.9	< 0.05
Sperm Concentration (Million/ml)	17.37±1.0	51.67±20	< 0.001
Vitality (%)	19.06±1.0	71.16±1.3	< 0.001
Total Motility (%)	11.94±3.1	75.53±0.73	< 0.001
Progressive motility (%)	5.11±1.2	49.21±2.6	< 0.001
Morphology Index (%)	12.99±2.53	51.22±1.48	< 0.001

Results are expressed as mean ±SD, or (%).

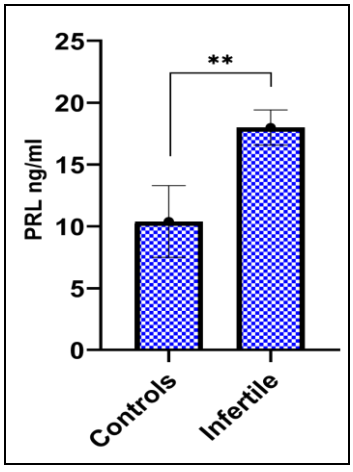

Figure-1: Levels of Prolactin in the study groups.

A significant negative correlations were observed between prolactin levels and sperm count (r = -0.68), progressive motility (r = -0.62), morphology index (r = -0.48), and vitality (r = -0.51), ($p<0.0001$) as shown in figure-2 a, b, c, and d, respectively.

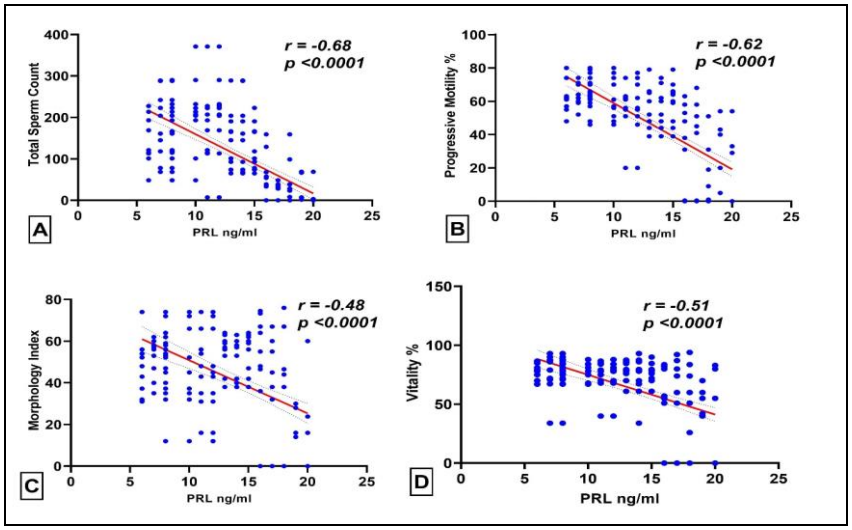

Figure 2: Correlations between Prolactin and A: Total sperm count, B: Progressive motility, C: Morphology index, and D: Vitality.

DISCUSSION

Male infertility is a significant issue globally, with prevalence estimates varying depending on the population studied and the criteria used for diagnosis. Generally, it's reported that male factors contribute to infertility in about 40-50% of cases where couples have difficulty conceiving.[2]

Hyperprolactinemia stands as one of the primary factors leading to hypogonadotropic hypogonadism in both men and women.[8] Prolactin can inhibit the production of gonadotropin-releasing hormone (GnRH) from the hypothalamus, which in turn suppresses the release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) from the pituitary gland. LH and FSH are essential for stimulating testosterone production and spermatogenesis in the testes.[9] Therefore, elevated prolactin levels can disrupt this hormonal cascade and impair sperm production. The present study suggests correlation between increased prolactin levels and abnormalities in semen quality. A negative correlations were observed between levels of prolactin and sperm count, vitality, progressive mobility, and morphology index as shown in figure-2. These finding are in consistent with previous reports that consider the influence of PRL on the male reproductive function.[10] Siddhant and colleagues reported that patients with hyperprolactinemia had lower testosterone and lower total motile sperm count compared to men without hyperprolactinemia. Moreover, they found that 43.1% of men with hyperprolactinemia had Oligospermia.[11] Prolactin can also affect sexual function in men. Elevated prolactin levels have been linked to erectile dysfunction, decreased libido, and other sexual dysfunctions, which can impact fertility by reducing the ability to achieve successful intercourse.[12,13] Elevated prolactin levels can have detrimental effects on male fertility by disrupting hormonal regulation, impairing sperm production and quality, and affecting sexual function.

Male infertility is a complex issue with broad implications for individuals, couples, and society as a whole. Addressing it requires comprehensive medical evaluation, emotional support, and sometimes significant financial investment in

treatment options. Treatment for male infertility, such as assisted reproductive technologies (ART) including in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI), can be expensive and not always covered by insurance. So, studies exploring the non-invasive, lower-cost options in management of male infertility remains to be crucial for enhancement of patient outcomes.

CONCLUSION

According to the findings of the present study, elevated prolactin levels may affect male infertility and semen analysis parameters. As compared to healthy controls, infertile males had significantly higher levels of prolactin. More cohort studies are recommended to validate these findings and investigate these associations.

Declarations

Ethical approval and consent to participate

The study was approved by the Ethics Committee at Kosti teaching hospital – Kosti -Sudan, informed consents were obtained from all participants in the study.

Availability of data and material

Please contact the authors for data requests.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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