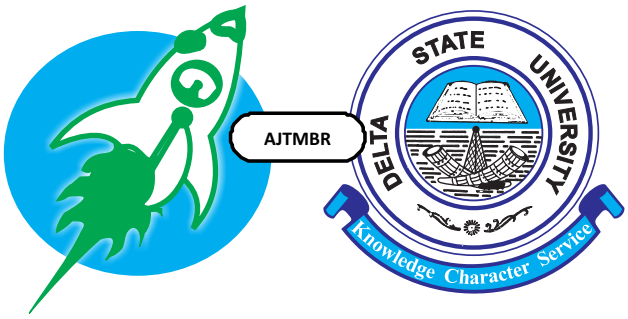
African Journal of Tropical Medicine and Biomedical Research (AJTMBR)



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Focus and Scope

The African Journal of Tropical Medicine and Biomedical Research is a multidisciplinary and international journal published by the College of Health Sciences, Delta State University of Abraka, Nigeria. It provides a forum for Authors working in Africa to share their research findings on all aspects of Tropical Medicine and Biomedical Sciences and to disseminate innovative, relevant and useful information on tropical medicine and biomedical sciences throughout the continent. The journal will publish original research articles, reviews, editorials, commentaries, short reports, case reports and letters to the editor. Articles are welcome in all branches of medicine and dentistry including basic sciences (Anatomy, Biochemistry, Physiology, Pharmacology, Psychology, Nursing etc) and clinical sciences (Internal Medicine, Surgery, Obstetrics and Gynaecology, Dental surgery, Child Health, Laboratory Sciences, Radiology, Community Medicine, etc). Articles are also welcome from social science researchers that document the intermediating and background social factors influencing health in countries of Africa. Priority will be given to publication of articles that describe the application of the principles of primary health care in the prevention and treatment of diseases.

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Table of Contents

Effect of Occupational exposure to Gasoline on Reproductive and Thyroid hormones among male Petrol station attendants in Kwara State

Adunmo Godwin O.; Seyi Taiwo; Ibrahim Muniru; Busari, A. O.

Abstract

Introduction: Petrol fume contain organic compounds that have been suggested to be endocrine disruptors. There is paucity of data on petrol fume-linked health challenges in Nigeria. Thus, we evaluated the effects of petrol fume exposure on blood levels of reproductive and thyroid hormones among petrol pump station attendants in Kwara state, Nigeria.

Material and Methods: Eighty (80) petrol station attendants and fifty (50) non-occupationally exposed subjects were recruited as controls. Anthropometric indices were taken and fasting blood samples were collected after signing the consent form. Free triiodothyronine (FT3), free thyroxine (FT4), thyroid stimulating hormone (TSH), testosterone, follicle stimulating hormone and luteinizing hormone were evaluated using standard techniques.

Results: Average age and BMI of petrol fume-exposed subjects are 27.40±0.419 and 24.98±0.254 respectively and was not different from controls. Elevated FT3 and FT4 were evaluated with a decreased TSH level in the exposed group when compared with controls. In contrast, FSH, LH and testosterone were significantly reduced in exposed group when compared with control.

Conclusion: The result of this study shows that petrol fume toxicants adversely alter thyroid and gonadal functions thereby modulating circulating levels of reproductive and thyroid hormones in male petrol station attendants in Kwara state.

Keywords: Petrol fumes, thyroid hormones; reproductive hormones, infertility.

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Introduction

Global health concern has been raised on the account of continuous unintentional exposure of humans to toxic derivatives of petroleum in the recent years[1]. These exposures have been indicated to engender hormonal imbalance associated with several disorders[2,3]. Hydrocarbon components of petroleum products are of economic importance, but some are toxic and have been implicated in a number of diseases and environmental degradations[4,5]. In addition, the impacts of exposure are more felt in some occupations and work environments than others[6].

Previous report shows more than 10% of Nigeria's population is exposed to hydrocarbon products from petroleum[7]. It is therefore apparent that continuous unintentional inhalation of volatile organic compounds in petroleum products especially by petrol station attendants is

a major occupational health hazard across the country. Unfortunately, most of these attendants neither use protective devices to prevent inhalation of compounds in petroleum products; nor do they visit the hospital regularly for routine medical check-up while many have been on this job for an extended period of time[8].

Gasoline (petrol) is a popular derivative of petroleum used for automobiles, industrial engines and home generators in many developing countries including Nigeria. It is a complex mixture containing about 62% alkanes, 7% alkenes and 31% aromatics, alcohols, ethers and additives[9]. Aliphatic and aromatic hydrocarbons, such as benzene, toluene, ethylbenzene and xylene (BTEX) are released as vapors from gasoline during the processes of loading, offloading or fueling, and are considered among the most hazardous compounds for human health[10]. Gasoline fumes are widespread in the environment with the common sources of contact or exposure well known to be petrochemical industries (refineries, oil fields and filling stations), engineering workshops and homes. Inhalation of petrol vapors was shown to impair liver and renal function[11,12], alter hematopoiesis[13] in gasoline station attendants. Benzene and xylene have been more associated with defects due to oxidative stress, alterations in DNA repair and expression of oncogenes [14,15].

Infertility remains a major global health problem with multifactoral causes. Disorders of sexual function are underlined by endocrine/hormonal issues and have been correlated with exposures to toxic environmental chemicals. Importantly, spermatogenesis is known to be more sensitive to environmental toxicants[16]. Studies documented that occupational exposure to gasoline decrease blood levels of reproductive hormones with attendant impairments in the gonadal function[2,17]. The effects of occupational exposure to petrol on thyroid function are not fully clear. Previous studies observed fluctuations in thyroid hormone levels upon exposures to petroleum-derived fuels[18,19]. Thyroid hormones imbalance has been previously linked with testicular dysfunction and infertility in males[20]. In this study, we investigated the effects of occupational exposure to gasoline on serum levels of reproductive and thyroid hormones among male petrol station attendants in Kwara state.

Study population

A total of eighty (80) adult male subjects with not less than four(4) years petroleum exposures were recruited from Ilorin and Offa; Kwara State, Nigeria. Fifty (50) non-exposed adult males were also recruited from the same metropolitan area to serve as study control.

Exclusion criteria

Female subjects among petroleum station's attendants were excluded from the study. Study participants were exclusively adult males that satisfy the inclusion criteria. Only adult male subjects who have worked for 5 years and above are considered.

Data collection

Information on demographic factors, anthropometric details and life style factors of each study participants were derived through an accurately structured questionnaire. Other information about personal data such as smoking habits, alcoholism and other addictions were enquired for and noted.

Height: This parameter was measured against a flat vertical surface with the subject standing without raising the heel from the ground. The feet were brought together without shoes aligned with a ruled bar against a vertical surface. The reading

was obtained and recorded to the nearest metre (m).

Weight: The weighing device is placed on a parallel surface. It was used to take measurement of each study participants. The subjects were made to stand on the scale with shoe off and the reading was obtained and recorded to the nearest kilogram (kg).
Body Mass Index (BMI)
This was derived from the expression; BMI= Weight (kg)/Height (m).

Statistical analysis
Statistical analysis of the data was done using SPSS version 17 software (SPSS inc, Chicago, IL, USA). The comparison of the mean of the two groups was done using student's *t*- test. Analysis of variance (ANOVA) two-tailed was used when the means of more than three groups were to be compared. Honestly significant difference turkey test was used in conjunction with ANOVA to find means that were significantly different from each other.

Collection of blood samples
The blood sample was obtained from the study participants during the day light without any special requirement for collection. No fasting episode is required throughout the sample collection.

The venepuncture was performed on the cubital fossa with tourniquet applied on the upper arm for easy access to the vein. 5.0ml of blood sample was collected following aseptic procedure from each participant and dispensed into Lithium heparin bottles. The blood obtained was thereafter spun at 3,000xg for 10minutes. The plasma was separated and refrigerated at -20oC. Analysis of biochemical parameters was done in the laboratory.

Biochemical Assays

Determination of Serum FSH, LH, Testosterone, TSH, T3 and T4
The determination of FSH, LH, Testosterone, TSH, T3 and T4 in the serum was conducted using enzyme-linked immunosorbent assay (ELISA) principles. Hormone concentrations were measured spectrophotometrically at 450 nm.

Results
Demographic characteristics
Average age and BMI of petrol fume-exposed subjects are 27.40±0.419 and 24.98±0.254 respectively (compared with 25.96±0.328 and 24.15±0.192 in non-exposed controls)

Effect of petrol exposure on reproductive hormones
Serum Follicle stimulating hormone (FSH), luteinizing hormone (LH) and testosterone level were all significantly reduced in exposed subject when compared with the control.

Effect of petrol exposure on the thyroid hormones
Means of FT3 and FT4 were significantly elevated in subject exposed petrol when compared with the control. However, thyroid stimulating hormone (TSH) was significantly reduced in exposed subject when compared with the control.

Discussion
Endocrine glands regulate physiological processes through release of hormone substances, while any impairment in synthesis, transport and/or bioavailability of the hormones could lead to hormonal imbalance and systemic disorders[21,22]. Petrol fume contain organic compounds such as BTEX and heavy metals that act as endocrine disruptors rendering cyto- and hemo-toxic effects[8]. This study provides data on

the effect of occupational exposure to gasoline fume on serum levels of reproductive and thyroid hormones in male petrol station attendants in Kwara state. Average age and BMI of petrol fume-exposed subjects are 27.40±0.419 and 24.98±0.254 respectively (compared with 25.96±0.328 and 24.15±0.192 in non-exposed controls) (Table 4.1). This shows that healthy weight, young male subjects were recruited and there is no significant difference in BMI of petrol station attendants compared with controls.

Our results further revealed that occupational exposure to petrol fume caused plausible decreases in serum levels of follicle stimulating hormone and testosterone with slight reduction in luteinizing hormone level when compared with control (Table 4.2). This suggest that inhalation of organic constituents in petrol fume may have suppressing effect on the hypothalamic-anterior pituitary-testicular axis, by altering hypothalamic production of gonadotropin releasing hormone, which in turn could alter synthesis or release of FSH, LH and testosterone. Previous study in line with our observation reported significant attenuations in males reproductive hormones (FSH, LSH and testosterone) in petrol station attendants in Edo state, Nigeria[6]. Male infertility is a common public health challenge in Nigeria and exposures to environmental toxicants may mediate oxidative stress in Leydig cells causing impaired steroidogenesis and hypotestosteronemia[23]. Exposure to petrol fumes in rats has been implicated at the level of the gonads to induce testicular dysfunction and reduce sperm parameters with oxidative stress and decreased antioxidant enzymes as key pathogenic mechanisms[17].

Thyroid pathophysiology is a growing area of interest in evaluating toxicological effects due to the involvement of thyroid-secreting hormones in key processes including metabolism, growth and development. The thyroid gland produces thyroxine (T4), which is a relatively an inactive prohormone, while the highly active hormone is triiodothyronine (T3). There are reports that toxic chemicals can disrupt thyroid hormone balance directly or indirectly through various mechanisms. From our data, there was elevation in the levels of both T3 and T4 with a reduced TSH level in petrol fume-exposed subjects when compared with control (Table 4.3). Meludu *et al* shows that higher serum T3 (active thyroid hormone) but not T4 levels was accompanied with a decrease in TSH level in gasoline exposed workers in Anambra, South-East Nigeria[19]. Conversely, a study investigated the thyroid effect of diesel petroleum intoxication experimentally and found significant attenuations in serum thyroid hormones levels with increased TSH level[18]. Evidences show that thyroid hormones regulate male reproductive function from developmental stage up till spermatogenesis, erectile and ejaculatory processes. Interestingly, both hypothyroidism and hyperthyroidism have been implicated in the impairment of testicular functions and worsened semen quality[24,25,26]. The scope of this study did not investigate whether the reductions in male reproductive hormones in petrol station attendants are due to fluctuating thyroid hormone concentration. Nevertheless, exposure to endocrine disruptors mediates their deleterious systemic effects through common pathways of oxidative stress and lipid peroxidation[27,28] that must have caused both reproductive and thyroid hormones imbalance in this study.

In conclusion, findings from this study validates that inhalation of gasoline fumes cause disruptions in reproductive and thyroid hormones systems, providing data on

occupational exposure of male petrol station attendants in Kwara state, Nigeria. Prolonged exposure in these subjects would cause alterations in gonadal functions and exacerbate hormonal imbalance leading to infertility. It is therefore recommended that petrol station attendants especially males, should adhere to the use of protective masks to prevent inhalation of gasoline fume and a medical checkup routine should be adopted by workers at gasoline stations.

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