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Pattern of Semen Parameters and Factors Associated with Infertility in Male Partners of Infertile Couples in Nigeria

Aduloju Olusola Peter[1], **Adegun Patrick Temi**[2*], **Areo Peter Olufemi**[3], **Odimayo Michael Simidele**[4], **Atiba Samuel Adeniran**[5] **and Idowu Ademola Amos**[5]

[1]*Department of Obstetrics and Gynaecology, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria*

[2]*Division of Urology, Department of Surgery, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria*

[3]*Division of Urology, Department of Surgery, Ekiti State University, Ado-Ekiti. Ekiti State, Nigeria*

[4]*Department of Medical Microbiology, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria*

[5]*Department of Chemical Pathology, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria*

[*]**Corresponding author**: Adegun Patrick Temi, Division of Urology, Department of Surgery, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria, Tel-234-8034531236; E-mail: patrickikelomo@yahoo.com

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Abstract

Background: Infertility is a urological and common gynecological problem. Male factor contributes significantly to the aetiology of infertility. Semen analysis has remained a useful investigation in the search for male factor infertility. Most studies on semen pattern were done based on the World Health Organization (WHO) 1999 criteria for human values for semen characteristics.

Objective: To determine the prevalence of infertility, pattern of semen parameters and factors associated with infertility in Nigerian male partners of infertile couples.

Methods: A descriptive cross-sectional study of infertile couples presenting at the infertility clinic between January 2014 and December 2015 was carried out at Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, South-western Nigeria. Seminal fluid from the male partners was analysed in the laboratory using the World Health Organization (WHO) 2010 criteria for human semen characteristics.

Results: A total of 443 men participated in the study and 38.2% had abnormal semen parameters. Oligozoospermia (34.8%) and asthenozoospermia (26.9%) were the leading abnormal factors.

Smoking habit and previous groin surgery significantly predicted abnormal semen parameters, $p<0.05$. Staphylococcus aureus was the commonest organism for infection. Infertility and abnormal semen parameters were most prevalent at age group 31-35 years.Age range of male partners was 30-60 years with a mean age of 36.36 + 5.07. Duration of infertility was 1-11 years. The prevalence of secondary infertility was 83.7%.

Conclusion: There is a growing trend in the prevalence of secondary infertility in Nigeria. Oligozoospermia coupled with smoking habit and previous pelvic operations are the significant predictive factors for infertility. Men should be encouraged to participate early in the investigation of infertility.

Key words:

Abnormal semen; Infertility; Male partners; Nigeria; Predictive factors

Introduction

Infertility is both a urological and gynecological problem the world over [1]. Over 80% of the laparoscopic investigations done in most gynecological settings are for infertility management [2-4]. It remains a sensitive issue in our environment and a source of social stigma [2-5]. The burden of this social stigma is felt more by the female partners who are often seen as being responsible for infertility and are faced with the challenges of economic deprivation, social neglect, marital instability, emotional stress and unhappiness Infertility is a global problem with a variation in prevalent rate from one region to the other. Worldwide, infertility is generally quoted as occurring in 8-15% of all couples while in sub-Saharan Africa, a prevalent rate of 15-45% has been variously reported [2,4,7,8]. However in Nigeria, reports from earlier studies showed a prevalence of 20-30% [8,9].

Infertility is an underlying pathology with female factors contributing 30-40% of causes, male factors about 30-40% while both factors and unexplained infertility account for 20-40% of causes [4,7,8,10,11]. The aetiology of male infertility is largely unknown in most cases [8,12]. However, studies have shown upward trends in the prevalence of sexually transmitted infections and urogenital infections. Seminal tract infections play major contributory role in male infertility and affect fertility by different mechanism including impairing spermatogenesis, sperm function and obstruction of the seminal tract [7,11-13]. Other factors that may lead to male infertility include varicocele, endocrine disturbance, immunological conditions, sexual dysfunction and ejaculatory failures [8,12].

Semen analysis has remained a useful investigation in the search for male factor infertility and it provides insight into the process of sperm production-count and sperm quality (motility and morphology) [4,7,9,10]. The semen parameters have been found to be important determinant of functional competence of the spermatozoa [13,14]. Therefore, careful evaluation of the semen parameters may point to the possible causes of the male infertility, institution of further investigation and the appropriate treatment targeted at the aetiological factors.

Most previous studies on semen pattern done were based on the World Health Organisation (WHO) 1999 criteria for human values for semen characteristics [2,5-8,10]. However, there is scanty research carried out on semen pattern using the WHO 2010 criteria, especially in Nigeria [4,15].

This study was to assess the pattern of semen parameters, using the current WHO 2010 criteria, in male partners of infertile couples attending the infertility clinic of Ekiti State University Teaching Hospital, Ado-Ekiti. It will also identify the contribution of male factor to the burden of infertility in male partners of infertile couples. To the best of our knowledge, this is the first study in this country.

Materials and methods

Subjects: The study was a cross sectional descriptive evaluation of seminal fluid of male partners of infertile women presenting to the infertility clinic of Ekiti State University Teaching Hospital, Ado-Ekiti between January 2014 and December, 2015.

Inclusion criteria: Male partners of women that presented at the clinic with inability to conceive after a period of 12 months or more despite regular and adequate unprotected coital exposure and gave their consent to participate were recruited into the study.

Exclusion criteria: Male partners of women who did not present with infertility, those women with less than 12 month history of infertility and those who did not consent were excluded. Also, couples who were married less than one year before presentation, not living together or not having regular intercourse were excluded. The male partners of women who met the criteria were invited to the clinic through the women and a total of 443 consecutive male partners of women with infertility were recruited into the study.

Sample collection: A self-administered semi-structured questionnaire which had two sections was used to elicit information from the participants. The first section elicited information about the socio-demographic characteristics of the participants: age, educational status, religion, occupation, marital status, family setting, type of infertility, duration of infertility, history of smoking and alcohol intake, history of childhood mumps infection, past history of chronic medical diseases like diabetes mellitus and groin operations such as herniorrhaphy, hydrocelectomy etc. The second section inquired about the result of semen analysis: volume, concentration, count, motility, morphology, period of continence, method of collection etc. The male partners were adequately counseled and given instructions on how to collect the semen samples. These instructions included abstinence from coitus for 3-5 days, washing of their hands before starting masturbation, sample collection by masturbation only and kept close to the body and delivered to the laboratory of the Hospital within 15-20 mins of semen collection if they were not collected in the laboratory. Spilled samples were avoided. All samples were collected into sterile screw capped plastic universal containers. The semen samples were collected in a dedicated room with bed and other facilities to make them relax within the laboratory while those participants that live close to the Hospital were allowed to collect at home and the samples brought to the Hospital within 15-20 minutes of collection and analysed within one hour of collection.

Laboratory methods: The semen analysis was performed according to the methods and standard outlined by WHO, 2010 [16]. The parameters assessed included: volume 1.5 ml or more; sperm concentration $>15\times10^6$ cells/ml; motility >40% progressive/forward movement; morphology >4% normal form; white blood cell 1×10^6 cells/ml. The sample analysis was done by same laboratory scientist to avoid inter-laboratory variations. Semen analysis was done within one hour of their collection and was assessed for volume, appearance, liquefaction, concentration, motility, morphology, viability and presence of pus cells. The semen volume was measured using a graduated disposable pipette and pH checked with the pH paper. After liquefaction, the semen specimen was thoroughly mixed with the help of a pipette and a thin drop of specimen was spread on a glass slide by placing a cover slip on it. Sperm motility was assessed using Olympus Binocular microscope with magnification (X100) while the sperm concentration was counted in million/millilitre using the Meckler counting chamber and categorised in accordance to WHO normal and pathological ranges. Bacteriological tests were also carried out on the semen samples. Each semen sample was cultured on appropriate culture media at 37°C for 24-48 hours to detect bacterial pathogens and the positive samples were sub-cultured to determine the appropriate antibiotics sensitivity pattern.

The operational definitions used were:

Normospermia: sperm count of 15 million per milliliter and above.

Oligospermia: sperm count of below 15 million per milliliter.

Azoospermia: absence of spermatozoa in the ejaculate.

Asthenospermia: reduced sperm motility- <40%.

Teratozoospermia: reduced sperm morphology- <4%.

Oligo-astheno-teratozoospermia (OAT): all variables are abnormal.

Data analysis: The data collected was entered into and analysed using the Statistical Package for Social Sciences (SPSS) software version 17 (Chicago, Illinois). The data was analysed for frequency, mean and Chi Square with the level of significance set at $P<0.05$. Logistic regression analysis was performed to determine the risk factors that were significantly associated with abnormal sperm concentration.

Ethical consideration: Ethical approval was obtained from the Ethics and Research Committee of Ekiti State University Teaching Hospital, Ado-Ekiti and written consent was obtained from the couple who participated in the study having duly explained to them the objectives of the study. The questionnaires were made anonymous and couples were at liberty to withdraw or refrain from the study without any consequence.

Results

A total of 443 men participated in the study. The analysis revealed that 274 (61.8%) of them had normal parameters while 169 (38.2%) had abnormal semen parameters. Age range of male partners was 30-60 years with a mean of 36.36+5.07. Duration of infertility was 1-11 years with a mean of 3.13+2.40. Range of volume of semen was 0.5-5 mls with a mean of 2.36+1.22. The range of period of abstinence was

3-7 days with a mean of 4.54+0.99. The range of sperm concentration was 0-170 × 10^6/ml with a mean of 35.41+31.60. Total sperm count range was 0-510 × 106/ml and a mean of 90.36+97.44.

Table 1 showed that majority (69.1%) of the participants was between 31-45 years. A total of 72 (16.3%) participants were investigated as a case of primary infertility while 371 (83.7%) were investigated for secondary infertility. Table 2 showed the various risk factors associated with abnormal semen parameters. The smoking habit of participants, past infections with mumps and previous groin surgery were significantly associated with abnormal semen parameters, $p < 0.05$. In addition, alcoholic habit was not significantly associated with abnormal semen parameters, $p > 0.05$.

Characteristics		Frequency (N=443)	Percentages (%)
Age group (yrs):	30 and below	55	12.4
	31-35	216	48.8
	36-40	90	20.3
	41-45	55	12.4
	46-50	24	5.4
	50 and above	3	0.7
Smoking:	Yes	41	9.3
	No	402	90.7
Alcohol:	Yes	18	4.1
	No	425	95.9
Mump history:	Yes	19	4.3
	No	424	95.7
Groin surgery:	Yes	45	10.2
	No	398	89.8
Infertility:	Primary	72	16.3
	Secondary	371	83.7

Table 1: Socio-demographic characteristics of male participants.

Variables	Sperm concentration			p value
	Low	Normal	Total	
Smoking				
Yes	26(57.8)	19(42.2)	45(10.2)	0.04*
No	143(35.9)	255(64.1)	398(89.8)	
Alcohol				
Yes	10(55.6)	8(44.4)	18(4.1)	0.121
No	159(37.4)	266(62.6)	425(95.9)	
Previous groin surgery				
Yes	26(57.8)	19(42.2)	45(10.2)	0.004*
No	143(35.9)	255(64.1)	398(89.8)	

Table 3 showed logistic regression analysis of the significant risk factors associated with abnormal semen parameters. Multivariate logistic regression showed that smoking habit, past infections with mumps and previous groin surgery in the male participants were significantly associated with abnormal semen parameters when controlled for multiple risk factors, $p<0.05$.

Variables	AOR (95% CI for AOR)		p value
Smoking			
	No	1	
	Yes	0.479 (0.252-0.911)	0.025*
Previous groin surgery			
	No	1	
	Yes	0.460 (0.243-0.871)	0.017*
Past infections with mumps			
	No	1	
	Yes	0.396 (0.150-1.046)	0.040*
Occupation of male partners			
	Professionals	1	
	Artisans	1.486 (0.989-2.231)	0.056
AOR- Adjusted odd ratio; CI-Confidence interval; * = Statistically significant			

Table 3: Showing multivariate logistic regression analysis with sperm concentration as dependent variable.

Table 4 showed that 154 (34.8%) of the participants produced seminal volume of less than 2 mls while 289 (66.9%) produced more than 2 mls of seminal fluid. The various abnormalities occurring singly or in combinations are as shown in Table 2.

SFA*	Frequency (n=169)	Percentages (%)
Oligozoospermia	59	34.9
Asthenozoospermia	45	26.6
Oligoasthenozoospermia	24	14.2
Teratozoospermia	11	6.5
Asthenoteratozoospermia	10	5.9
Oligoteratozoospermia	7	4.2
Oligoasthenoteratozoospermia	7	4.2
Azoospermia	6	3.5
*SFA=Sperm Fluid Analysis		

Table 4: Pattern of abnormal semen parameters of male partner involved in the study.

Table 5 showed that all age groups had seminal fluid abnormality but highly prevalent in age group 30-35 years. Table 6 showed the various organisms isolated in 160 (36.2%) samples that had positive culture while 283 (63.8%) had negative culture. Staphylococcus aureus was the commonest organism isolated.

Discussion

This study revealed that the prevalence of secondary infertility was 83.7% while the prevalence of primary infertility was 16.3%. This is higher than figures reported for the study on national estimates of the prevalence of primary and secondary infertility in sizeable areas of sub-Saharan [17]. This pattern reflected a growing trend in the prevalence of secondary infertility in this environment [8,9]. This may be attributable to the significant contribution of obstruction of both the female and male genital tract resulting from the high rate of genital infections in both female (post-abortal sepsis, puerperal sepsis) and abnormal semen parameters in male partners, especially in this setting [2,7].

The high prevalence of abnormal semen parameter of the couples investigated in this study is in agreement with similar high prevalence reported in India [10]. The high prevalence of abnormal sperm parameters in this study may be contributory to higher infertility rate caused by the male factor [2]. This may be due to the fact that sperm

abnormalities is usually associated with distortion in the process of spermatogenesis, be it pre-testicular (hormonal), testicular (chromosomal) or post-testicular (disorder in transportation, ejaculation, infections etc) [4,7,9,13].

These abnormal parameters occurring singly or in combinations impair fertility even with normal sperm concentration. The outcome of treatment of male factor infertility has been reported to be highly dependent on the presence of these factors. The prognosis of infertility is usually inversely proportional to the number of abnormal patterns, one factor abnormality better than two-factor and two-factor better than three-factor abnormality [2,7,10].

Age group of husband (years)						
SFA*	**30 and below**	**31-35**	**36-40**	**41-45**	**46-50**	**51 and above**
Azoospermia	0	3	1	1	1	0
Oligozoospermia	13	40	1	4	0	1
Teratozoospermia	4	4	1	2	3	1
Asthenozoospermia	4	21	6	9	3	2
Oligoteratozoospermia	1	2	1	1	1	1
Oligoasthenozoospermia	4	8	2	3	4	3
Asthenoteratozoospermia	1	3	1	2	2	1
Oligoteratoasthenospermia	1	2	1	2	1	0
*SFA=Sperm Fluid Analysis						

Table 5: Distribution of abnormal semen parameters by the age group.

Organisms	**Frequency (n= 443)**	**Percentages (%)**
Staph aureus	108	24.4
Klebsiella species	15	3.4
Escherichia coli	10	2.3
Streptococcus species	8	1.8
Candida species	6	1.4
Multiple coliforms	13	2.9
No organism isolated	283	63.8

Table 6: Showing the organisms cultured.

Single-factor abnormality, low sperm count-oligozoospermia (34.8%) and poor motility-asthenozoospermia (26.9%) have been described in the literatures as the leading factors in abnormal sperm parameters in male infertility while teratozoospermia contributed 6.9% [2,9,13].

However, two-factor abnormality, astheno-oligozoospermia was recorded in 14.2% of cases in this study, a finding compatible with that found in other parts of Nigeria [2,4,10]. In addition, three-factor abnormality, oligo-astheno-teratozoospermia occurred in 3.6% of this study which is not far-fetched from that reported in other studies in Nigeria [2,4,18].

Consequently, the presence of these factors could be associated with poor outcome with the use of the conventional methods in treatment of infertile couples. However, with the newer techniques and advancement in assisted reproduction and conception which are becoming increasingly available in our environment, pregnancy may be achieved [2,4,9,19]. Furthermore, majority of male partners in this study had normal sperm concentration and mean sperm density despite the degree of infertility. This implies that the determinant of fertility of the male factor is not only the absolute sperm count but that other components of the sperm factors such as the motility and the morphology among other things are equally important. Hence, infertility is not only associated with low sperm count but also with defective sperm parameters and other factors including female factors.

More importantly, majority of the male partners (66.9%) produced normal semen volume despite their infertility. This finding is similar to the reports of Butt et al., Nwafia et al. and Imam et al. [7,20,21]. However, adequate volume recorded in this study may not be unconnected with the period of abstinence observed by the male partners before seminal analysis. This underscored the importance of abstinence before seminal fluid collection for analysis. Studies have shown that prolonged abstinence is associated with increased sperm

concentration but does not necessarily improve the morphology and motility [4,7,22].

Besides, the prevalence of positive microscopic culture of 36.2% in this study and the most prevalent isolated organism are in agreement with previous findings by other researchers [4,8,23,24]. This may due to penile contamination of the semen during collection despite the aseptic technique advised. It may also be due to male genital infection which is an important aetiological factor in male infertility which may lead to distortion of the process of spermatogenesis, impairment of sperm function and obstruction of the seminal tract [2,4,7,13,22].

Life style of the participants such as smoking and alcohol consumption; previous groin operations like herniorrhaphy and varicocelectomy and past mumps infections have been demonstrated to have adverse effects on sperm parameters [13,25]. There was a statistically significant association between infertility rate and smoking habit, past groin surgeries, past infections with mumps and abnormal sperm parameters in this study. This finding is consistent with previous reports by other researchers [26-28].

Therefore, male factor abnormalities remain significant contributors to infertility as demonstrated in this study and the importance of semen analysis cannot be overemphasized in the detection of sperm abnormalities.

Conclusion

There is a growing trend of secondary infertility in Nigeria. Oligozoospermia, plus other abnormal semen parameters coupled with smoking habit and previous pelvic operations were the significant predictive factors. It is important to always view infertility as a couple's problem rather than stigmatising/ostracising women alone. Men should be encouraged to take up this challenge and present themselves for prompt and appropriate management.

Finally, Government should ensure the establishment of accessible public centres for assisted reproduction to all and sundry irrespectful of economic status in order to alleviate the challenges posed by male infertility.

Limitations of the Study

The limitations in this study include inability to measure the testicular volume, assess the presence of varicocele and crypto-orchidism, culture for Chlamydia trachomatis and Neisserean gonorrhea. In addition, the inability to perform testicular biopsy, which is an important procedure in the evaluation of semen parameters, is also a limitation. Finally, the manual method of using counting chambers used in this study while the computed assisted semen analysis (CASA) may provide better information is another limitation.

Declaration of Interest

The authors declare no conflict of interests.

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