ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26oct1196

Infertility Among Commercial Shuttle Bus Drivers in Onitsha Urban Nigeria: The Role of Testosterone Dysregulation and Occupational Heat Stress in Onitsha Metropolis, Southeastern, Nigeria

Odo V. C.[1]; Omeye Emmanuel[2]; Iboyi Nathaniel Onuche[3]; Anyaoike N. N.[4]

[1;2;3;4]Tansian University, Orba Campus

Publication Date: 2026/11/06

Abstract: Male infertility has emerged as a growing public health concern globally, particularly in occupational groups exposed to environmental and physiological stressors. This study investigated testosterone dysregulation and infertility risk among commercial shuttle bus drivers in Onitsha metropolis, Southeastern Nigeria. A cross-sectional analytical study involving 180 participants (120 commercial shuttle bus drivers and 60 age-matched controls) was conducted between January and October 2025. Serum testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), cortisol, and semen parameters were assessed using ELISA and WHO semen analysis protocols. Occupational exposure variables including daily driving duration, cabin heat exposure, traffic congestion intensity, and years of service were evaluated. Results showed significantly lower mean testosterone levels among drivers (3.42 ± 1.21 ng/mL) compared with controls (5.18 ± 1.47 ng/mL; $p < .001$). Drivers also demonstrated significantly reduced sperm count, sperm motility, and sperm morphology indices. Heat exposure duration positively correlated with cortisol levels ($r = .62$, $p < .001$) and negatively correlated with testosterone concentration ($r = -.58$, $p < .001$). Logistic regression identified prolonged occupational heat exposure and driving duration above 10 hours/day as independent predictors of infertility risk. The findings suggest that chronic occupational heat stress and environmental pollution may contribute substantially to testosterone dysregulation and impaired reproductive health among urban transport workers in Onitsha metropolis, Nigeria. Occupational reproductive health interventions and environmental health policies are recommended.

Keywords*: Male Infertility, Testosterone Dysregulation, Occupational Exposure, Heat Stress, Shuttle Bus Drivers, Onitsha, Nigeria, Reproductive Health.*

How to Cite: Odo V. C.; Omeye Emmanuel; Iboyi Nathaniel Onuche; Anyaoike N. N. (2026) Infertility Among Commercial Shuttle Bus Drivers in Onitsha Urban Nigeria: The Role of Testosterone Dysregulation and Occupational Heat Stress in Onitsha Metropolis, Southeastern, Nigeria. *International Journal of Innovative Science and Research Technology*, 11(10), 3074-3078. https://doi.org/10.38124/ijisrt/26oct11196

I. INTRODUCTION

Male infertility contributes to approximately 40–50% of infertility cases worldwide, with environmental and occupational exposures increasingly implicated in declining male reproductive health. Rapid urbanization, traffic congestion, environmental pollution, and prolonged exposure to heat are emerging risk factors in developing countries, particularly among commercial drivers.

Commercial shuttle bus drivers in Onitsha metropolis represent a highly vulnerable occupational group. Onitsha is one of the busiest commercial cities in West Africa, characterized by intense vehicular traffic, elevated ambient temperatures, poor air quality, and prolonged working hours. These conditions may predispose drivers to chronic heat stress, endocrine dysfunction, oxidative stress, and impaired spermatogenesis.

Previous studies in Nigeria demonstrated altered testosterone and gonadotropin levels among long-distance drivers and other occupationally exposed populations. Evidence further indicates that heat stress negatively affects testicular function and hormonal balance by impairing Leydig cell activity and increasing oxidative stress. Despite increasing reports of infertility among urban workers, limited empirical data exist regarding commercial drivers in SouthEastern Nigeria. This study therefore assessed the relationship between testosterone dysregulation and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26oct1196

infertility indicators among shuttle bus drivers in Onitsha metropolis.

➢ *Objectives of the Study*

- To determine serum testosterone levels among shuttle bus drivers in Onitsha.
- To evaluate semen quality indices among commercial drivers.
- To assess the relationship between occupational heat exposure and testosterone dysregulation.
- To identify predictors of infertility risk among shuttle bus drivers.

➢ *Research Hypotheses*

- *Null Hypothesis (H0)*

There is no significant relationship between occupational exposure and testosterone dysregulation among shuttle bus drivers.

- *Alternative Hypothesis (H1)*

Occupational exposure significantly contributes to testosterone dysregulation and infertility among shuttle bus drivers.

II. LITERATURE REVIEW

➢ *Occupational Heat Exposure and Male Reproductive Health*

Heat stress is increasingly recognized as a major occupational hazard affecting reproductive health. Elevated scrotal temperature disrupts spermatogenesis and testosterone synthesis. The testes normally function optimally at temperatures 2–4°C below core body temperature. Chronic sitting, engine heat, prolonged driving, and tropical ambient temperatures may elevate scrotal temperature beyond physiological tolerance.

➢ *Testosterone Dysregulation*

Testosterone regulates spermatogenesis, libido, and male reproductive capacity. Dysregulation may occur through oxidative stress, endocrine disruption, or hypothalamic-pituitary-gonadal axis dysfunction. Studies in Nigeria demonstrated lower testosterone levels among occupationally exposed men.

➢ *Environmental Pollution and Fertility*

Urban air pollution contains particulate matter, hydrocarbons, and heavy metals capable of inducing oxidative stress and DNA damage in spermatozoa. Chronic exposure to vehicular emissions in congested urban environments may therefore impair fertility.

III. METHODOLOGY

➢ *Study Design*

A cross-sectional comparative study was conducted.

➢ *Study Area*

The study was carried out in Onitsha metropolis, Anambra State, Nigeria.

➢ *Population*

Commercial shuttle bus drivers operating within Onitsha urban transport routes constituted the study population.

➢ *Sample Size*

A total of 180 participants were recruited: 120 commercial shuttle bus drivers and 60 non-drivers as controls.

- Inclusion Criteria: These included- Male participants aged 25–55 years, with a minimum of 3 years driving experience as an active shuttle bus driver.
- Exclusion Criteria: These include participants with the history of orchitis or testicular surgery; Diabetes mellitus, alcohol dependence, Hormonal therapy.

➢ *Data Collection*

Structured questionnaires obtained information on:

Age, Driving duration, Years of service, Smoking habits, Heat exposure duration.

➢ *Laboratory Analysis*

Venous blood was collected from the participants and the sera separated immediately for testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), Cortisol analysis using ELISA methods . Also, semen specimens after three days of sexual abstinence were collected and WHO semen analysis protocols were employed.

➢ *Statistical Analysis*

Data obtained from the experiments were analyzed using the statistical package for social sciences software for windows version 27. Independent t-test was used to summarize the parameters of the study participants and results were expressed as Mean ± Standard Deviation (SD). Heat exposure duration, cortisol and testosterone were correlated using Pearson Correlation and Logistic regression The level of significance was set at $p<0.05$.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26oct1196

IV. RESULTS

Table 1 Sociodemographic Characteristics of Participants

Variable	Drivers (n = 120)	Controls (n = 60)	p-value
Mean age (years)	39.5 ± 7.2	37.8 ± 6.9	<.184
Daily work duration (hours)	11.3 ± 2.1	7.2 ± 1.4	< .001
Years of occupation	12.6 ± 5.4	8.1 ± 4.2	< .003
Smokers (%)	31.7	15.0	< .021

Table 2 Hormonal Profile of Participants

Hormone	Drivers	Controls	p-value
Testosterone (ng/mL)	3.42 ± 1.21	5.18 ± 1.47	< .001
LH (mIU/mL)	9.31 ± 2.44	5.82 ± 1.93	< .001
FSH (mIU/mL)	10.12 ± 3.21	6.40 ± 2.11	< .001
Cortisol (µg/dL)	21.6 ± 5.8	13.4 ± 4.2	< .001

Table 3 Semen Parameters

Parameter	Drivers	Controls	p-value
Sperm count (million/mL)	18.2 ± 6.4	36.5 ± 8.2	< .001
Motility (%)	34.1 ± 10.5	58.7 ± 9.1	< .001
Normal morphology (%)	3.1 ± 1.4	6.2 ± 2.1	< .001
Correlation Analysis			

Table 4 Correlation Between Occupational Variables and Testosterone Levels

Variable	Correlation coefficient (r)	p-value
Daily driving duration	−0.53	< .001
Cabin heat exposure	−0.58	< .001
Cortisol levels	−0.61	< .001

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26oct1196

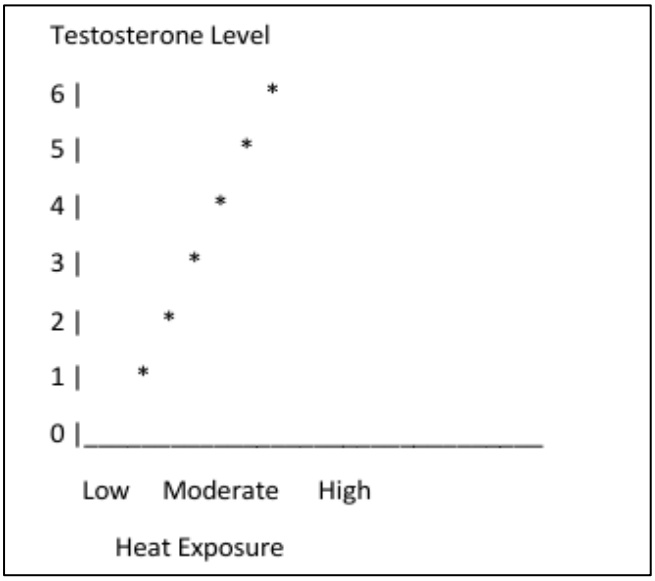


Fig 1 Relationship Between Heat Exposure and Testosterone

V. DISCUSSION

The present study demonstrated significantly lower testosterone levels among commercial shuttle bus drivers compared with controls. The observed endocrine abnormalities may be attributable to prolonged heat exposure, oxidative stress, air pollution, sedentary occupation, and circadian rhythm disruption. These findings align with earlier Nigerian studies reporting endocrine dysfunction among long-distance drivers and occupationally exposed workers.

The observed reduction in sperm quality parameters suggests impaired spermatogenesis potentially resulting from chronic heat exposure and oxidative stress. Environmental heat has been shown to negatively affect Leydig cell function and testosterone biosynthesis.

Elevated cortisol levels among drivers indicate chronic physiological stress. Cortisol suppresses gonadotropin-releasing hormone and may indirectly impair testosterone production. The inverse relationship between cortisol and testosterone observed in this study supports previous findings on stress-induced infertility.

Onitsha's congested urban environment may additionally expose drivers to pollutants capable of inducing oxidative damage to sperm DNA. This may further worsen infertility outcomes.

➢ *Public Health Implications*

The findings underscore the need for occupational reproductive health surveillance among commercial drivers. Interventions should include: Heat reduction strategies in vehicles, Scheduled work-rest cycles. Routine reproductive health screening, Urban pollution control measures. Occupational health education.

VI. LIMITATIONS OF THE STUDY

Cross-sectional design limits causal inference. Self-reported occupational exposure may introduce recall bias. Environmental heat indices were not directly measured.

VII. CONCLUSION

Commercial shuttle bus drivers in Onitsha metropolis exhibit significant testosterone dysregulation and impaired fertility indices associated with occupational heat exposure and chronic physiological stress. Prolonged driving duration, environmental heat, and urban pollution may substantially contribute to reproductive dysfunction among drivers. Targeted occupational health interventions are urgently needed to reduce infertility risks in this population.

RECOMMENDATIONS

- Establish occupational reproductive health policies for commercial drivers.
- Introduce heat-control mechanisms in public transport vehicles.
- Conduct periodic hormonal and fertility screening.
- Improve urban environmental management and traffic regulation.
- Encourage further longitudinal studies with biomarker monitoring.

REFERENCES

[1]. Abriba, S. P., & Osadolor, H. B. (2023). Correlation study of stress biomarkers, endocrinopathies, semen quality and quantity in infertile men in Abuja, Nigeria. *International Journal of Research in Medical Sciences*, 11(4), 1251–1259.

[2]. Abriba, S. P., & Osadolor, H. B. (2023). The effects of stress biomarkers on sex hormones, sperm quality and quantity in infertile men in Abuja, Nigeria. *International Journal of Research in Medical Sciences, 11(2),* 887–895.

[3]. Dowe, C. A., & Osadolor, H. B. (2022). Evaluation of testosterone, dihydrotestosterone and gonadotropins among long distance drivers in Benin City, Nigeria. *American Journal of Biomedical Science,* 14(1), 1–11.

[4]. Kumar, N., & Singh, A. K. (2022). Impact of environmental factors on human semen quality and male fertility: A narrative review. *Environmental Sciences Europe,* 34(6), 1–22. https://doi.org/10.1186/s12302-021-00585-w

[5]. Popoola, A. G. N., Ibrahim, M., Mustapha, A. A., & Garuba, W. O. (2024). Reproductive hormone profiles and infertility risk in heat-exposed female kitchen workers in Ilorin, Nigeria. *International Journal of Research and Scientific Innovation*, 11(10), 151–162.

[6]. Yeiya, E. A., & Emokpae, M. A. (2022). Awareness of reproductive health risks, sex hormone levels and sperm indices among farmers exposed to pesticides in Nigeria. *Journal of Environmental Health Science,* 48(4), 244–253.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26oct1196

[7]. Ashonibare, V. J., Ashonibare, P. J., & Akhigbe, R. E. (2024). SARS-CoV-2 impairs male fertility by targeting semen quality and testosterone level: A systematic review and meta-analysis. *PLOS ONE*, 19(9), e0307396.
[8]. Yilmaz, B., et al. (2025). Analyzing the impact of occupational exposures on male fertility indicators: A machine learning approach. *Reproductive Toxicology*, 121, 108959.
[9]. Chen, X., et al. (2025). Effects of oxytocin on heat-perturbed testes of adult Wistar rats. *International Journal of Scholarly Resources*, 17(2), 44–58.
[10]. World Health Organization. (2023). WHO laboratory manual for the examination and processing of human semen (6th ed.). *WHO Press*.