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Original Article

Study on Impact of Occupation on Semen Parameters

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ABSTRACT

Male infertility is defined by the World Health Organization (WHO) as the inability of a male to make a fertile female pregnant for a minimum of at least one year of regular unprotected intercourse. The WHO has estimated that around 9% of partners are suffering from fertility concerns, out of which male factor contributes to nearly 50% . **Objective :**To investigate the impact of occupational exposure on male infertility. **Methodology :** A retrospective cross-sectional study was conducted at GSL fertility centre with the sample collected in a period of 6 months by semen analysis . **Results:** Heat exposed individuals showed azoospermia, oligoastheno, teratozoospermia, and teratozoospermia, more frequently comparatively than the control. In chemical exposed individals there observed more of azoospermia,in pesticide exposed individual there showed higher ratio of Asthenoterato, Asthenozoo, Teratozoo compared to the control group. **Conclusion:** Occupation of men also a factor in abnormal sperm parameters, which may lead into infertility.

Keywords*: Semen analysis, Infertility, Heat, Chemical, Pesticide.*

INTRODUCTION

Male infertility is defined by the World Health Organization (WHO) as the inability of a male to make a fertile female pregnant for a minimum of at least one year of regular unprotected intercourse[1]. The WHO has estimated that around 9% of partners are suffering from fertility concerns, out of which male factor contributes to nearly 50%.[2].Male infertility is an increasing and serious medical concern, though the mechanism remains poorly understood.Male fertility is largely determined in spermatogenesis, the development of spermatozoa from spermatogonia in the testes. This meticulous developmental process is marked by both mitotic and meiotic divisions, followed by extensive morphological and biochemical differentiation, leading to a mature spermatozoan[3].

Potential associations between infertility and health may arise from genetic, developmental, and lifestyle factors. [4] Several research studies have indicated that sperm counts have been in decline for decades and researchers say modern lifestyles and contact with chemicals (Pesticides, Insecticides, Heavy metals) and heat is the major concern for this decline[5].

Mechanisms have described that pesticide exposure damages spermatozoa, alter Ser-toli or Leydig cell function, both in vitro and in vivo and thus affects semen quality[6]. The major problem with pesticides is that exposure may be both environmental and occupational. It will depend on technology and timing of pesticide application and farming type. Pesticides as a group of chemicals which includes insecticides, herbicides, and fungicides express endocrine effects from xenoestrogens to aromatase inhibitors[7]. The harmful effect of testicular heat stress on sperm characteristics including nuclear DNA integrity[8].

Human spermatozoa are very susceptible to oxidative stress-induced lipid peroxidation because of high levels of

polyunsaturated fatty acids (PUFAs) in their plasma membrane. This in turn causes increased production of reactive oxygen species (ROS) which causes increased sperm DNA fragmentation and male infertility[5].

Contemporary professional jobs that often enforce a sedentary lifestyle and are frequently associated with testicular overheat, deserve special attention with respect to male fertility potential. Interestingly, the harmful effect of testicular heat stress on sperm characteristics including nuclear DNA integrity was well characterized[9].

An increasing body of research indicates men who lead sedentary lifestyles are more likely to experience late-onset male hypogonadism, which is brought on by low testosterone (T) levels, decreased libido, erectile dysfunction, and reduced sperm viability[10].

OBJECTIVES

The objectives of the following study are:
1)To know the impact of occupation on the semen parameters .
2)To know the association between the lifestyle / work life on male fertility.

METHODS

Study design and setting: This is a retrospective cross sectional study conducted from the data that has been collected from the patients of infertility who had visited the GSL-fertility center, Rajahmundry. Consent was taken from every patient who had fulfilled the selection criteria. Ethical reviews and assessments were processed and approved by GSL medical institutional ethical board committee.

Study population: A total of 400 semen analysis data had been collected from the patients who had visited with infertility problems.

Inclusion criteria: Male subjects with infertile couples aged 21-50 yrs.

Exclusion criteria: 1) Male subjects with infertile and aged above 50 yrs.
2) Male subjects with smoking and alcohol consumption.
3)Male subjects with the history of mumps, History of vasectomy and who had undergone testicular surgeries.

Data collection and procedure: Data related to individual identification were removed, ensuring the annoyance of each individual during the entire study process.The information was taken by trained interviewers regarding the demographics, marital status, type and duration of infertility, occupational history including job title and task, and exposure to occupational hazards. According to participants' occupations and considering similar occupational exposures occupational categories were derived based on their type of exposure-Heat(drivers,welders,brick workers,chef), Industrial Chemicals(painter,factory workers,etc), pesticides exposure (farmers,) with control (clerical workers,financers,software workers,banking,etc). Semen analysis test was performed for each participant and local examination was done by fertility specialist. Semen specimens were assessed according to the WHO guidelines (2021) for volume, sperm concentration, progressive and non-progressive motility, and normal morphology . The semen analysis method in this study was computer-assisted semen analysis (CASA).

The CASA procedure involves several key steps, performed in a clinical or laboratory setting:
1. Sample Collection: A semen sample is collected via masturbation into a sterile non-toxic container, typically after 2–7 days of sexual abstinence to ensure optimal sample quality.
2. Sample Preparation: The semen is allowed to liquefy at room temperature for 20–30 minutes. It may be diluted or processed to achieve uniform consistency for analysis.
3. Sample Loading: A portion of the liquefied sample is placed onto a specialized counting chamber or microscope slide under controlled conditions.
4. Microscopic Examination: The slide is examined under a phase-contrast microscope equipped with a high-resolution camera. The CASA system captures digital images or videos of sperm cells.
5. Sperm Analysis: The software analyzes the captured data, tracking individual sperm movements and assessing parameters such as concentration, motility, morphology, and vitality. Advanced algorithms classify sperm based on velocity, trajectory, and other kinematic measures.
6. Data Interpretation: Results were interpreted by trained professionals, who assess sperm parameters against WHO reference values to determine semen quality and identify abnormalities.
7. Reporting: A comprehensive report is generated, detailing quantitative measurements (e.g., sperm count, motility percentages, morphological abnormalities) and for any detected issues.

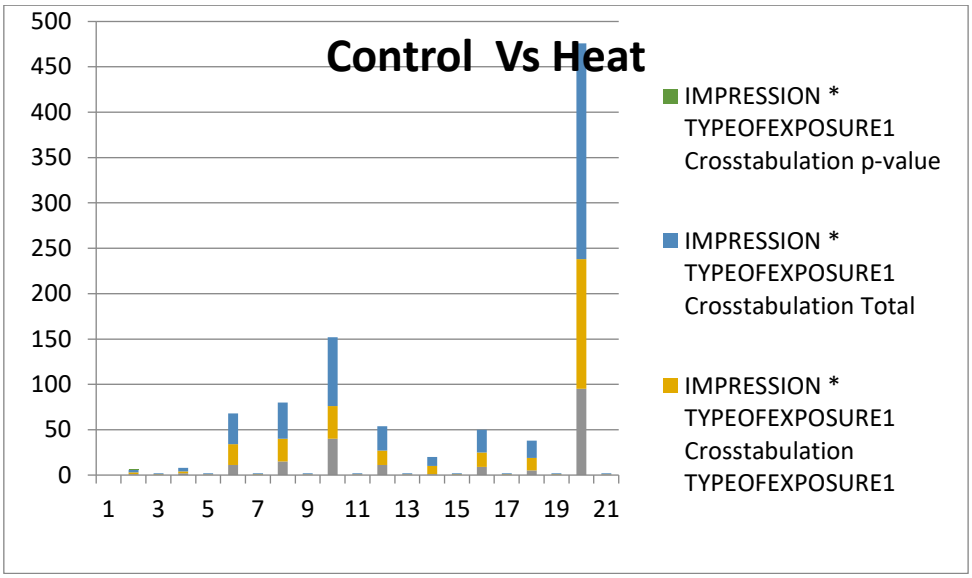
Statistical analysis: All acquired data were entered into SPSS version 20 software. Subsequently, the data were all reviewed, coded, and properly validated. The non-Gaussian distributed data were logarithmically transformed prior to

statistical analysis. Analysis was done using Shapiro-Wilk test, descriptive statistics, Chi-square test, and Fisher's exact test. Probability values of less than 0.05 were regarded as statistically significant.

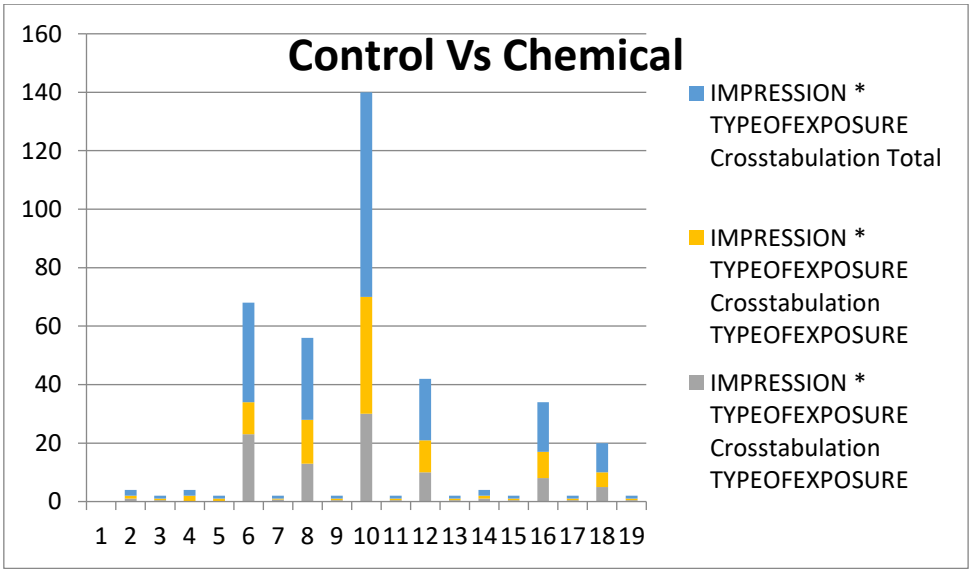
RESULTS

In this present study, 400 men were evaluated, having different occupational exposures and, they were categorized into heat exposure, pesticide exposure, industrial exposure. For analytical purposes, the control group was participants of normal life style.

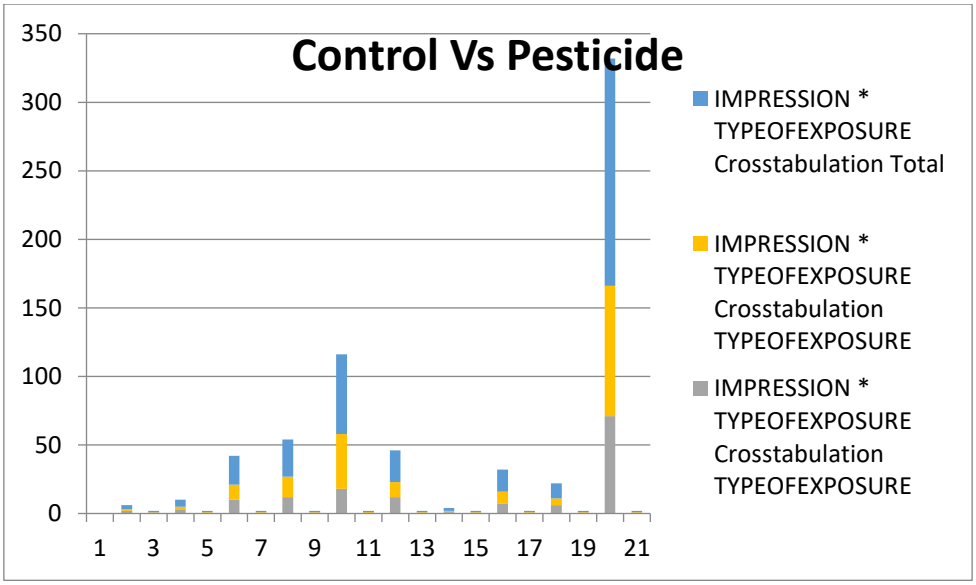
To examine the association between semen analysis of control vs. heat exposure a cross tabulation was performed. A total of 238 participants were taken, out of which 95 (39.9%) were in the control group and 143 (60.1%) in the heat-exposed group. The distribution indicated that abnormal semen parameters, such as azoospermia, oligoastheno teratozoospermia, and teratozoospermia, were more frequently observed among heat-exposed individuals compared to controls. Specifically, 67.6% of azoospermic, 73.7% of teratozoospermic, and 90.0% of oligoasthenozoospermic cases occurred in the heat-exposed group. In contrast, normozoospermia was slightly more prevalent among controls (52.6%) than that of the heat-exposed group(47.4%), but these were statistically insignificant. (χ^2 test, $p = 0.168$).This shows that the difference did not reach statistical significance as there were higher proportions of abnormal semen profiles observed in the heat-exposed group.



In the comparision of chemical Vs control the observations are as follows, out of 186 patients examined (95 were control and 91 were chemical exposed). The **AZOO** (23 chemical exposed) group had a higher proportion in the **chemical exposure group** (67.6% vs. 32.4%). **NORMOZOO** cases were more frequent in the **control group** (57.1% vs. 42.9%). These patterns suggest a trend that chemical exposure *might* be related to poorer sperm quality (χ^2=7.831,p=0.450)— but statistically, it's not significant in this sample including the Pearson Chi-Square.



166 cases were taken for pesticide Vs control the findings show that **Normozoo** were more common among the **control group (69%)** than with those of **exposed to pesticides (31%)**. Asthenoterato, Asthenozoo, Teratozoo showed slightly higher percentages in the **pesticide group**, suggesting a potential rise in abnormal sperm ratio . The **p-value 0.613**, showing statistical in significance that trend toward poorer semen quality in exposed individuals($\chi^2 = 6.305$, $p = 0.613$)



DISCUSSION

In a Tunisian study with 2122 men that visited infertility clinics and filled a detailed questionnaire showed that occupational exposure to pesticides was associated with a significantly higher risk of asthenozoospermia and necrozoospermia, while exposure to cement correlated with a higher risk of oligozoospermia[11], In contrast, a study showed no association between semen impairment and exposure to solvents, excess heat, or mechanical vibrations [12] which was in coincidence with the present study partially.

Exposure of farm workers to organophosphate and carbamate pesticides, which was confirmed by elevated erythrocyte acetylcholinesterase (AChE) and plasma butyrylcholinesterase (BuChE), was associated with lower sperm motility and sperm immaturity without significant deviations from normal serum testosterone, LH, and FSH Sperm analysis in groundnut farmers in Myanmar who used chlorpyrifos and carbamates, often above recommended growing season, which was less pronounced (46 %) in the non-growing season [13],farmers have been reported to have poor sperm quality. Studies have shown that individuals who drove for more than 3 hours each day experienced longer times to conception and changes in sperm quality [14].

There are studies that shown that male reproductive organs are one of the major sites for insults resulting from exposure to environmental chemicals leading to male infertility [15]. Organochlorine pesticides which are widely used, including DDT and its metabolites, act as endocrine disrupting chemicals [16].

Temperature plays a crucial role in maintaining normal spermatogenesis in testes. The scrotal temperature is 2–4 °C lower than the core body temperature [17,18] .

A recent study on male rats reported that exertional heat stroke can cause erectile dysfunctions, disruption of testicular temperature, poorly differentiated seminiferous tubules, diminished sperm quality, loss of interstitial Leydig cells, Sertoli cells, leading to azoospermia and infertility [19] Which was in agreement with the present study. Another similar study conducted on bovine sperm also reported that heat stress in bulls induces seminal plasma oxidative stress thereby affecting the sperm mitochondrial function, motility, plasma membrane integrity, and DNA fragmentation, ultimately leading to infertility [20].

Strong associations were found between sitting 6 hours during work and exposure to noise and increased DNA damage and decreased motility. These findings are inline with studies showing that sedentary work leads to an increase in scrotal temperature[21,22]that is strongly associated with decreased sperm concentration [22]. Similar results were found for total spermcount, FSH, and inhibin B. In contrast, motility, morphology, pH, and testosterone were not significantly associated with temperature [23,24].

The alteration of semen parameters associated with physical factors such as heat shoulds top after the end of exposure[25], but little is known about the reversibility of semen impairment associated with electromagnetic fields[26],
In some studies they found more subjects with asthenospermia among men exposed to excess heat[27,]and a higher risk of asthenospermia among subjects exposed to extended periods of sitting[28],which is in confirmation with present study
Chemical exposure were analyzed for both current and past exposures since their action could impair the present spermato genesis and also spermatogonial stemcells[29], leading to delayed spermatogenesis impairment.

More refined analyses of each semen parameter proved the higher riskof asthenospermia in subjects exposed to heavy metals[30].

CONCLUSION

Study reveal that men working in pesticide ,Chemical and heat related areas have a negative affect on fertility .There needs more research to be done on various aspects of occupational related infertility on men to know the details about it

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