Research Article ISSN 2639-9342

Gynecology & Reproductive Health

A Longitudinal Study on Risk Factors of Abnormal Semen Parameters at a Specialist Hospital in the Gambia

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Received: 10 Jan 2025; **Accepted:** 25 Feb 2025; **Published:** 03 March 2025

Citation: Anyanwu M, Suwareh K, Uzokwe V, et al. A Longitudinal Study on Risk Factors of Abnormal Semen Parameters at a Specialist Hospital in the Gambia. Gynecol Reprod Health. 2025; 9(3): 1-6.

ABSTRACT

Background: *Normal semen parameters have shown overwhelming decline in the last 50 years all over the world. The trend of decline is more pronounced in the western region of sub-Saharan African. In view of the rapid deterioration observed in our practice between 2017 (8.9%) and in 2023 (45.4%), we decided to conduct research to explore on possible risk factors.*

Methodology: *Longitudinal study on semen parameters from January to March 2024. The variables were divided into three thematic areas which includes sociodemographic characteristics, Lifestyle implications and chronic medical/ surgical conditions. Data was entered into a computer database and analyzed with SPSS version 26. Univariable logistic regression analysis of risk factors with test of significance at p-value of <0.05 was performed.*

Results: *A total number of 104 semen parameters were analyzed. Mean age of the study population was 46 years with a range of 26 to 72 years. The most common age group was 36 to 45 years. Mandinka tribe was the majority and many of them were businessmen. Majority (62%) were of low parity. Atayal and energy drinks (p- value 0.75 and 0.55); Alcohol intake and Jumbo consumption (p-value 0.48 and 0.47), cigarette smoking and Marijuana (0.52 and 0.48) respectively. The sociodemographic characteristics and chronic medical conditions (p-value 0.08-0.82; and 0.36) showed no association with abnormal semen in the study population.*

Conclusion: *The study showed no significant association of sociodemographic characteristic, lifestyle factors and chronic medical conditions with abnormal semen parameters in the male factor infertility in the Gambia. Further studies are recommended.*

Keywords
Male infertility, Risk factors, Lifestyle, Medical, Surgical.

Abbreviation
FSH: follicule stimulating hormone, ICSI: intracytoplasmic sperm injection.

Introduction
Male factor infertility is the inability of a male to achieve conception in a fertile female. It is seen as an alteration in sperm concentration (Oligo) and/or motility (Astheno) and/or morphology (Terato) in at least one sample of two sperm analyzes, collected 1 and 4 weeks apart [1]. The diagnosis of male factor depends on the combination

of two samples taken at least 4 weeks apart and sperm parameters below the WHO normal values [2]. The semen analysis is the procedure of investigating male factor infertility yet an imperfect tool but remains the cornerstone to investigate male infertility [3].

The trend of the prevalence of male infertility is changing and varied from region to region and country to country. A recent report on the status of infertility in India, states that nearly 50% of infertility is related to the reproductive anomalies or disorders in the male [4].

Some scholars working elsewhere have shown that, as high as 90% of male infertility problems are related to count and there is a positive association between the abnormal semen parameters and sperm count [5]. These abnormal sperm parameters could be due to pre-testicular, testicular, and post-testicular factors [6].

Regarding pre-testicular, testicular, and post-testicular factors, Azoospermia fits well in the descriptions. Azoospermia is no spermatozoa in the ejaculate [7]. It could be due to pre-testicular, testicular or post-testicular. Pre-testicular may be due to problems of hypothalamo-pituitary-testicular axis where the production of spermiogenesis hormones are deficient such as the gonadotrophins or due to genetic factors that led to malfunction of the neuroendocrine system. These might be risk factors of Azoospermia but in this study we explored demographic characteristics, lifestyle factors and chronic medical or surgical conditions.

In testicular origin of Azoospermia the FSH will be high and sometimes markedly elevated because the neuroendocrine system is intact and working assiduously well to overcome the testicular impediment and therefore have elevated values of the hormones. Exploring genetic predisposition was beyond the scope of this study.

Post-testicular will have normal hormone values as the sperm are produced but the outflow tract is blocked or absent as in Vas deferens agenesis in cases of cystic fibrosis. History of chronic medical condition may reveal underlying medical condition which can be volunteered when asked and any other chronic illness that may affect sperm parameters were also explored. Previous history of sexually transmitted infection may be a risk factor of obstructive Azoospermia if stricture or ejaculatory duct block occurs following chronic infection.

Regarding lifestyle factors such as alcohol consumption, cigarette smoking, coffee and caffeine products, some energy drink and Marijuana (illicit recreational drugs) were reported in the previous published papers [8-11] as established potential risk factors of abnormal semen parameters. However, a common social factor which is a lifestyle and almost always an addiction is the consumption of Atayal (cooking of black tea with excessive sugar) and Jumbo (a seasoning agent put in preparation of various food) with unknown documented impact on semen parameters were included in this study to determine whether there is any association with abnormal semen parameters.

In the sociodemographic characteristics in this study we included occupation. Some occupation has been implicated to predispose to abnormal sperm parameters [12-15]. Working in asbestos company and companies were some unknown chemicals are used in the manufacturing industries, might be toxic to health if inhaled or ingested which affect sperm parameters have been reported [13,14]. Similarly, long distance driving as an occupation seen in truck drivers has long been established as a risk factor of abnormal parameters [16]. Chronic medical conditions were also explored as some have been associated with poor sperm qualities [17]. Also inguinal surgery was also assessed to determine the potential association with abnormal semen parameters in the study population.

In view of the raising trend of male infertility we decided to explore on some risk factors that we thing is accessible in our setting to suggest potential risk factors of male infertility.

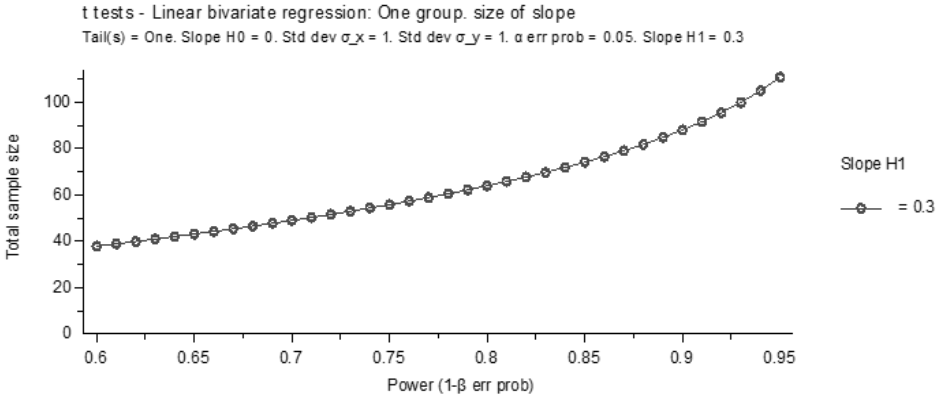
Methodology

Study Design

Longitudinal study on semen parameters from January to March 2024.

Study Population

Couples with abnormal semen parameters irrespective of type of abnormal semen report.



Sample Size

Sample size was calculated with G power 3.1 software. A sample size of 100 with effect size at 30% = 0.3, Power at 95, t-test at 0.05. Thirty percent (30%) was used as the effect size to get a sample size of 100 because the assumption is 30% prevalence of male infertility.

Inclusion and Exclusion Criteria

All couples with documented results of complete primary evaluation of male factor infertility was included in the study. Those with incomplete investigations and documented reports were excluded from the study. The male factor was assessed with seminal fluid analysis (SFA), interpreted with the World health organization (WHO) reference values [18].

Recruitment of Study Participants

The recruitment was performed consecutively until sample size was achieved. The variables were formulated into a questionnaire in three thematic areas which includes sociodemographic characteristics, Lifestyle implications and chronic medical/ surgical conditions.

Terminology

Atayal drink: This is a substance produced from black tea and large volumes of sugar boiled to very high degree temperatures and served as special tea.

Jumbo: This is a substance used during cooking to season the food to a good test. Large quantities may test real good on food but health implications may not be known.

Energy drink: Some may contain anabolic substances to boost energy.

Data Analysis

Data was entered into computer database and consistent checks instituted to ensure errors are corrected before analysis. Data was analyzed with SPSS version 26. Univariable logistic regression analysis of risk factors with test of significance at p-value of <0.05 was performed. Results were expressed by simple descriptive statistics in tables and graphs.

Ethical Considerations

Ethical approval was requested and secured from the hospital management ethics and scientific committee. Informed consent was obtained from all participants and personal information were confidential.

Results

A total number of 104 semen parameters were analyzed. Mean age of the study population was 46 years with a range of 26 to 72 years. The most common age group was 36 to 45 years. Mandinka tribe was the majority and many of them were businessmen. Majority (62%) were of low parity.

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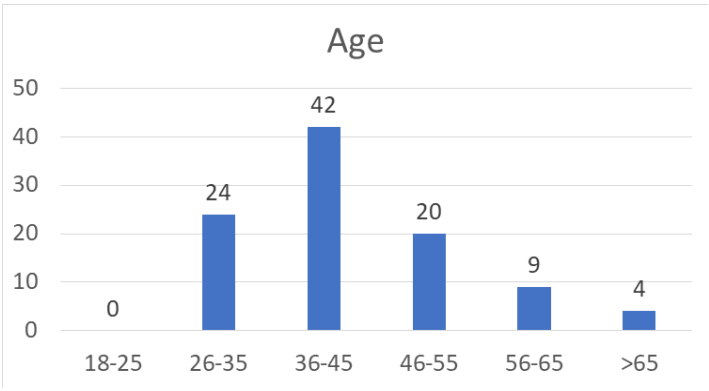

Figure 1: Age distribution of the study population.

Thematic 1 Sociodemographic characteristic: Univariable Analysis of Risk factors of Abnormal semen in randomly selected men in The Gambia (N=104).

Variable		n	N	%	OR	95% CI	P value
Age (years)							0.82
	26-35	22	25	88.0	1		
	36-45	38	42	90.5	1.3	0.27 - 6.33	
	46-55	17	20	85.0	0.77	0.14 - 4.32	
	56-65	9	9	100	1	1.00 - 1.00	
	>65	4	4	100	1	1.00 - 1.00	
Parity	0-1	60	64	93.8	1		0.25
	2-4	23	26	88.5	0.51	0.11 - 2.46	
	>4	11	14	78.6	0.24	0.05 - 1.25	
Level of education	None	5	5	100	1		0.30
	Primary	2	2	100	1	1.00 - 1.00	
	Secondary	41	44	93.2	2.2	0.49 - 9.93	
	Tertiary	31	36	86.1	1	1.00 - 1.00	
Tribe	Mandinka	39	45	86.7	1		0.59
	Fula	18	19	94.7	2.77	0.31 - 24.73	
	Wollof	8	8	100	1	1.00 - 1.00	
	Others	29	32	90.6	1.49	0.34 - 6.45	
Occupation	Business	45	47	95.7	1		0.08
	Others	49	57	86.0	0.27	0.05 - 1.35	

Thematic area 2: Medical and surgical illness/conditions: The (p-value 0.08-0.82; and 0.36) showed no association with abnormal semen in the study population.

Univariable Analysis of Risk factors of Abnormal semen in randomly selected men in The Gambia (N=104).

History of medical illness	No	91	100	91.0	1		0.36
	Yes	3	4	75.0	0.3	0.03 - 3.16	
Chronic medical condition	No	89	99	89.9	1		
	Yes	5	5	100	1	1.00 - 1.00	

Thematic area 3: Lifestyle factors: Univariable Analysis of Risk factors of Abnormal semen in randomly selected men in The Gambia (N=104). Atayal and energy drinks (p- value 0.75 and 0.55); Alcohol intake and Jumbo consumption (p-value 0.48 and 0.47), cigarette smoking and Marijuana (p-value 0.52 and 0.48) respectively.

Attaya	no	38	41	92.7	1		0.52
	yes	56	63	88.9	0.63	0.15 - 2.60	
Energy drink	no	42	47	89.4	1		0.75
	yes	52	57	91.2	1.24	0.34 - 4.56	
Cigarette	no	82	90	91.1	1		0.55
	yes	12	14	85.7	0.59	0.11 - 3.09	
Marijuana	no	83	91	91.2	1		0.48
	yes	11	13	84.6	0.53	0.10 - 2.82	
Alcohol	no	75	85	88.2	1		
	yes	18	18	100	1	1.00 - 1.00	
Jumbo	no	45	51	88.2	1		0.47
	yes	49	53	92.5	1.63	0.43 - 6.17	

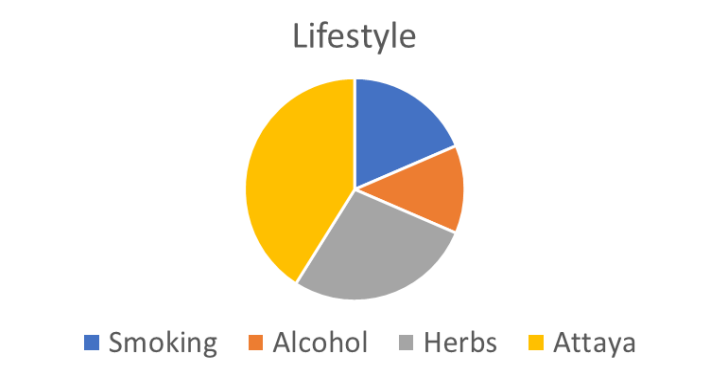

Figure 2: Percentage distribution of lifestyle parameters.

Discussion

A total number of 104 semen parameters were analyzed. The degree of abnormal parameters was not stratified. The study looked at the relationship of the demographic characteristics, life style, and medical conditions of the study population with abnormal semen parameters.

Thematic 1 The sociodemographic characteristics:

Mean age of the study population was 46 years with a range of 26 to 72 years. The most common age group was 36 to 45 years. The age of the study population had no association with abnormal sperm. The most common age was between 36 and 45 years some literature has implied age related semen quality depletion but in our study group the age was not seen as a risk factor to abnormal semen parameters (17). There are reports on the relationship of body mass index (BMI) (19) and low sperm count which is a cardinal sociodemographic characteristics that was not assessed in this study.

Certain occupation has been implicated in the risk of low sperm quality. In our study, majority of them were businessmen (62%) which was not categorized as in what type of business. However, evidence of long distance driving and working in chemical companies preclude what is assumed as business in our settings. Business in our setting includes buying and selling all kinds of things or being a contractor or proprietor that supervise not actually exposed to toxins or chemicals to the extent of causing semen abnormality. So the result we obtained is supportive that occupation that predominates among the study group may not adversely affect semen parameter.

Low parity (62%) observed in the study is also demonstrating the role of male factor in the aetiogenesis of subfertility in our setting. Para zero to one is the commonest group suggesting primary infertility may be the leading type of infertility which has been published (..).

Other sociodemographic characteristics analyzed in this study had no relationship with abnormal semen parameters even in other studies conducted by scholars working elsewhere.

Thematic 2: Lifestyle factors which are modifiable did not show any significant statistical association with abnormal sperm parameters.

Despite overwhelming evidence [11-15], that alcohol and coffee consumption; cigarette and marijuana smoking; anabolic energy drink and some dietary factors have negative impact on sperm quantity, volume and quantity our study did not show remarkable association. Even though some of the patients admitted drinking energy drink that have substantial amount of alcohol and those who accepted that they do take alcohol, the logistic regression analysis did not implicate either as a risk factor to abnormal semen parameters. Even those that smoke cigarette or marijuana did not have significant association with abnormal semen parameters. The quantification of daily consumption and smoking was not determined neither was stratification performed in this study however, what is clear is that the amount of this substances in the body may not be sufficient to cause or predispose to abnormal semen parameters.

Similarly, the sample size might be small to detect any significant association of these lifestyles with abnormal semen parameters. Although sample size calculation at the male factor infertility of 30% as effect size even though the prevalence was 45% may also be a factor. The power at 95% and test of significance with p-value at 0.05 should be able to mitigate the shortfall in the sample size (as adequate) to see a change that could occur not by chance.

This study introduced a particular lifestyle which is a social factor that is very common. Atayal and Jumbo consumption (p-value 0.48 and 0.47) respectively. There was no statistical significant association with low sperm count. Atayal is overboiled tea with some herbs and excess sugar and Jumbo is a seasoning agent used in daily cooking of food. The excess consumption was not determined in the study but taking any amount did not show any relationship with abnormal semen parameters.

Thematic 3: chronic medical conditions (p-value 0.08-0.82; and 0.36) showed no association with abnormal semen in the study population. Some of the chronic medical condition assessed includes hypertension, diabetes, past inguinal surgeries, chronic ingestion of medications for any sickness, varicocele and varicocelectomy history in the past were all assessed. Majority responded no (90%) and the yes response may not be sufficient to cause significant association with abnormal semen analysis.

Clinical Application of the Findings

Searching for risk factors of abnormal semen parameters in our setting is a worthwhile exercise but getting the number that will show significant difference that occurred not by chance may be difficult. Difficult in the sense that, to extract appropriate and unambiguous information by a direct interviewer administered questionnaire certainly does not have ability to verify any information the patient may decide to answer (yes or no). Also to assess genetic factors real-time may require expensive facilities to conduct such a research with no definite influence on the management of male factor infertility which is ICSI. Ethical approval of such research may require a lot of justification in our setting. It might be for research purposes not directly essential in clinical practice.

It is imperative we put into perspective the overwhelming evidence that semen parameters of human race has been declining in the last 50 years [20-25]. The findings also indicated regional disparities of unknown origin in the abnormal semen parameters. Scholars working elsewhere have suggested that in western part of sub-Saharan Africa the declining rate of semen parameters is more profound [25,26]. Could this be climate change, global warming or all of the above, events are still unfolding. A good research interest area.

Study Limitation

Single site fertility center study with small sample size. A multicenter and multinational study in this field is required.

Conclusion

The study showed no significant association of sociodemographic characteristic, lifestyle factors and chronic medical conditions with abnormal semen parameters in the male factor infertility in the Gambia. Further studies are recommended.

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