

Concept of Dried Seminal Biochemical Parameters in Substantiating Male Infidelity

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ABSTRACT

Background and Objective: Infidelity is the desecration of a couple's vows on sexual serenity and individuality leading to psychological damage, post-traumatic stress disorder, family breakdown and at times murder. Solutions to infidelity are multifaceted of which early detection with evidence could be of great help. This study was therefore designed to find an alternative approach to discovering a scientific means of detecting the occurrence of sexual intercourse which is the fulcrum of infidelity.

Materials and Methods: The under wares of the subjects recruited for the study were collected after voluntarily enrolling in the study. The study was categorized into four groups, no-sex male (NSM), sex group (S), sex bath wash (SBW) and sex bath and no wash (SBNW). Concentrations or activities of seminal zinc, magnesium, inorganic phosphate, prostate-specific antigen (PSA) and acid phosphatase (ACP) were analyzed using WHO-approved methods after the elution of the semen-stained under wares in distilled water. One-way ANOVA (*Post hoc*-LSD) on SPSS (version 21) statistical software was used for the data analysis. **Results:** The findings of the study showed a significant increase in concentrations or activities of PSA and ACP when compared amongst the groups, whereas the seminal electrolytes were not significant. In a similar vein, comparisons of other parameters such as seminal magnesium, inorganic phosphate and zinc exhibited non-significant differences between the various studied groups.

Conclusion: The concentrations of PSA and ACP could be utilized as an adjunct investigative tool in affirming the occurrence of sexual intercourse and infidelity in particular.

KEYWORDS

Male infidelity, semen, electrolytes, prostate-specific antigen, acid phosphatase

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INTRODUCTION

Infidelity is synonymous with words like extramarital, adultery, unfaithful, cheating or stepping out¹. The concept of infidelity has many schools of thought as it pertains to definitions and interpretations. It is defined as having sexual encounters with someone outside a monogamous relationship. Hertlein *et al.*² definition of infidelity is multifaceted as it encapsulates involvement in a sexual relationship outside one's legitimate partner, cybersex, pornography addiction and, physical or emotional intimacy with someone other than one's spouse. Blow and Hartnett³, Fife *et al.*⁴ added a new dimension of betrayals and internet sexual escapade to the definitions of infidelity. In a similar vein, Pour *et al.*⁵ added romantic exchanges with no sexual involvement as a component of infidelity.



Psychological damages resulting from infidelity include low sexual and personal confidence, feelings of rage and betrayal, separation and even post-traumatic stress disorder⁶. A lot of murder cases in marriages are rooted in infidelity^{7,8}. Also, diseases and other forms of comorbidities have been attributed to the act of infidelity^{9,10}. Similarly, family breakdown due to infidelity results in the exposure of children to early life abuses that contribute to an increase in crimes and other social vices in society⁴. Summarily, the fallout of infidelity is negatively colossal and heavily injurious to society. This calls for scientific approaches in detecting infidelity to resolve potential crises that could lead to the negativities enumerated above.

Semen is a complex viscous fluid containing several molecules and nutrients formed in male reproductive organs. The molecules found in semen include zinc, citrate, fructose, calcium, glucose, lactic acid, magnesium, potassium and proteins¹¹. These molecules play a crucial role in maintaining the viability of sperm cells found in semen. Seminal stain detection and identification are of great importance in jurisprudence, particularly in cases of infidelity, alleged rape, sexual assault and sexual homicide. The forensic laboratory utilizes various empirical methods in the detection and identification of seminal fluids on cloths or linen, with the potential utilization in a court of law^{12,13}.

Seminal biochemical parameters such as electrolytes and enzymes are utilized for clinical diagnosis and management of diseases^{14,15}. The determination of these parameters in semen-stained underwear clothing of males could be utilized in the inclusion or exclusion of infidelity. Forensically, the presence of substances in a crime scene could be used in the inclusion or exclusion of suspects. Hence the presence of these seminal parameters on underwear without cogent explanation could be indicative of the act of infidelity. This study was therefore, aimed at using some seminal electrolytes and enzymes in interrogating a viable scientific approach to resolving the conundrum of infidelity.

MATERIALS AND METHODS

Study area: The Federal University Otuoke was the study location. Federal University Otuoke is located in Otuoke town in Ogbia Local Government Area of Bayelsa State, Nigeria. Bayelsa State is one of the thirty-six states of Nigeria situated in the South-South Geopolitical Zone known for petroleum exploration and exploitation. The male underwear was purchased from Tombia market, Yenegoa Local Government Area, Bayelsa State. In a similar vein, the laboratory analysis component of the study was conducted at the Eni-yimini Laboratories LTD located in Yenagoa, Bayelsa State. The study duration was two months starting on 21st January, 2022 and terminating on 20th March of the same year.

Study population: The nature of research made it quite tasking the recruitment of subjects. Despite the difficulties encountered a total of fifty male adults granted consent and were recruited for the study.

Fifty males underwear's were purchased from Tombia market, Bayelsa State. The male underwear was distributed to the subjects. The study was grouped into four groups, Group A represented no sex male (NSM), Group B represented sex group (S), Group C represented sex bath wash (SBW) and Group D represented sex bath and no wash (SBNW).

Ethical approval: The ethical clearance and experimental protocol were approved by the Directorate of Research and Quality Assurance of the Federal University Otuoke, Bayelsa State. In a similar vein, informed consent was extracted from the subjects after a thorough explanation of the nitty-gritty of the study.

Selection criteria: Subjects recruited for the study were healthy and had not undergone prostate surgery or any other similar surgeries as confirmed by the university physician. The age range was between 18 to 30 years old.

Sample collection and preparation: The area of the underwear stained with semen was marked with water-insoluble inks and then cut off from the main underwear. The part cut off was soaked in distilled water inside a beaker. The top layer of the water was decanted and the sediments were poured into plain bottles for laboratory analysis.

Laboratory analysis: Prostate-specific antigen (PSA) was estimated using the ELISA method (Accubind kit).

Acid phosphatase (ACP) was assayed spectrophotometrically (WTW photoLab® 7100 VIS Spectrophotometer | Xylem Nigeria) using a Biosystem kit (China). Similarly, inorganic phosphate, magnesium and zinc concentrations were estimated spectrophotometrically (Agappe Diagnostics, Switzerland).

Statistical analysis: Data were analyzed with the Statistical Package for Social Science (SPSS) program version 22 (SPSS inc., Chicago, Illinois, USA, Version 18-12). One-way ANOVA (*Post hoc*-LSD) was used in comparing the means of the electrolyte concentrations and enzyme activities of the various groups. The level of significance of the study was pegged at less than or equal to 0.05 (95% confidence of interval).

RESULTS AND DISCUSSION

No significant difference ($p > 0.05$) in seminal electrolyte concentrations (magnesium, zinc and inorganic phosphate) compared among the five groups of the study was shown in Table 1. On the contrary, Table 2 exhibited a significant difference ($p < 0.05$) in concentrations of ACP and PSA when compared to the studied groups.

Comparison of the studied seminal electrolytes between the various groups exhibited non-significant differences (Table 1). Irrespective of the non-significant stance, the detection of these seminal electrolytes on a male under wares is of futuristic advantage. The electrolytes deposited on the male under wares are traceable to multisource such as the semen, the under ware, the water and the detergent or the soap used. This is the major handicap to the utilization of seminal electrolytes in infidelity investigation. However, with modern technology in molecular tagging and speciation, this handicap can be prevented. Affirmations by the World Health Organization (WHO) in several publications of the presence of electrolytes in water have further proven the difficulties in its applications in infidelity investigation¹⁶.

Table 1: Comparison of the mean concentrations of studied seminal electrolytes of the various groups

Parameters	Group A	Group B	Group C	Group D	F-value	p-value
Mg (mmol L^{-1})	0.6863 \pm 0.1150	0.3683 \pm 0.1564	1.7057 \pm 1.2165	0.5320 \pm 0.3321	2.676	0.118
Zn (mmol L^{-1})	300.7897 \pm 353.9380	576.9473 \pm 603.0632	2209.9113 \pm 2091.9064	698.9330 \pm 509.4425	1.726	0.239
P _i (mmol L^{-1})	0.3347 \pm 0.2482	1.6103 \pm 0.640	2.4467 \pm 2.0525	0.4167 \pm 0.2555	2.565	0.127

Group A: No sex male, Group B: Sex group, Group C: Sex bath wash, Group D: Sex bath and no wash, Mg: Magnesium, Zn: Zinc, P_i: Inorganic phosphate, Data are expressed as Mean \pm SD, Significant at 0.05 confidence ($p < 0.05$) and \pm : Plus-minus sign

Table 2: Comparison of mean concentrations of ACP and PSA of the various groups

Parameters	Group A	Group B	Group C	Group D	F-Test	p-value
ACP	0.0000 \pm 0.0000	0.0560 \pm 0.0401 ^a	0.0073 \pm 0.0006 ^{a,b}	0.0093 \pm 0.0085 ^{a,b}	0.956	0.04
PSA	0.0033 \pm 0.0041	7.9367 \pm 10.2629 ^a	41.9407 \pm 67.9971 ^{a,b}	42.0393 \pm 67.8235 ^{a,b}	0.633	0.03

ACP: Acid phosphatase, PSA: Prostate specific antigen, Group A: No sex male, Group B: Sex group, Group C: Sex bath wash, Group D: Sex bath and no wash, a: $p < 0.05$ vs Group B-D, b: $p < 0.05$ vs Group C-D, Data are expressed as Mean \pm SD, Significant at 0.05 confidence ($p < 0.05$) and \pm : Plus-minus sign

Moreover, the concentration or activity of PSA) and ACP were found to be significant when compared among the studied groups (Table 2). The adult male prostate gland and the urethral epithelium's surrounding cells produce a serine protease known as PSA. Furthermore, it is also known as selenoproteins, E1 protein, P30 and PA¹⁷. It is a protein that is only found in males and is secreted by the prostate gland. The results, however, demonstrated that the concentration of PSA and ACP on semen-stain clothing can be used to detect the incidence of sexual intercourse of which infidelity formed a component. Semen is typically accepted as evidence in the prosecution of sexual assault cases. Although the presence of sperm confirms the existence of semen, this is not always the case as other seminal biomarkers could also affirm the same. Examples of semen biomarkers include semenogelin (Sg) and prostate-specific antigen (PSA)¹⁸. Hence, the detection of PSA and ACP on semen-stained under wares could be indicative of an incidence of sexual intercourse. This finding concurred with a similar study by Peonim *et al.*¹⁹ on the utilization of seminal biomarkers in determining the occurrence of sexual intercourse.

The dilemma associated with this finding is factors that can affect the viability of seminal PSA and ACP upon exposure to harsh environments. Similar concerns are found in publications authored by Awasthi *et al.*²⁰ and Garg *et al.*²¹. However, the result of this study has similarities with that of Farnen *et al.*²².

The application of seminal biochemical parameters in detecting the occurrence of sexual intercourse is a nascent concept that needs further replicative and additional studies for validation. Further inroads or interrogations by researchers into this concept will add much value to the body of knowledge and forensic science in particular.

CONCLUSION

This study highlighted the scientific approaches to detecting the occurrence of sexual intercourse and infidelity in particular. Seminal electrolytes, PSA and ACP formed the parameters of interest in interrogating the emerging concept. Summarily, the study revealed that seminal PSA and ACP could constitute a supporting tool in substantiating the occurrence of infidelity.

SIGNIFICANCE STATEMENT

This study discovered the presence of seminal prostate-specific antigen (PSA) and acid phosphatase (ACP) on dried semen-stained under wares of males after sexual intercourse. The discovery is of importance to forensic science as it could be a useful tool in the investigation of alleged infidelity or denial of the incidence of sexual intercourse or rape.

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