

The relationships between serum prolactin level and semen analysis parameters among patients attended the reproductive health center, Khartoum 2016–2017

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Abstract

Introduction: This study aimed to determinate the effects of serum prolactin (PRL) level on semen analysis parameters (semen volume, sperm count, sperm motility, and sperm morphology). **Subjects and Methods:** This study was observational descriptive retrospective cross-sectional study. The study included 212 male patients selected by systematic random sampling from all patients who attended the reproductive health-care center in Khartoum. Data were collected from the all participants files. Serum PRL level and semen analysis parameters were obtained from laboratory records. Participants were classified into hyperprolactinemic and normal PRL level groups according to their serum PRL level. Data were analyzed using the Statistical Package for Social Science version 23. Descriptive data were presented as mean/median \pm standard deviation/standard error of mean (SEM) or percentages. Independent *t*-test was used to determine the differences in semen analysis parameters between the two study groups. $P < 0.05$ was considered statistically significant. **Results:** Our study showed high level of PRL hormone among study participants (median = 543.0, SEM = 43.1 ml IU/L). There were significant differences in sperm motility and morphology between normal and hyperprolactinemic patients ($P = 0.05$ and 0.01 , respectively). However, there were no significant differences in semen volume or sperm count between the two study groups. There were negative significant correlations between the PRL level and percentage of motile sperms ($P = 0.001$) and the percentage of normal morphology sperms ($P = 0.001$). However, there were no significant correlations between PRL level and sperm count or semen volume. **Conclusion:** Hyperprolactinemia in males causes significant changes in semen contents which may explain infertility in those patients.

Key words: Hyperprolactinemia, infertility, semen volume, sperm count, sperm morphology, sperm motility

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INTRODUCTION

Prolactin (PRL) is a hormone that is best known for its role in enabling mammals, usually females, to produce milk. Although PRL seems to play an important role in

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the energy metabolism of human sperm,^[1] high PRL concentrations have inhibitory effects in both humans and animals. In particular, hyperprolactinemia decreases the pulsatile secretion of luteinizing hormone (LH) and, to a lesser extent, of follicle-stimulating hormone (FSH). (54)^[2]

PRL excess causes male infertility by altering semen analysis parameters.^[3] Many studies investigated the effects of serum PRL level on semen analysis parameters. Some of them reported strong associations between the PRL level and semen analysis parameters,^[4-8] while others showed no significant associations between the PRL level and semen analysis parameters.^[3,9-11] Several studies showed significant association between PRL level and semen volume.^[12,13] It has been found that any increase in serum PRL level impairs fertility by decreasing sperm concentration and motility without affecting sperm morphology.^[5] Hyperprolactinemia impairs motility and sperm quality and produces morphologic alterations similar to those observed in prepubertal testes.^[4] Other studies showed insignificant correlations between serum PRL on one hand and sperm count,^[14] sperm motility, and semen volume^[3,15-17] on the other hand.

Although there were several studies that investigated the effects of serum PRL level on semen analysis parameters, few attempts were made in Sudan to determine these effects. Therefore, this study aimed to determine the effects of serum PRL level on semen analysis parameters (semen volume, sperm count, sperm motility, and sperm morphology) among males attending reproductive health-care center in Khartoum, Sudan.

SUBJECTS AND METHODS

This was observational descriptive retrospective cross-sectional study conducted at reproductive health-care center which is located in Khartoum state in the Mac Nimir Street near the Khartoum Teaching Hospital. The study included all male patients who attended the reproductive health-care center during the period from March 2016 to March 2017 (500 males). The sample size was calculated using the equation: $n = N/1 + N(d)^2$ and 212 males were selected by systematic random sampling method. Data were collected from patients' files, and semen analysis parameters results were obtained from laboratory records. Then, participants were classified into normal and abnormal PRL level according to kits manufacturer (≤ 375 mIU/L as cutoff point). Data were fed in IBM computer and analyzed using Statistical package for social sciences version 23 (IBM corp., Armonk, N. Y.). Descriptive data were presented as mean/median \pm standard deviation/standard error of mean (SEM). The relationships between serum PRL level

and semen analysis parameters (semen volume, sperm count, sperm motility, and sperm morphology) were analyzed using Pearson correlation test. Furthermore, independent test was used to determine the differences in semen analysis parameters between normal and hyperprolactinemic participants. $P < 0.05$ was considered statistically significant. The study was conducted after the approval of the Ethical committee at International University of Africa and the approval of reproductive health-care center. Furthermore, verbal consent was taken from each participant.

RESULTS

The average age of the participants was 37.0 ± 1.70 years. The average serum PRL level was 531.0 ± 43.1 ml IU/L. The average values for semen volume were 2.39 ± 1.21 ml, semen count were $6.65 \pm 3.62 \times 10^6$ /ml, percentage of motile sperms were $30\% \pm 1.72\%$, and percentage of normal morphology sperms were $33\% \pm 1.40\%$ [Table 1].

Most of the study participants (90.1%) were hyperprolactinemic (PRL level >375 ml IU/L) and 9.9% had normal serum PRL level [Table 2].

There were significant differences in sperm motility and morphology between the two groups ($P = 0.03$ and 0.01 , respectively). However, there were no significant differences in age, semen volume, or semen count between normal and hyperprolactinemic males ($P = 0.78$, 0.84 , and 0.36 , respectively) [Table 3].

Pearson correlation test showed significant negative correlations between PRL level and the percentages of motile sperms and of normal morphology sperms ($P = 0.005$ and 0.001 , respectively). PRL level had no significant

Table 1: Age, prolactin level, and semen analysis parameters among study participants (n=212)

	Mean/median	SD/SEM
Age (years)	37.00	7.10
Prolactin level (mIU/L)	531.00	43.09
Sperm volume (ml)	2.39	1.21
Sperm count ($\times 10^6$ /ml)	6.65	3.62
Motile sperms (%)	30.00	1.72
Normal sperm morphology (%)	33.00	1.40

SD: Standard deviation, SEM: Standard error of mean

Table 2: Distribution of participants according to prolactin level (n=212)

Prolactin group	n (%)
Normal (prolactin level <375 mIU/L)	21 (9.9)
Hyperprolactinemia (prolactin level >375 mIU/L)	191 (90.1)
Total	212 (100.0)

correlations with semen volume or sperm count ($P = 0.60$ and 0.26 , respectively) [Table 4].

DISCUSSION

Our study showed high level of PRL among participants, and this is in agreement with other studies which revealed high PRL level among infertile men.^[4,16,17] Normal PRL level increases the production of steroids and androgen by increasing the LH receptors in Leydig cells, FSH receptors in Sertoli cells, the total lipid production in germ cells, and conversion of spermatocyte to spermatid.^[11] However, in hyperprolactinemia, serum testosterone levels are generally low without an accompanying increase in LH levels.^[15]

In the present study, there was no statistical significant difference in semen volume between hyperprolactinemic and normal males. Furthermore, there was no statistical significant association between PRL level and semen volume. Several studies showed this insignificant association between PRL level and semen volume.^[3,15-17] However, other studies showed significant negative association between PRL and semen volume.^[12,13]

In this study, there was no statistical significant difference in sperm count between the two study groups. Furthermore,

there was no statistical significant association between PRL level and sperm count. A study conducted by Wein *et al.*, 2011, for assessing the clinical significance of PRL determination, during infertility investigations, on serum samples of 204 males showed no significant correlation between serum PRL level and sperm count.^[15] Okada *et al.*, 1996, investigated the relationship between serum PRL and semen analysis parameters and showed no statistical significant correlation between PRL level and sperm count.^[14] Gunasekar *et al.*, 1991 found no correlation between sperm count and hyperprolactinemia.^[11] However, other studies revealed significant negative association between these two parameters.^[4,6,18-20]

Our study showed significant difference in the percentage of motile sperms between high and normal PRL level patients. Furthermore, there was significant negative relationship between PRL level and the percentage of motile sperms. Velázquez-Ramírez *et al.*, 1980 found statistical significant negative association between PRL level and the percentage of motile sperms.^[21] Seminal quality and levels and serum PRL were determined in 60 men attending an infertility service center and showed that men with high serum PRL level had low percentage of motile sperms.^[6] A study included 120 patients who were divided into four groups of asthenozoospermia, oligozoospermia, severe oligozoospermia, and azoospermia revealed that PRL level had significant effects on sperm concentration and motility.^[4] However, few studies showed insignificant relationship between PRL level and sperm motility.^[9] Hyperprolactinemia had a negative effect on sperm motility by decreasing ATP production from mitochondria.^[22] Furthermore, hyperprolactinemia may be associated with thyroid dysfunction,^[23] decrease of parathyroid hormone causes decrease in calcium, Ca²⁺ channels are the key components in male reproduction such as in the acrosome reaction and sperm motility, and this may explain the hyperprolactinemia effects on sperm motility.^[24] Furthermore, this association can be explained by the relationship between sperm autoantibody and hyperprolactinemia.^[24]

The present study showed significant difference in the percentages of normal morphology sperms between the two study groups and negative significant correlation between PRL level and the percentage of normal morphology sperms. A study conducted by Al-Daghistani *et al.*, 2006

Table 3: Comparison of age and seminal analysis parameters between normal and hyperprolactinemic participants (n=212)

Prolactin groups	Mean±SD	P
Age		
Normal	35.67±7.08	0.78
Hyperprolactinemia	37.14±7.15	
Sperm volume		
Normal	2.19±1.02	0.84
Hyperprolactinemia	2.41±1.23	
Sperm count		
Normal	23.26±39.43	0.36
Hyperprolactinemia	29.17±53.96	
Sperm motility		
Normal	34.05±20.03	0.03*
Hyperprolactinemia	27.36±25.44	
Sperm morphology		
Normal	38.67±13.23	0.01*
Hyperprolactinemia	29.03±20.88	

* $P < 0.05$. SD: Standard deviation

Table 4: The correlations between serum prolactin level and semen analysis parameters (n=212)

	Sperm volume	Sperm count	Sperm motility	Sperm morphology
Prolactin				
Pearson correlation	-0.04	-0.08	-0.19**	-0.24**
Significant (two-tailed)	0.60	0.26	0.005	0.001

** $P < 0.001$

found that hyperprolactinemia produces morphologic alterations in sperms similar to those observed in prepubertal testis.^[20] However, it has been found that any increase in serum PRL level impairs fertility by decreasing in sperm concentration and motility without affecting sperm morphology.^[5] The negative strong correlation between PRL level and sperm morphology, observed in this study, could be explained by the effect of PRL on cell division.^[13]

CONCLUSION

High PRL level is associated with low percentage of motile sperms and low percentage of normal morphology sperms. These results could explain high PRL level among infertile men.

Further studies are needed to investigate the possible mechanisms by which high PRL level can affect semen analysis parameters.

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Conflicts of interest

There are no conflicts of interest.

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