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Original Research Article

Environmental and Occupational Risk Factors in Relation to Male Infertility

G. Sudha[1], KSN Reddy[2]

[1]UGC-Post Doctoral Fellow, [2]Assistant Professor,
Department of Anthropology, Sri Venkateswara University, Tirupati, Andhra Pradesh.

Corresponding Author: G. Sudha

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ABSTRACT

Background: Male infertility refers to the inability of a male to achieve pregnancy in a fertile female. Male factors accounts for 40-50% of infertility in human. Male infertility is commonly due to deterioration in the sperm quantity and quality.
Objectives: To determine the environmental risk factors on decreasing male fertility in Tirupati town of Chittoor district, Andhra Pradesh.
Materials and Methods: This is a cross-sectional descriptive study in which 523 infertile men were selected by convenience sampling and were evaluated.
Results: Individuals, who were applying pesticides, have a greater risk for infertility as they were directly exposed to the pesticides and other chemicals. More percentage (39.19%) of males is infertile when they have both the habits of smoking and alcohol. the impact of exposure to toxins on men shows sperm damage and low sperm count
Conclusion: Male infertility is a multifactorial disease process with a number of potential contributing causes. Lifestyle and dietary choices, pesticide residues, and xeno-estrogens all may adversely affect spermatogenesis. Steps should be taken to create an environment of awareness regarding the issue and male partner should be investigated first thereby reducing the negative social impacts.

Key words: Environmental factors, Infertility, Alcoholism, Occupational exposure.

INTRODUCTION

Male infertility refers to the inability of a male to achieve pregnancy in a fertile female. Male infertility is considered when identifiable female causes of infertility are excluded and semen quantity and quality fails to fulfill WHO criteria. [1] It is a worldwide problem affecting people of all communities, though the cause and magnitude may vary with geographical location. Infertility is not merely a health problem; it is also a matter of social injustice and inequality. [2] The exact cause of male infertility is still unknown in more than 50% of cases. [3]

In general, the environmental factors in male infertility are linked to occupational hazards and lifestyle. Male infertility is a multifactorial disease process with a number of potential contributing causes. There is association between infertility and occupational exposure to heat/ pesticides/ chemicals/ altered hormonal changes/ sedentary lifestyle/ consumption of animal fats/ smoking/ dietary changes has detrimental effect on sperm morphology, time to conception, alterations in motility

and an overall increase in the number of abnormal sperm. [4,5] Exogenous heat, pesticides/ glycol ethers/ printing/ adhesives/ metals like lead, cadmium and mercury are known to have adverse effect on sperm production. [6] In chronic alcoholics, there is good evidence for impairment of spermatogenesis and reductions in sperm counts and testosterone levels. [7, 8]

Developments of industrialization and urbanization have dramatically changed the lifestyles it gradually leads to the increase of various environmental risk factors. Humans are exposed to polluted air, containing harmful elements such as lead, drinking water which is frequently contaminated by different noxious materials like arsenic, chromium, benzene, agricultural water and soil containing pesticides and chemical fertilizers which subsequently will produce contaminated crops use of hormones and drugs in animal husbandries and presence of their residues such as steroidal hormones in meat and dairy products, the ever-growing use of synthetics and preservatives in food industry. Produce contaminated crops use of hormones and drugs in animal husbandries and presence of their residues such as steroidal hormones in meat and dairy products, the ever-growing use of synthetics and preservatives in food industry. [9] In the light of above background the purpose of this present study is intended to cover environmental risk factors, especially emerging risk factors, on decreasing male fertility in Tirupati town of Chittoor district, Andhra Pradesh.

MATERIALS AND METHODS

This is a cross-sectional descriptive study in which 523 infertile men were selected by convenience sampling and were evaluated. The study materials belong to infertile men from all communities of different socioeconomic milieu who sought medical assistance for treatment in three private infertility clinics in Tirupati town. These clinics have adequate infrastructural facilities for all kinds of clinical investigations of infertility either of male or female. The purpose and overview of the study was explained at the time of the interview, and interviewees were informed that their participation was entirely voluntary, their anonymity would be assured, they could withdraw from the study at any time and the information that they will be providing would be used solely for the purposes of the study. After approval from ethical committee and taking an informed consent, all male patients attending the clinic were included and evaluated by history, clinical examination and investigations such as urine R/E, ultrasound abdomen/pelvis and scrotum and semen analysis. A detailed work history containing current and past occupational exposures was obtained and patients were also asked about their current occupation and daily activities they were also told that the researcher would assume responsibility for the safekeeping of the data, and that they could request deletion of their data at any point. The exclusion criteria are any physical illness which prevents them from Conceiving and suffering from any neurological or psychiatric illness. A validated questionnaire has been administered to collect the data pertaining to the causes of infertility; life styles besides clinical investigations were also carried out to the sample. The results thus achieved have been critically analyzed and presented.

RESULTS

In table 1, the incidence of infertility was observed in 92 individuals (17.59%) as businessmen, computer operators, engineers and other sedentary workers. 122 (23.32%) of cases were in the fields of mechanics, technicians in workshops. 146 (27.91%) include under the category of goldsmiths, drug factories and workers in industries have exposure to toxic agents that affect normal spermatogenesis. 71 (13.57%) under private jobs, teachers, official and police. 54 (10.32%) were belong to doctors, health department and X-ray department. 38

(7.26%) came under agricultural workers, painters and labourers; especially those who were applying pesticides have a greater risk as they were directly exposed to the pesticides and other chemicals.

Table 1: Distribution of the infertile males according to their occupations

Occupation	n	%
Business/ Sedentary/ Computer operator/Engineer	92	17.59
Drivers/mechanic/technician/workshp/ sportsmen	122	23.32
Gold smith /Drug factories/ workers in industries	146	27.91
Private jobs/ Teachers/ Officials/ police	71	13.57
Doctor/Health dept/X-ray dept	54	10.32
Painters/labours/Agriculture	38	7.26

Table 2 shows that the distribution of sample according to type of habits. On the basis of smoking and alcohol habits among the infertile males, it is observed that more percentage (39.19%) of males is infertile when they have both the habits of smoking and alcohol. But when consider the habit of smoking and alcoholism alone, the infertility in smokers is 32.50% and among alcoholics it is 23.90%. It proves that there is a strong association between infertility and smoking and alcoholic habits.

Table 2: Distribution of infertile males according to smoking and alcoholic habits

Type of Habit	n	%
Smoking	170	32.50
Alcoholism	125	23.90
Smoking & Alcoholism	205	39.19
Normal	23	4.39

Table 3 explains that the impact of exposure to toxins on men. There are several toxins, like toluene and glycol ethers, decrease the sperm count. Phthalates (poly vinyl chloride) will damage the sperm count. Lead (batteries, ceramics and plastic) reduces fertility and also lowers sperm count. Chlorinated hydro carbons and pesticides are might be expected to impact adversely on sperm damage and low sperm count.

Table 3: Impact of Exposure to toxins on men*

Exposure	Impact on men
Toluene (inks, coatings, gasoline, cosmetics, glues)	Decreased sperm count [10]
Phthalates (plasticizers added to plastics like polyvinyl chloride; also widely used in cosmetics)	Sperm damage [11,12]
Glycol ethers- primarily short-chain (electronics, deicing, inks, dyes, varnish, paint, printing, cosmetics, photography, some pesticides)	Decreased sperm count [13]
Lead (paint, batteries, electronics, ceramics, jewelry, printing, ammunition, PVC plastic)	Low sperm count, reduced fertility [14,15]
Chlorinated hydrocarbons (some pesticides, wood preservatives, dioxins, PCBs)	Sperm damage [16]
Pesticides	Low sperm count [17]

* [18]

DISCUSSION

Infertility is a fairly common issue worldwide and many researchers have worked hard to probe into the statistics and causes of this problem. In general the environmental factors in male infertility are linked to occupational factors and life style. In the present study, the incidence of infertility was observed in businessmen and executives. This may be because businessmen and other executives have more psychological stress and strain. It is known that stress and strain cause infertility. [19] Many more jobs are now sedentary and males of all ages spend more time on sedentary hobbies and less time on physical activity. [20] Agricultural workers especially those who are applying pesticides have a greater risk as they are directly exposed to the pesticides and other chemicals. Studies have reported the effects of pesticide exposure and chemicals on the reproductive performance of these workers and also studies have reported that occupational exposure to different chemical agents in the workers employed in various chemical plants and cement factory. [5,21]

It is observed that more males (39.19%) are infertile when they have both the habits of smoking and alcohol. A similar pattern has been reported in other studies that smokers are 60% more likely to be infertile than non-smokers. Smoking reduces the chances of IVF producing a live birth by 34% and increases the risk of an IVF pregnancy miscarrying by 30%. [22]

Other studies prove that in males, smoking negatively affects sperm production, motility and morphology and is associated with an increased risk of DNA damage. [23,24] Thus, there is strong evidence of the adverse effects of smoking on fertility operating through a range of pathways in both the general and infertile population. Moreover, in chronic alcoholics, there is good evidence for impairment of spermatogenesis and reductions in sperm counts and testosterone levels. [7,8] In other studies it proves that excess alcohol consumption may also have a direct effect on the maturation of the ovum, ovulation, blastocyst development and implantation. [25,26]

The implication of toxins such as glues, volatile organic solvents, silicones, physical agents, chemical dusts and pesticides in infertility had been established. [27] Occupational exposure to lead has been shown to cause a significant decrease in male fertility. [28] Occupational exposure to toxins may also affect sperm quality. Agents such as pesticides, cadmium, lead and manganese may interfere with reproductive function. Exposure to phthalates can occur via dietary consumption, dermal absorption or inhalation and has been linked with impaired spermatogenesis and increased sperm DNA damage. [29,30]

CONCLUSION

Male infertility is a multifactorial disease process with a number of potential contributing causes. Considering the majority of male infertility cases are due to deficient sperm production of unknown origin, environmental and occupational factors must be evaluated. Occupational risk factors, including exposure to heat, chemicals, and heavy metals needs to be examined. Lifestyle and dietary choices, pesticide residues, and xeno-estrogens all may adversely affect spermatogenesis. Avoid lifestyle issues that may be detrimental to sperm quality including the use of illicit drugs, heavy alcohol use, smoking, certain medications, excessive heat to the scrotal area and anabolic steroids used for body building, which have direct effects on the testis through lowering the body's ability to make its own testosterone. Male factor contributes significantly towards infertility and several treatable causes can be sorted out easily. Thus, steps should be taken to create an environment of awareness regarding the issue and male partner should be investigated first thereby reducing the negative social impacts.

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