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SEMEN QUALITY OF WORKERS OCCUPATIONALLY EXPOSED TO BUSINESS, DRIVING AND COOKING.

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ABSTRACT

Semen analysis of men occupationally exposed to business, driving and cooking from a cross section of population of Anantapurm district, Andhra Pradesh, India was done as it provides a useful profile of the function of the male reproductive health. Twenty four (24) men of each occupation, working in business, driving and involved in cooking were selected, of which twelve (12) belonged to age group of 21-30 and twelve in the age group of 31-40. Different semen parameters like volume, liquefaction, alkalinity, sperm count, motility and morphology were observed. Incidences of Hypospermia 51 in persons, Teratozoospermia 16, Oligozoospermia 58, Oligoasthenozoospermia 21, and Oligoasthenoteratozoopermia 12 were observed in men of all three occupations indicating that these occupations are potential hazards for men as their reproductive health was affected in men of these occupations
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KEYWORDS: Occupational exposure, Men, Reproductive health, Semen analysis.

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INTRODUCTION

Low-wage populations for their lively hood disproportionately work in occupations associated with hazards at work place environment. Men especially to feed the family has no choice of occupation and hence there is a significant public health concern about the potential effects of occupational exposure to toxic substances on reproduction. Many toxicants with reported or suspected reproductive and developmental effects are still in regular commercial use and present potential exposure to workers. Occupational exposure and environmental exposure to hazardous substances have been conjectured as one of the aetiologies of sperm number decline [1]. There has been a great development in epidemiological and laboratory methods to perform observational studies in humans; in particular with respect to functional measures of fertility and laboratory refinements of studies of semen quality [2-3]. Most research on human male reproductive health has been stimulated by studies of the effects of exposures in animals and their offspring, surveillance and anecdotal observations also have led to investigations of male reproductive exposures [4]. The consequences of occupational exposures on the reproductive health of males in Anantapur district, Andhra Pradesh by examining certain key parameters related to male reproduction. The study population consisted of men working in business, driving and cooking for more than from five (5) years. It has been shown that 15-20% of couples attempting to achieve pregnancy are unable to conceive and the male factor was diagnosed as the main problem in more than half of them [5]. Carlsen and colleagues, in 1992, were the first to show robust evidence towards a semen quality decline [6]. A number of studies have reported reduced semen quality among men occupationally exposed to various chemicals [7-9], welding [10-12], heat [13-15] or prolonged automobile driving [16]. Semen quality has also been studied in relation to various lifestyle factors, such as caffeine and alcohol intake, but no consistent findings have been reported [17-20]. Gradual decline in quantity and quality of sperm production has been the main reason and as such has become a growing concern in recent years. Several factors like changes in lifestyle, diabetes, bladder, prostate or urethral surgery have been implicated as possible causes of the deterioration of male reproductive health. Sexual issues like premature ejaculation and erectile dysfunction can also lead to infertility. Men for their lively hood disproportionately work in occupations for long hours inviting potential effects. Assessment of various reproductive health Indices of men with occupational exposure has been carried out around the globe. Alarming reports were there from 1880's with regard to decline in sperm count. Studies have shown that in some parts of the world, average sperm counts have dropped by 50% since the 1940 [21-22]. Keeping this in view the present study is designed to analyse the semen analysis. For years it has remained the benchmark measurement of male fertility. Hence this study would be of great utility as adverse health effects observed in case studies provide clues to potential health effects that should be studied to determine no effect levels.

MATERIALS AND METHODS

Two hundred healthy human males who are occupationally involved in business, cooking and working as drivers were interviewed particularly regarding age and time of exposure. From this sample seventy two (72) persons were selected and divided into three groups. Each group consisted of twenty four (24) men who are involved in these three occupations. Out of this twenty four, twelve are of the age group of 21-30 and twelve in the age group of 31-40 years. The study protocol was approved by the Institutional Animal Ethical Committee. Before enrollment in the study, written consent was obtained from volunteers. The selected men were invited to clinical laboratory and semen sample was collected by masturbation and ejaculated into a clean wide mouth glass container. Care was taken to see that the sample was collected after a minimum of two days and a maximum of seven days sexual

abstinence. The semen sample collected was kept at room temperature (20°C-37°C) to avoid any effect on spermatozoa. Container was labeled with the person's name, identification number, date and time of collection. WHO guidelines were followed in collection and analysis of semen sample [23]. The following investigations were carried out on the samples.(i) Colour, volume and pH: Colour of the semen was observed immediately after collection and the volume was measured using the graduated test tube. The semen reaction was observed by measuring its pH.

(ii) Liquefaction: Immediately after ejaculation into the collection vessel sample was kept at room temperature and time of liquefaction was observed for 90 min. Semen was typically a semisolid coagulated mass first and within a few minutes at room temperature, the semen usually begins to liquefy (become thinner). The time taken to liquefy was noted.

(iii) Sperm count and motility: Sperm count and motility were made using the above liquefied sample under the microscope. Total sperm count (Mill/ml) was calculated by using neubauer chamber [23]. Briefly the liquefied semen was diluted 1:20 with sodium carbonate and this diluted sample was placed in the neubauer chamber and counted under the microscope (Labomed). Motility was determined by counting the number of motile and immotile spermatozoa from the same slide in several randomly selected fields under 20X objective until at least 200 spermatozoa were counted. The minimum of five microscopic fields were examined.

(iv) Sperm morphology: This was determined with the help of smears made from semen samples using the feathering technique. A clean glass slide was taken, washed in 70% ethanol and dried. A small drop of semen (5 to 20 µl) was taken onto the slide. The edge of a second slide was placed on the first, at an angle of 45° and the semen drop was dragged along the surface to make a thin smear. These were then air dried and fixed. Sperm morphology was evaluated using hematoxylin and eosin stain. Normal and the abnormal sperms were observed under 100X oil immersion microscope. Each of the spermatozoa was examined for head, mid–piece and tail defects. A total of 200 spermatozoa was observed for defects and expressed in percentage. Loose heads were counted (as abnormal forms), while free tails were not counted. Structures without any head anterior to the basal plate were not counted.

RESULTS

Analysis of semen carried out in men of three different occupations namely business, driving and cooking are given in tables 1 to 4. In this investigation we found that all men had alkaline semen. The volume of semen measured was less than the normal values in fifty one (51) men out of seventy two (72). In men whose occupation was business eight persons in the age group of 21-30 and nine persons in the age group of 31-40 have shown hypospermia (Table 1). In men who work in driving, eight persons in the age group of 21-30 and eight persons in the age group of 31-40 have shown hypospermia (Table 2). In men whose occupation was work in cooking nine persons in the age group of 21-30 and nine persons in the age group of 31-40 have shown hypospermia (Table 3). Liquefaction time of semen observed in men involved in all three occupations was within the time given by WHO in all age groups (Table 1-3). With regard to sperm count it was less than the normal values in fifty eight (58) men out of seventy two (72) men who were examined. In men whose occupation was business ten persons in the age group of 21-30 and ten persons in the age group of 31-40 have shown oligozoospermia (Table 1). In men who work in driving, eleven persons in the age group of 21-30 and nine persons in the age group of 31-40 have shown oligozoospermia (Table 2). In men whose occupation was work in cooking ten persons in the age group of 21-30 and eight persons in the age group of 31-40 have shown oligozoospermia (Table 3). Morphologically abnormal sperms have been noticed in sixteen men (16) out of seventy two (72) men examined. In men whose occupation was business two persons have shown Teratozoospermia in the age group of 21-30 and five persons in the age group of 31-40

have shown Teratozoospermia (Table 1). In men who work in driving three persons have shown Teratozoospermia in the age group of 21-30 and two persons in the age group of 31-40 have shown Teratozoospermia (Table 2). In men whose occupation was work in cooking one person have shown Teratozoospermia in the age group of 21-30 and three persons in the age group of 31-40 have shown Teratozoospermia (Table 3). With regard to sperm motility there was no difference between men of these three occupations and normal values given by WHO in all age groups (Table 1-3).

DISCUSSION

Human sexual function refers to the integrated activities of the testes and secondary sex glands, the endocrine control systems, and the central nervous system-based behavioral and psychological components of reproduction. Erection, ejaculation, and orgasm are three distinct, independent physiological and psychodynamic events that normally occur concurrently in men [24]. Male occupational reproductive hazards are most times "silent" and hence analysis of all possible parameters are made and compared with the WHO reference ranges for semen parameters [23]. Semen which has a very high buffering capacity than most other fluids in the body was observed for its colour abnormality. It was noticed that there was no change in the color of the semen which was collected from all seventy two men who were involved in three different occupations indicating that the occupations did not have an effect. WHO considers 1.5 ml as the lower reference limit with regard to semen volume [25]. But in clinical practice, men ejaculating a volume of less than 2ml are considered infertile. In this study fifty one (51) men out of seventy two (72) have shown lower semen volume, a condition known as hypospermia. This evidence that these three occupations work places had adverse effect on semen volume. Though this is relatively common issue in men of any age, low testosterone level and nutritional deficiencies could be the factors for low-volume [26]. Our results are in confirmity with the observations made by other researchers in men involved in different occupations [27-28]. In the female reproductive tract, the vaginal region is acidic. Alkalinity of the semen has to neutralize this acidic nature for the spermatozoa to survive without being destroyed. We did not notice any abnormal change in pH even in one person (Table-1-3). Another important characteristic of semen is liquefaction. Semen is a thick gel at the time of ejaculation and normally becomes liquid within 20 minutes (or 15 to 60 mins) after ejaculation. The thick gel is formed by proteins from the seminal vesicles. It was shown that liquefaction occurs only in a pH range of 6.8-8.8, at which pepsin is not active [29]. If liquefaction is delayed it will be difficult for sperm to break thick semen. Also the semen must liquify quickly for sperm to swim out of the acidic vagina. All men examined from three different occupations exhibited liquefaction time within the normal time range. Semen or seminal fluid is an organic fluid that contains spermatozoa. Sperm makes only 1 to 10% of the semen. Reduced sperm count was observed in fifty eight (58) out of seventy two (72) subjects examined, which is quite alarming. The present findings are consistent with previous studies which demonstrated decreased sperm count under various situations [30-32]. Sperm motility has been shown to be a good predictor of human male fertility *in vivo* and *in vitro* [33]. Sperm motility has also been found to be strongly associated with the probability of conception [34-35]. As the sperm cells are motile, their motility in percent was used to grade the quality of semen. Decreased sperm count and motility were observed reported earlier due to different pesticides in rats [36-38]. In humans also this situation of reduced sperm motility was reported [39-41]. Normal sperm has an oval head and long tail. Abnormality of sperm could be defective heads/tails. If semen sample contains 4% of morphologically normal forms, it is considered fit. Observations made in this study indicate that in driving one person (1) was found to be morphologically abnormal. Deterioration of sperm motility and sperm morphology was noticed in men as result of exposure to different

pesticides [42-43]. In humans also decline in semen quality due to environmental polluted, occupational exposures are changes in life style was observed by [44].

Table 1
Semen analysis of men involved in business.

S.No	Parameters Examined	Normal Values	Age:21-30	Age:31-40
1	Colour	Grey-opalescent	Grey-opalescent	Grey-opalescent
2	Reaction	Alkaline	Alkaline	Alkaline
3	Volume	1.5-5ml	1.32±0.56[1] (0.5-2.5)[2]	1.29±0.36 (1-2)
4	Liquefaction	15-60mins	23.11±32.5 (15-90)	25.18±37.83 (15-90)
5	Sperm count	39-150mill/ml	18.86±26.66 (14-72)	13.15±28.5 (9-60)
6	Total motility	32%	14.47±50.5 (35-70)	11.23±43.83 (35-70)
7	Morphology	4%	3.83±0.38 (3-4)	3.58±0.51 (3-4)

Note: 1. Values are mean ± SD (n=12).
2. Minimum and maximum are given in parentheses.

Table 2
Semen analysis of men working in driving.

S.No	Parameters Examined	Normal Values	Age:21-30	Age:31-40
1	Colour	Grey-opalescent	Grey-opalescent	Grey-opalescent
2	Reaction	Alkaline	Alkaline	Alkaline
3	Volume	1.5-5ml	1.45±0.74[1] (0.5-2.5)[2]	1.48±0.59 (1-2.5)
4	Liquefaction	15-60mins	22.89±31.66 (15-90)	17.51±32.91 (20-75)
5	Sperm count	39-150mill/ml	16.45±25.5 (9-70)	18.04±30.33 (9-75)
6	Total motility	32%	10.28±46.83 (35-70)	12.26±46.91 (35-70)
7	Morphology	4%	3.75±0.45 (3-4)	3.91±0.51 (3-5)

Note: 1. Values are mean ± SD (n=12).
2. Minimum and maximum are given in parentheses.

Table 3
Semen analysis of men working in cooking.

S.No	Parameters Examined	Normal Values	Age:21-30	Age:31-40
1	Colour	Grey-opalescent	Grey-opalescent	Grey-opalescent
2	Reaction	Alkaline	Alkaline	Alkaline
3	Volume	1.5-5ml	1.3±0.56[1] (0.5-2.5)[2]	1.35±0.51 (1-2.5)
4	Liquefaction	15-60mins	21.63±35.0 (15-90)	25.52±38.33 (15-90)
5	Sperm count	39-150mill/ml	18.58±26.33 (15-72)	18.92±31.33 (14-70)
6	Total motility	32%	10.72±46.25 (35-70)	12.58±45.83 (35-70)
7	Morphology	4%	3.91±0.28 (3-4)	3.75±0.45 (3-4)

Note: 1. Values are mean ± SD (n=12).
2. Minimum and maximum are given in parentheses.

Table 4
Sperm Analysis of male persons in the age group of 21-30 and 31-40 years exposed to business, driving and cooking as a result of their involvement in business, driving and cooking workers.

S.No	Occupational exposure	Age group in years	Abnormalities in number of men
1	Business	21-30	Hypospermia-8, Teratozoospermia-2, Oligozoospermia-10, Oligoasthenozoospermia-4, Oligoasthenoteratozoopermia-2.
		31-40	Hypospermia-9, Teratozoospermia-5, Oligozoospermia-10, Oligoasthenozoospermia-4, Oligoasthenoteratozoopermia-4.
2	Driving	21-30	Hypospermia-8, Teratozoospermia-3, Oligozoospermia-11, Oligoasthenozoospermia-3, Oligoasthenoteratozoopermia-1.
		31-40	Hypospermia-8, Teratozoospermia-2, Oligozoospermia-9, Oligoasthenozoospermia-3, Oligoasthenoteratozoopermia-2.
3	Cooking	21-30	Hypospermia-9, Teratozoospermia-1, Oligozoospermia-10, Oligoasthenozoospermia-4, Oligoasthenoteratozoopermia-1.
		31-40	Hypospermia-9, Teratozoospermia-3, Oligozoospermia-8, Oligoasthenozoospermia-3, Oligoasthenoteratozoopermia-2.

Oligozoospermia (58)
It refers to a condition when the sperm count is lessthan 39 million/ml.

***Hypospermia* (51)**
Semen volume, less than 1.5 ml.

Teratozoospermia (16)
When less than 4% of the normal sperms show abnormal morphology the condition is described as teratozoospermia

Oligoasthenozoospermia (21)
Oigoasthenozoospermia is a combination of low sperm count (less than 39 Mill/ml) and sperm
motility (less than 32%).

Oligoasthenoteratozoospermia (12)
Oligoasthenoteratozoospermia is a combination of low sperm count, motility and abnormal morphology (less than 4% of normal forms).

CONCLUSION

In conclusion, it can be said that men involved in occupations such as business, driving and cooking have shown a decrease in sperm count and volume. The effect on these two parameters may be as a result of exposure to heat, which is caused by sitting for long time or being in hot place.

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