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Research Paper

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Assessment of Hormone Levels in Men with Fertility Problems Attending a Tertiary Infertility Center in North Karnataka

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***Abstract*—** we assessed the serum levels of Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) and Testosterone (T) which are the principle hormones responsible for the control of spermatogenesis. A total of 125 married men facing fertility problem and 35 proven fathers were assessed for the serum hormone levels and the sperm count, attending a tertiary infertility center in North Karnataka. Statistical analysis of different variables were performed using SPSS 20.0. Significant reduction in mean sperm count and increased Luteinizing Hormone levels among cases was found (p <0.05). There was an insignificant difference between the mean serum levels of Follicle Stimulating Hormone and Testosterone of the cases to that of the control group (p = 0.191, p = 0.228). The current study found significant correlation of Sperm count with serum Follicle stimulating hormone and (p = 0.014) and insignificant correlation with Luteinizing hormone (p = 0.523) and Testosterone (p = -0.078) among cases.

Keywords— Spermatogenesis, Male Infertility, Follicle Stimulating Hormone, Luteinizing Hormone, Testosterone

I. INTRODUCTION

Spermatogenesis encompasses an intricate network of processes that occur in the seminiferous tubules and culminates in the production of the mature male gamete [1]. The complete spermatogenic process in humans thought to require approximately 42–76 days [2]. Hormones play a vital role in initiating and maintaining male reproductive function, yet it is not well understood how variations in the levels of some hormones impact semen quality [3]. The endocrine control of spermatogenesis is governed by the neuroendocrine activity along the hypothalamic-pituitary-testicular axis. The release of follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary gland is elicited by gonadotropin-releasing hormone (GnRh) secreted by the hypothalamus [4]. FSH binds to receptors in the Sertoli cells and stimulates spermatogenesis [5]. LH stimulates the production of Testosterone (T) by the Leydig cells, and in turn, acts on the Sertoli and peritubular cells of the seminiferous tubules to stimulate spermatogenesis [6]. The failure of the pituitary to secret FSH and LH will result in disruption of testicular function leading to infertility [7]. Although only 2% of male infertility is due to an endocrinological cause [8], identification is important, as specific hormonal therapy is often successful. Prior reports have stated that the circulating levels of specific reproductive hormones in men are allied with semen quality [9, 10].

From last few decades infertility has become a remarkable problem worldwide. Since FSH, LH and Testosterone collectively initiate and sustain spermatogenesis, they assist as surrogates of semen quality in epidemiologic studies. Anomalous levels of these vital hormones in men with low sperm count is an indication of unusual sexual and reproductive health. The consequences between these hormone levels and sperm concentration among infertile males is little known. Thus, an effort has been made to assess FSH, LH and testosterone levels and their association with sperm concentration in a population that included men suffering from fertility problems who are enlisted in an infertility centre of North Karnataka.

II. MATERIALS AND METHODS

Study Population:

125 Male partners of infertile couples, diagnosed for having fertility problem as cases and 35 fertile men as controls, who attended a fertility clinic in Hubli, Karnataka were enlisted

after fulfilling the inclusion and exclusion criteria for this study.

Inclusion criteria:
- Cases with the age group of 25-45 year.
- Partner aged 18 to 40 year.
- Couples with "pure" male factor infertility of 12 months or more, defined as not pregnant in spite of being desirous of pregnancy for at least 12 months with normal sexual activity and no birth control.
- Abnormality of any one of the sperm parameters according to WHO-2010 for concentration, motility or morphology.
- Having fathered one or more pregnancies.

Exclusion criteria:
- Cases of which the females reported with anatomical, immunological, endocrinological and infectious problems were excluded.
- Diagnosed or suspected genetic or psychiatric disease in either patient.
- History of treatment with cytotoxic drugs, irradiation, or sulfasalazopyrine.
- History of cancer and vasectomy.

III. RESULTS

The age of men with fertility problem was 34.36±1.19 year (n=125) at the time of diagnosis. These cases were alienated into seven abnormal conditions based on their semen analysis, according to WHO-2010 guidelines. Amongst which, 23.21% were Asthenozoospermia and 21.6% were Severeoligoasthenoteratozoospermia (SOAT) cases. Apart from Azoospermia cases, SOAT cases were having lowest sperm count (4.63±0.53 mil/ml).

Table 1. Sperm count and hormonal levels in control and cases.

Subjects	Sperm Count (mil/ml)	FSH (mIU/ml)	LH (mIU/ml)	T (ng/dL)
AS	45.55±3.52	4.88±0.23	6.81±0.25	12.41±0.34
AS+TE	29.47±3.17	7.47±0.22	6.79±0.31	7.44±0.19
AZ	0.00±0.00	17.79±0.22	9.99±0.24	6.63±0.14
OL+AS+TE	10.75±0.25	9.01±0.25	6.58±0.74	7.50±0.24
OL	10.50±1.19	12.73±0.23	10.23±1.11	4.40±0.28
S+OL+AS+TE	4.63±0.53	9.31±0.17	7.21±0.47	8.00±0.15
TE	29.37±3.58	4.26±0.16	6.18±0.14	7.85±0.15
Control	59.89±3.64	7.75±0.12	5.26±0.14	7.97±0.10

Values are presented as Mean ± Standard error; FSH=Follicle Stimulating Hormone; LH=Luteinizing Hormone; T=Testosterone; S.E=Standard Error, AS= Asthenozoospermia, AS+TE= Asthenoteratozoospermia, AZ=Azoospermia, OL+AS+TE= Oligoasthenoteratozoospermia, S+OL+AS+TE=Severeoligoasthenoteratozoospermia, TE= Teratozoospermia.

Follicle stimulating hormone level was found elevated in azoospermia (17.79±0.22 mIU/ml) and oligozoospermia cases (12.73±0.23 mIU/ml). Higher levels of luteinizing hormone was also found in Oligozoospermia cases (10.23±1.11 mIU/ml). Testosterone level was high in asthenozoospermia cases (12.41±0.34 ng/dL) **(Table-1)**.

Table 2. Serum hormone levels of the case and the control group.

Subjects	Sperm Count (mil/ml)	FSH (mIU/ml)	LH (mIU/ml)	T (ng/dL)
Control	59.89±3.64	7.75±0.12	5.26±0.14	7.97±0.10
Case	21.19±1.91	8.78±0.42	7.45±0.18	8.50±0.23
p value	< 0.001*	0.191	< 0.001*	0.228

Values are presented as Mean ± Standard error; FSH=Follicle Stimulating Hormone; LH=Luteinizing Hormone; T=Testosterone; S.E=Standard Error, *p**= significance at 0.05.

Significant correlation was found with respects to sperm count and luteinizing hormone levels ($p<0.05$) between cases and controls **(Table-2)**.

Table 3. Correlation coefficients (r) for serum FSH, LH and Testosterone with that of the Sperm count among the cases.

Sperm Count (mil/ml)	FSH (mIU/ml)		LH (mIU/ml)		T (ng/dL)	
	Control (N=35)	Cases (N=125)	Control (N=35)	Cases (N=125)	Control (N=35)	Cases (N=125)
0-20	8.81±0.0	11.01±0.5	6.20±0.0	7.78±0.3	8.60±0.0	7.60±0.2
21-40	7.74±0.3	5.39±0.4	5.15±0.2	6.31±0.2	7.97±0.3	8.61±0.4
41-60	7.63±0.3	5.18±0.4	5.13±0.4	7.35±0.3	8.01±0.2	10.68±0.7
61-80	7.65±0.2	4.92±0.5	5.24±0.2	7.32±0.4	8.16±0.1	10.96±1.2
81-100	7.89±0.3	4.34±0.9	5.39±0.3	8.65±0.5	7.59±0.2	14.70±2.0
r	0.947		0.384		-0.835	
***p* value**	0.014*		0.523		0.078	

Values are presented as Mean ± Standard error; FSH=Follicle Stimulating Hormone; LH=Luteinizing Hormone; T=Testosterone; S.E=Standard Error, N= Number, *p**= significance at 0.05.

There exists a strong correlation between sperm count and follicular stimulating hormone levels amongst the cases ($p<0.05$) **(Table-3)**. Variations in the levels of FSH, LH and Testosterone and the sperm counts are represented in **Figure-1, Figure-2,** and **Figure-3** respectively.

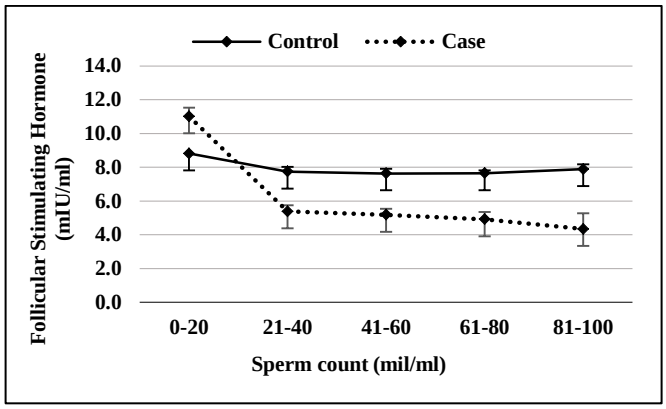

Figure 1. Levels of FSH amongst cases and control at different sperm count. FSH=Follicle Stimulating Hormone.

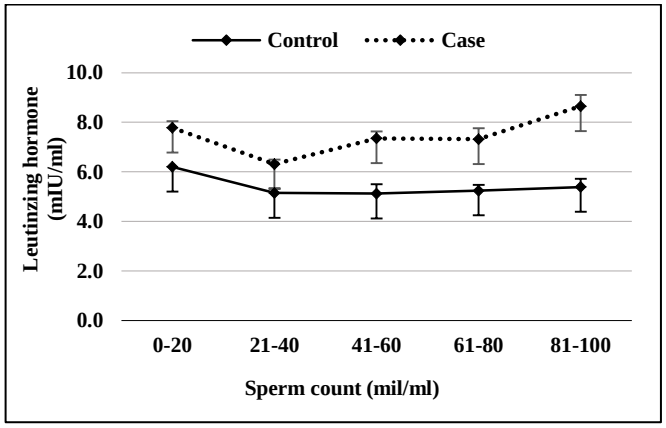

Figure 2. Levels of LH amongst cases and control at different sperm count. LH=Luteinizing Hormone.

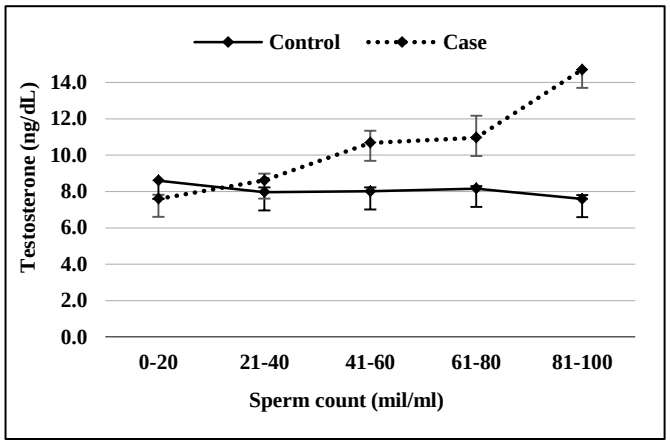

Figure 3. Levels of Testosterone amongst cases and control at different sperm count.

IV. DISCUSSION

Follicle stimulating hormone, luteinizing hormone and Testosterone are the essential factors for the production of spermatozoa. FSH directly acts on sertoli cells to stimulate spermatogenesis and LH plays an indirect role by stimulating the production of testosterone in Leydig cells which in turn acts on sertoli and peritubular cells to produce spermatozoa [11]. The failure of the pituitary to secrete FSH and LH results in disruption of testicular function and male infertility [12]. Hence, the evaluation of fertility hormones like FSH, LH and Testosterone in the management of male infertility is expedient. The present study showed a significant reduction in the sperm count of cases when compared with control group (p<0.001). Measurement of serum FSH is of utmost importance, which offers a useful index of the state of the seminiferous epithelium when the concentration is related to sperm density [12]. In this report, elevated levels of FSH were found in azoospermia and oligozoospermia cases when compared with the control as observed in earlier reports [13-17]. If testes are damaged, elevated levels of LH and low levels of testosterone will be found. It is because, pituitary gland floods an extra LH, hoping this will encourage higher Testosterone production. In this study elevated levels of FSH and LH were seen in infertile males [18].

V. CONCLUSION AND FUTURE SCOPE

With a multidimensional aetiology, male infertility has become a challenge. Normal concentration of gonadotrophins are characteristic parameters of regular spermatogenesis, whereas testosterone gives an indication of proper functioning of Leydig cells. Abnormal levels of gonadotrophins and androgens indicate the damage to germinal epithelium, decrease in inhibin secretion, unusual negative feedback mechanism, unusual function of pituitary gland, primary testicular failure, seminiferous tubule dysgenesis, Sertoli cell failure which is often linked with male infertility. Hence, a proper endocrinological work-up in assessing male infertility is essential because these cases may have noticeable endocrinopathy which can be correctable by suitable replacement therapy either with GnRH or LH and FSH. Complimentary inspections of additional male populations are needed for a better understanding of the relationship between hormones and semen quality.

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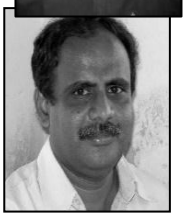

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Dr. Murigendra Hiremath obtained his M.Sc. in 1996 and Doctoral Degree in 2001 from the Karnatak University, Dharwad. He Joined National Institute of Advanced Studies, Indian Institute of Sciences Campus, Bangalore in 2002. He Joined KLES Dr.Prabhakar Kore Hospital & MRC, Belgaum as a Scientist and Chief Coordinator for Clinical Trials and Research in 2007. Since 2013, He is working as an Associate Professor at the Department of Biotechnology and Microbiology, Karnatak University, Dharwad. His research interests are in Biotechnology, Reproductive Toxicology, Environment, Health and Agricultural Sciences. As a research mentor he has guided 2 Students for MPhil degree and 2 Students for PhD . Presently, 6 students are pursuing for PhD degree under his guidance. He has published morethan 100 research papers, 3 Book Chapters and a book on Environmental Biotechnology. Considering his research contribution he was awarded Best Research Publication Award in 2013 from Vision Group of Science & Technology, Government of Karnataka.

