Correlations Between Seminal Plasma Hormones and Sperm Biophysical Parameters in Infertile Males in Ibadan.

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Abstract

Context: There is a complex relationship between seminal plasma hormone levels and infertility in men. Previous studies had shown no specific pattern in the serum or seminal plasma hormone profiles of men with infertility and it is debatable whether there is a need to perform routine seminal hormone assays in the management of men with infertility.
Objective: The aim of this study is to determine of there is a relationship between seminal plasma hormone levels and semen biophysical parameters in infertile males.
Study Design, Setting and Subjects: Healthy male volunteers, comprising 20 normozoospermics, 20 oligozoospermics and 11 azoospermics were recruited from the Urology and Gynaecology Clinics at the University College Hospital, Ibadan. Semen samples were analysed according to the WHO guidelines and seminal plasma prolactin, follicle-stimulating hormone (FSH), luteinising hormone (LH) and testosterone concentrations were estimated by enzyme immunometric method according to the WHO protocol.
Main Outcome Measures: The correlation between semen biophysical parameters and seminal plasma hormone levels in infertile men.
Results: A significant positive correlation was seen between seminal plasma FSH concentration and seminal plasma volume in all subjects. In normozoospermic men, significant correlation was found only between prolactin concentration and sperm viability and between LH concentration and sperm motility.
However, in oligozoospermic males, prolactin concentration had significant positive correlation with sperm count and motility while LH concentration had significant positive correlation with sperm motility only.
Conclusion: Seminal plasma hormone assays are of no value in assessing male infertility.

Key Words: Semen, Seminal Plasma, Gonadotropins, Infertility. [Trop J Obstet Gynaecol, 2003, 20: 7-11]

Introduction

The male contribution to infertility among couples worldwide has been estimated to be about 33% [1]. In Nigeria, the male partners' contribution to sub-fertility is estimated to be about 54%, based on semen analysis alone; but when the reproductive potential of the wives are put into consideration, the males' contribution is of the order of about 40% [2, 3]. Despite this, little attention is placed on male infertility in developing countries because of the widely held erroneous belief that infertility is a 'female problem'. It is therefore not surprising that investigations would often have been completed in the woman before her male partner is considered. Often, these male partners are very uncooperative thereby impeding the proper management of the couple and leaving the woman to go from one clinician to another in search of a solution. In the process, some women end up with charlatans and traditional healers who worsen their misery.

In the past, studies have shown no specific trend in serum hormone profiles of infertile males [4]. While some workers reported normal serum follicular stimulating hormone (FSH) and luteinizing hormone (LH) levels, others have reported increased levels of these gonadotropins and a decreased level of testosterone in infertile males compared with fertile ones [4, 5, 6]. Smith, Luqman and Rakoff [7] reported slightly raised mean prolactin levels in the seminal plasma of infertile men. The seminal plasma prolactin levels correlated with the sperm count and sperm motility in both the fertile and the infertile subjects studied [7].

In unpublished data from our unit, we found that increased serum gonadotropins is associated with male idiopathic infertility while serum prolactin and testosterone were only significantly raised in azoospermic males. Therefore, hormone interactions in the infertile males are complex and nonspecific. In this study, we report the correlations between seminal plasma hormones and semen biophysical parameters in fertile and infertile males.

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Subjects and Methods

Semen samples were obtained from fifty-one healthy male volunteers (20 normozoospermic, 20 oligozoospermic and 11 azoospermic men) by masturbation into clean wide-mouthed sterile containers. They were recruited from the Gynaecology and Urology clinics at the University College Hospital, Ibadan, after each person had given an informed written consent. Each subject was recruited if he fell within the reproductive age group of 20 – 45 years, had normal distended testes, no testicular varicocoele, no galactorrhoea, no genital infections, no chronic illness or serious systemic diseases, no previous groin or scrotal surgery, no evidence of hypogonadism and was not using any contraceptive method, fertility drugs or long term medication. Also, heavy smokers, those with HIV seropositive blood or with unstable marital relationships were excluded. The normozoospermics were recruited if they had proven fertility and had fathered at least two children from the present marriage. The oligozoospermics and azoospermics were attending the clinics for the first time for infertility despite regular unprotected sexual intercourse. They had normal libido and their sexual activities were normal except for their complaint of infertility.

Each sample was collected in the morning in a private room close to the laboratory and allowed to stand for 60 minutes at room temperature. A part was used for routine semen analysis according to the WHO guidelines [8]. The sperm count was determined using a haemocytometer and motility was assed by the method of Eliasson [9]. Viability was determined by staining with eosin-nigrosin mixture while morphology was determined by staining the semen with the Papanicolaou stain and microscopically subdividing the spermatozoa into oval, immature, amorphous double tailed or double headed, tapered forms and those with tail defects. All the semen analyses were performed by two experienced laboratory technologists and crosschecked by one of the authors.

The other part of the sample was centrifuged at 3000rpm and the seminal plasma stored at –200C until analysed for hormones. The seminal plasma prolactin, FSH, LH and testosterone concentrations were estimated in the sample by enzyme immunometric method according to WHO protocol (10) at the WHO Collaborating Centre, Ogun State University Teaching Hospital, Shagamu, Nigeria.

Statistical Analysis

Means of duplicate readings were used for analysis. Differences between means were tested with analysis of variance (ANOVA) and Bonferroni *post-hoc* test as necessary. Pearson's correlation was used to assess the degrees of correlation between semen biophysical parameters and seminal plasma hormone levels. The statistical significant level was put at $p < 0.05$.

Results

The mean ± SEM values of the semen parameters and seminal hormones levels in the subjects are shown in Table 1.

Table 1

Semen Parameters and Seminal Plasma Hormone Levels in the Three Groups

Characteristic	Normo spermic n = 20	Oligo spermic n = 20	Azoo-spermic n = 11
Semen Biophysical Parameters	mean *(SEM)*	*mean (SEM)*	*mean (SEM)*
Volume (ml)	2.4 (0.3)	2.5 (0.3)	2.7 (0.8)
Sperm Count (x10^6/ml)	72.6 (4.6)	5.2 (2.0)*	N.A.
Motility (%)	78.8 (1.8)	35.5 (5.0)*	N.A.
Viability (%)	80.4 (1.2)	46.8 (5.1)*	N.A.
Morphology (% normal)	83.6(1.1)	55.7 (6.0)	N.A.
Seminal Plasma Hormones			
LH (mIU/ml)	0.2 (0.1)	0.5 (0.3)	0.4 (0.3)
FSH (mIU/ml)	0.3 (0.1)	0.5 (0.2)	2.6 (1.6)*
Prolactin (mIU/ml)	98.0 (7.4)	112.4 (15.9)	88.7 (13.3)
Testosterone (nmol/l)	4.0 (0.6)	14.6 (2.4)*	14.6 (0.6)*

* Significant Difference, $p < 0.05$; *ANOVA*/Bonferroni *t*-test
N.A.: Not Applicable

There was no significant difference in the semen volumes of the three groups (ANOVA, $F = 0.82$, $p > 0.05$). The mean sperm count, motility and viability in the oligozoospermic males were all lower than those of the normozoospermic males. The mean seminal plasma testosterone of the normozoospermic males was significantly lower than those of the oligozoospermic males and the azoospermic males (ANOVA, $F = 14.02$, $p < 0.05$). The mean concentrations in the oligozoospermic and azoospermic males were similar (Bonferroni test: mean difference = 0.02, $p > 0.05$). The mean concentration of FSH in the normozoospermics was significantly lower than those of the azoospermics (Bonferroni test: mean difference = 2.32, $p < 0.05$) but similar to that of the oligozoospermics (Bonferroni *t* test: mean difference = 2.08, $p > 0.05$). The means of the seminal plasma prolactin and LH

concentrations were similar in the three groups (ANOVA, F = 0.783, $p > 0.05$).

Table 2

Correlation Between Seminal Plasma Hormone Levels and Semen Biophysical Parameters in the Three Groups

Parameter	LH	FSH	PRL	TES
	Pearson's Coefficient *r*			
Volume	+0.12	+0.29*	+0.09	+0.01
Sperm Count	-0.09	-0.19	-0.01	-0.54*
Motility	+0.03	-0.24	+0.15	-0.46*
Viability	+0.02	-0.25	+0.13	-0.36*
Morphology	+0.00	-0.27	-0.14	-0.39*

* Significant Difference, $p < 0.05$; *t*-test

Table 2 shows the correlation coefficient *(r)* for comparison between seminal plasma hormones concentration and semen biophysical parameters in all the 51 subjects examined. Significant positive correlation was found between semen volume and FSH concentration but not with any other semen parameters. There were significant negative correlations between seminal plasma testosterone concentration and all semen parameters except volume ($p < 0.05$). Seminal plasma concentrations of prolactin and LH had no significant correlations with any of the seminal biophysical parameters .

Table 3

Correlation Between Seminal Plasma Hormone Levels and Semen Biophysical Parameters in the 20 Normozoospermic Subjects

Parameter	LH	FSH	PRL	TES
	Pearson's Coefficient *r*			
Volume	-0.27	-0.24	+0.28	-0.14
Sperm Count	-0.03	-0.05	-0.01	+0.10
Motility	+0.24	+0.19	+0.12	+0.37*
Viability	-0.02	+0.27	+0.46*	-0.09
Morphology	+0.12	+0.11	-0.09	+0.03

* Significant Difference, $p < 0.05$; *t*-test

Table 3 shows that positive correlations exist only between prolactin concentration and viability, and between testosterone concentration and sperm motility in the normozoospermic males ($p < 0.05$).

In the oligozoospermic males, seminal plasma prolactin concentration had a positive correlation with sperm count and motility (Table 4), while seminal plasma LH concentration had significant positive correlation with only sperm motility ($p < 0.05$). No correlation was detected between any other seminal plasma hormone concentration and the various semen parameters in the group.

Discussion

The results of this study vary in some ways with the results of andrologic studies elsewhere [7, 11, 12], but confirms the unreliability of seminal plasma hormone assays in assessing male infertility. The raised mean FSH concentration in the infertile groups suggests that the neurosecretory mechanism for its production may be linked with factors regulating spermatogenesis. High testicular testosterone concentration is essential for normal spermatogenesis [13], but that excessively high concentration is detrimental to spermatozoa production is evident from the results of prolonged administration of exogenous testosterone [14, 15].

Table 4

Correlation Between Seminal Plasma Hormone Levels and Semen Biophysical Parameters in the 20 Oligozoospermic Subjects

Parameter	LH	FSH	PRL	TES
	Pearson's Coefficient *r*			
Volume	-0.20	-0.22	-0.14	+0.06
Sperm Count	+0.17	+0.25	+0.35*	+0.14
Motility	+0.32*	+0.24	+0.35*	+0.04
Viability	+0.29	+0.23	+0.19	+0.16
Morphology	+0.17	+0.15	+0.22	-0.10

* Significant Difference, $p < 0.05$; *t*-test

The relatively high testosterone and gonadotropin concentrations seen in azoospermics, suggest a derangement in the mechanism for testosterone uptake at the cellular level in either the pituitary or testes. The spermatogenic process may be damaged without much disturbance to Leydig cell function. Since direct testosterone feedback on the pituitary has been demonstrated in men [16], examination of the pituitary function as well as Leydig cell function is important in these patients. In this study, seminal testosterone correlates with sperm motility and may be useful along with other tests for assessing seminiferous tubule function. No correlation was found between FSH concentrations and any semen biophysical parameters in oligozoospermics and normozoospermics, but a positive correlation was found between LH concentration and sperm motility of oligozoospermics, in keeping with reports from elsewhere [12, 17]. The reasons for these differences are not known. Acquisition of energy for motility and survival by spermatozoa may be due to LH

activity, as suggested by previous workers [17].

Our results show a significant positive correlation between seminal plasma prolactin concentration and sperm count and motility in infertile males, in keeping with reports by some investigators [7, 18], but contrary to the reports others [11, 12, 19]. The variation in the observations may be due to differences in subject selection and/or hormone assay techniques. The mean sperm count of the infertile subjects in this study was 4 million/ml compared to 40.4 million/ml in the study by Smith *et al* [7], indicating that the severity of infertility in our infertile subjects, as judged by the sperm count, was worse.

The findings from this study are important in the light of previous studies that showed that prolactin is very important for spermatogenesis in animals [20]. A normal concentration of prolactin helps to maintain LH receptors in Leydig cells and has a permissive role in testosterone production in animals [21]. Both elevated and depressed prolactin levels have been shown to cause necrosis of testicular LH receptors and disturbance of gonadotropin secretion, without affecting serum testosterone concentration in animals [22]. In the human, prolactin acts in synergy with androgens in sperm production and hyperprolactinaemia has been found to be associated with male infertility by mechanisms that are as yet uncertain [23, 24, 25]. Various symptoms, including erectile dysfunction and galactorrhoea, have also been described in men with hyperprolactinaemia [26]. Excess prolactin may be counterproductive at the receptor level causing infertility. Also, increased serum gonadotropins in infertile men with hyperprolactinaemia have been reported, although the mechanism for this interaction is unclear [11, 27].

The positive correlation between seminal plasma prolactin concentration and sperm count seems to be in conflict with the association between hyperprolactinaemia and infertility. This will be so if serum prolactin concentration runs parallel to seminal plasma prolactin concentration but this is not necessarily so. The findings from this study further confirm that the use of seminal plasma hormones for assessing male infertility is unreliable and that the interrelationship between seminal plasma hormones and infertility is a complex one.

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