International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Ranasinghe C et al. Int J Reprod Contracept Obstet Gynecol. 2022 Oct;11(10):2611-2618
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20222454

Original Research Article

Lifestyle and occupation risk factors for poor semen quality: a cross sectional study in Sri Lanka

Chandana Ranasinghe[1], Yehan Gamage[1], Ominda Perera[1], Chaminda Karunarathna[1], Lahiru Sandaruwan Galgamuwa[2], Milhan Batcha[3], Kithsiri Jayasekara[1]*

[1]Department of Medical Laboratory Sciences, Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University, Sri Lanka
[2]Department of Parasitology, Faculty of Medicine, Sabaragamuwa University of Sri Lanka, Sri Lanka
[3]Castle Street Teaching Hospital, Colombo, Sri Lanka

Received: 18 August 2022
Revised: 13 September 2022
Accepted: 14 September 2022

***Correspondence:**
Dr. Kithsiri Jayasekara,
E-mail: kbjayasekara@gmail.com

ABSTRACT

Background: Infertility is a major problem all around the world. According to WHO, the rate of infertility is approximately 15% worldwide and it differ from geographical location, ethnicity and social status. Lifestyle habits, environmental and occupational hazards, physical parameters can be recognized as major risk factors which may affect male infertility. The objective of this study was to determine factors associated with male infertility in Sri Lankan context.
Methods: A cross-sectional study was conducted on 299 individuals participated for an infertility clinic at Castle Street Teaching Hospital, Colombo, Sri Lanka. Socio-demographic, occupational and environmental characteristics were collected using interviewer administered questionnaire. Semen samples were collected from each participant for laboratory investigations. Sperm concentration and motility were measured.
Results: Out of total participants, 30.1% of participants had a sperm concentration of $<15\times10^6$ and the sperm motility was <32% in 34.7% participants. Older age, tobacco smokers, using tight under wears and individuals exposed to either heat or chemical hazards were identified as risk groups with low sperm concentration and low semen volume. In addition, older age, individuals using tight under wears and individuals exposed to either heat or chemical hazards were significantly associated with low or abnormal sperm mortality. Individuals having diabetes showed a significantly higher non-motility rate of sperms. Alcohol usage, betel chewing, mumps, special radiation exposure, body mass index and waist circumference were not significantly associated with semen parameters in study population.
Conclusions: Older age, tobacco smoking, wearing tight underwear, occupational exposures, and diabetes mellitus has shown a risk for the generation of poor semen parameters, which can lead to male infertility. Furthermore, it is very important to carry out extended studies regarding this problem to establish the effect of above factors.

Keywords: Male infertility, Sperm concentration, Sperm motility, Occupational factors

INTRODUCTION

Infertility is a disease unable to achieve the pregnancy after 12 months or more of regular sexual intercourse without using contraceptive methods of couples.[1,2] At present about 30 million men around the world suffer from infertility around the world, ranging from 10-15% of couples, even up to 30% in some regions.[3] More than 90% of male infertility cases are as a result of low sperm concentration and poor semen quality.[4]

Male fertility can be influenced by a variety of environmental, occupational and lifestyle factors that contribute to the weakening of semen quality.[5,6] Working in high temperatures, exposure to radiation, electromagnetic waves and chemical substances, mumps, stress and alcoholism were reported as risk factors for male infertility.[7-10] Abnormalities of sperms can be caused by number of factors such as congenital birth defects, diseases, chemical exposure and lifestyle habits. In addition, wearing tight underwear, tight pants for a long period of time can cause testicular heating and drugs such as cocaine, marijuana can temporally reduce the sperm quality.[4] Marijuana can alter the ability of the sperms to swim and penetrate the egg. Heavy alcohol consumption and smoking may impair the sperm quality. Obesity and emotional stress impair hormonal levels and cause serious fertility defects.

Prevalence of global infertility rates is difficult to estimate since the presence of complicating factors belongs to both genders. Sometimes it becomes more difficult to estimate the infertility since it only addresses the women and outcome of pregnancy.[11] In addition, lesser rates of primary infertility were observed in younger ages in males than higher ages.[12] According to Hewabatage et al in 2017, a total of 26.4% male factors were contributed to primary infertility in Sri Lanka and 33% out of which are due to poor semen quality.[13]

The identification of risk factors precisely and measurement of the possible effects against semen parameters individually or collectively, could be very important in minimizing the levels of male infertility. In the Sri Lankan setting, the prevalence of the possible harmful factors and their effect on the people exposed to them is not thoroughly studied yet. Nevertheless, a study on environmental and occupational exposures as a cause of male infertility has been conducted.[14] An effort to detect any association between these factors and the quality of semen with the quality of semen should be very useful in the diagnosis and treatment of male infertility. Therefore, this study was designed to determine the impact of lifestyle, physical and occupational factors for the generation of poor semen parameters leads to male infertility in Sri Lanka.

METHODS

A cross-sectional study was conducted in infertility clinics and the Andrology laboratory, Castle Street Teaching Hospital, Colombo, Sri Lanka. All male patients between the age of 18-50 years old referred from the infertility clinic for seminal fluid analysis were selected for the study. We collected semen samples from the dedicated clinic for infertility which was receiving 60 patients per month approximately and the study was conducted during the period of five months from 1st October 2017 to March 1st 2018. Total of 299 patients suspected as primary infertile were selected for the study. Individuals with ongoing infertility treatment, cancer treatments such as radiotherapy and chemotherapy, suspected reproductive system infections/fever within last one month/sexually transmitted infections (STI), drug addicts, physical disabilities in the reproductive system such as varicocele, damaged or undergone testicular surgeries and hernia were excluded from the study population.

Demographic and other risk factors

An interviewer administered questionnaire was used to obtain demographic information and lifestyle related risk factors for infertility. History of smoking, betel chewing and alcohol intake was obtained with its type, duration and frequency. Other lifestyle related information as usage of hot water with its frequency, types of undergarments used, and occupation related risk factors as frequent heat exposure were obtained from all individuals. In addition, medical history, such as chronic disorders as diabetes mellitus, hypertension, asthma, arthritis and, had dengue fever in last one year period, history of mumps etc. were also collected as potential risk factors for male infertility.

Measurement of physical parameters

Anthropometric measurements as height (accuracy 0.1 cm), weight (accuracy 0.1 kg), waist and hip circumference of participants were measured according to WHO guidelines.[14] All measurements were taken by two members of the research group and mean values were calculated to minimize intra personal errors. The waist and hip circumference were measured according to the guidelines given by the WHO STEPS protocol. The BMI (body mass index) and the WHR (waist to hip ratio) was calculated.[15]

Specimen collection

Participants were instructed to give a semen sample after 2-5 days of abstinence. In addition, each participant was instructed to have a clean the genital area before the sample collection. The sample was collected into a sterile wide mouth plastic container by masturbation at the laboratory premises maintaining the confidentiality. After allowing liquefying, the sample was examined at room temperature within one hour of the sample collection. Semen was mechanically liquefied using 18 gauge syringe needle after one hour for highly viscous specimens.[16]

Laboratory investigations

All laboratory investigations were conducted in the laboratory at Castle Street Teaching hospital. Semen full report was investigated in all samples including liquefaction time, semen volume, viscosity, reaction, sperm concentration and sperm motility. All investigations were conducted and reported according to the instructions provided by the WHO guidelies.[16] Sperm concentration $<15\times10^6$ per ml defined as abnormal and subjects with $\geq15\times10^6$ were defined as normal. In addition, percentage of motile sperms (progressive motility) <32% defined as

abnormal and subjects with ≥32% were defined as normal.[16] Statistical analysis was perform according to the above two criteria.

Statistical analysis

Collected data were recorded initially in a spreadsheet and transferred to SPSS version 20(IBM. Somers, NY) for analysis.

Ages of the participants were categorized into two groups; ≤40 and >40 years. Educational qualifications divided as completed or less than ordinary level and completed secondary or tertiary level education according to the education system of the country. Types of exposure into risks factors were categorized in to four as chemicals, agrochemicals, radiation and heat. BMI was categorized according to 18.5-22.9 normal, ≥23 overweight, 25-29.9 pre obese and >30 as obese. The Cronbach's alphas for sperm concentration and sperm motility were 0.846. Descriptive statistics were performed on demographic data. The Independent sample t-test was performed done to identify the differences on total sperm count per ejaculation, percentage of motile sperms, abnormal forms and viability of sperms with socio demographic factors. One way ANOVA was performed to identify the variations of smoking pattern with total sperm count per ejaculation, percentage of motile sperms and the percentage of normal forms. In addition, Chi square test was used to determine the variations of sperm concentration and mortality with socio demographic characteristics. The logistic regression model was used to identify the contributing factors for the poor semen parameters in both univariate and multivariate analyses. P value less than 0.05 was considered as significant.

The ethical clearance (ERC/179/01/2017) was obtained by the Ethical Review Committee, Faculty of Medicine, General Sir John Kotelawala Defence University, Sri Lanka. Permissions were obtained from the director of Castle Street Teaching Hospital, Colombo, Sri Lanka to conduct the study. All individuals were informed that their participation was voluntary, and the procedure used did not pose any potential risk and their identities will be kept strictly confidential. Informed written consent forms were taken from all participants who voluntary participated and all information was kept in confidence.

RESULTS

A total of 299 subjects suspected as primarily infertile by reproductive endocrinologists were participated for this study. The Table 1 showed the two criteria of analyzing the participants. The age range of the participants was 20-49 years (mean 33.1±5.6). Individuals were participated from almost all provinces of the country with a maximum participation of 83.3%, from the Western province. A mean sperm count was 42.4×10^6 ml±34.6 with a minimum of 0 to maximum of 158×10^6/ml, in selected 299 subjects. The mean progressively motile sperms percentage was 62.4% in study the population. Mean BMI of the participants was 24.2 kg/m²±4.2 with the range of 15.9 and 44.1 kg/m², mean waist circumference 86.3±11 cm with the range of 59 cm and 132 cm and mean WHR was 0.94±0.06. Almost two third of the participants had low sperm concentration ($>15\times10^6$) and low (>32%) of progressively motile sperms (Table 1) in study the population.

Factors and their relationship with different semen parameters

The Independent sample t-test was performed to identify the differences on total sperm count per ejaculation and mean percentage of motile sperms on demographic, education, and behavioural/lifestyle, occupational and medical related factors. According to the results, significantly low concentrations were noticed in age >40 years, patients having diabetes mellitus and among tight undergarment users ($p<0.05$). Further Mean percentage of motile sperms was significantly low in age group >40 ($p<0.05$), boxes/ tight brief uses ($p<0.01$) and individuals having diabetic mellitus ($p< 0.05$) (Table 2). The Chi-square test was performed on sperm concentration and percentage of motility with socio demographic and other factors. The analysis showed significant association in smokers, ($p<0.05$), Boxer or tight brief/undergarment users ($p<0.05$), occupational exposure (heat) and occupational exposure (chemicals) ($p<0.05$) with low sperm concentration (≤15 million/ml). Other factors did not show any significant association with normal or low sperm concentrations. Boxer or tight brief/undergarment users, diabetes patients, occupational exposure heat and chemical showed significant association with low percentage of normal sperm motility (≤32%). however smoking, alcohol usage, betel chewing, mumps, radiation exposure were not identified as factors significant with low motility percentages of individuals (Table 3). In addition, only boxer/tight brief users were significantly associated with low sperm volume (<1.5 ml) compared to the individuals used normal underwear. Although, smokers, alcohol users, betel chewers, diabetes and mumps patients showed low sperm volume, there were no significant differences.

Analysis of semen parameters with different types of smokers

The Chi-square analysis showed the significant association between smokers with low sperm concentration. So more details was elaborated to identify the further associations.

They were further classified in to 4 different groups according to their current smoking pattern; non-smoker, occasional smokers (<7 cigarettes/week), light smokers (1-5 cigarettes/day) and medium/heavy smokers (>5 cigarettes/day). There were significant associations identified in increasing smoking habits with decreased total sperm count per ejaculation ($p<0.01$) and low

percentage of progressively motile sperm (p<0.01) (Table 4).

Logistic regression analysis

In multivariate logistic regression analysis, smoking habits and wearing tight under wears were identified as determinants for low sperm concentration (p=0.045 and 0.025 respectively).

In addition, multivariate analysis identified that diabetes and wearing tight underwear were identified as significant factors for the sperm motility (p=0.007 and 0.021 respectively).

Table 1: Sperm concentration and motility among individuals, two criteria used to analyze data (N=299).

Variables	Categories	n (%)
Sperm concentration (per ml)	Abnormal (<15×10^6)	90 (30.1)
	Normal (≥15×10^6)	209 (69.9)
Percentage of progressively	Abnormal (<32%)	104 (34.7)
Motile sperms	Normal (≥32%)	195 (65.3)

Table 2: Differences of mean sperm count per ejaculation and mean percentage of progressively motile sperms with socio-demographic characteristics (N=299).

Variables	Category	n (%)	Mean sperm count (million/ml)	Mean percentage of motile sperms
Age (years)	≤40	267 (89.3)	51.12*	69.95*
	>40	32 (10.7)	33.68	53.17
Education level	Up to O/L	210 (70.2)	42.06	60.25
	A/L or above	89 (29.8)	42.74	62.87
Smoking	Smokers	120 (40.1)	39.13	59.20
	Non smokers	179 (59.9)	45.67	63.92
Betel chewing	Betel chewers	86 (28.8)	40.24	61.49
	Non chewer	213 (71.2)	44.56	61.63
Alcohol usage	Alcohol users	210 (70.2)	40.03	60.68
	Not users	89 (29.8)	44.77	62.44
Boxes/tight brief usage	Boxer/tight brief users	111 (37.1)	36.35*	54.57**
	Normal underwear users	188 (62.9)	48.45	68.55
History of mumps	Yes	126 (42.1)	42.41	62.12
	No	173 (57.9)	42.39	61.08
History of diabetes	Yes	17 (5.6)	35.71*	52.59*
	No	282 (94.4)	49.09	70.53
Occupation level	Staff/executive	148 (49.5)	43.06	59.45
	Labourer grades	151 (50.5)	41.74	63.67
Occupational exposure to heat	Exposed	110 (36.8)	38.45	59.11
	Non-exposed	189 (63.2)	46.35	64.01
Exposure to radiation	Exposed (radiation)	235 (78.6)	39.17	62.05
	Non-exposed	64 (21.4)	45.63	61.07
BMI	Overweight and obese	118 (39.5)	42.13	61.01
	Normal or underweight	181 (60.5)	42.67	62.11
Waist circumference	High	100 (33.6)	41.07	62.21
	Normal	198 (66.4)	43.63	61.91

Note: *p<0.05, **p<0.01.

Table 3: Association of sperm concentration and percentage of motility with socio-demographic characteristics and other factors.

Variables	Category	Sperm concentration n (%) (per ml)		P value	Percentage of motile sperms		P value
		<15×10^6	≥15×10^6		<32%	≥32%	
Age (years)	≤40	78 (29.2)	189 (70.8)	0.170	89 (33.3)	178 (66.7)	0.129
	>40	12 (37.5)	20 (62.5)		15 (46.9)	17 (53.1)	

Continued.

Variables	Category	Sperm concentration n (%) (per ml)		P value	Percentage of motile sperms		P value
		<15×10⁶	≥15×10⁶		<32%	≥32%	
Education level	Up to O/L	68 (32.4)	142 (67.6)	0.187	75 (35.7)	135 (64.3)	0.603
	A/L or above	22 (24.7)	67 (75.3)		29 (32.6)	60 (67.4)	
Smoking	Smokers	45 (37.5)	75 (62.5)	0.022*	48 (40.0)	72 (60.0)	0.121
	Non smokers	45 (25.1)	134 (74.9)		56 (31.3)	123 (68.7)	
Betel chewing	Betel chewers	26 (30.2)	60 (69.8)	0.975	30 (34.9)	56 (65.1)	0.981
	Non chewer	64 (30.0)	149 (70.0)		74 (34.7)	139 (65.3)	
Alcohol usage	Alcohol users	68 (32.4)	142 (67.6)	0.187	77 (36.7)	133 (63.3)	0.293
	Not users	22 (24.7)	67 (75.3)		27 (30.3)	62 (69.7)	
Boxes/tight brief usage	Boxer/tight brief users	43 (38.7)	68 (61.3)	0.012*	47 (42.3)	64 (57.7)	0.035*
	Normal underwear users	47 (25.0)	141 (75.0)		57 (30.3)	131 (69.7)	
History of mumps	Yes	44 (34.9)	82 (65.1)	0.121	44 (34.9)	82 (65.1)	0.966
	No	46 (26.6)	127 (73.4)		60 (34.7)	113 (65.3)	
History of diabetes	Yes	6 (35.3)	11 (64.7)	0.302	11 (64.7)	6 (35.3)	0.008**
	No	84 (29.8)	198 (70.2)		93 (33.0)	189 (67.0)	
Occupation level	Staff/executive	38 (25.7)	110 (74.3)	0.099	44 (29.7)	104 (70.3)	0.069
	Labourer grades	52 (34.4)	99 (65.6)		60 (39.7)	91 (60.3)	
Occupational exposure to heat	Exposed	41 (37.3)	69 (62.7)	0.039*	43 (39.1)	67 (60.9)	0.014*
	Non-exposed	49 (25.9)	140 (74.1)		61 (32.2)	128 (67.8)	
Occupational exposure to chemicals	Yes	39 (37.5)	65 (62.5)	0.042*	46 (44.2)	58 (55.8)	0.026*
	No	51 (26.2)	144 (73.8)		58 (29.7)	137 (70.3)	
Exposure to radiation	Exposed (radiation)	67 (28.5)	168 (71.5)	0.251	79 (33.6)	156 (66.4)	0.417
	Non-exposed	23 (35.9)	41 (64.1)		25 (39.1)	39 (60.9)	
BMI	Normal	56 (47.5)	62 (52.5)	0.760	67 (56.8)	51 (43.2)	0.453
	Overweight or obese	34 (18.8)	147 (81.2)		35 (19.3)	146 (80.7)	

Note: Chi square test was used to obtain p value, *p<0.05, **p<0.01.

Table 4: Comparison of semen parameters with the smoking pattern.

Smoking groups	n (%)	Total sperm count per ejaculation mean (10^6)	Progressively motile sperms mean (%)
Non-smokers	179 (59.9)	43.54	47.55
Occasional smokers (<7 cigarettes/week)	33 (11.0)	44.52	46.12
Light smokers (1-5 cigarettes/day)	66 (22.1)	41.84	49.24
Medium/heavy smokers (>5 cigarettes/day)	21 (7.0)	16.40	30.95
P value		0.007	0.006
Total	299	41.37	46.60

Note: One way ANOVA was used to obtain p values.

DISCUSSION

Infertility is a prominent issue in reproductive health of both males and females worldwide. This study was aimed to investigate the impacts of demography, lifestyle and occupational factors for the development of poor semen parameters mainly in terms of sperm concentration and progressively motile sperms. The outcomes of the present study can be very important to diagnose, prevent and treat the male infertility in Sri Lanka. Differences and associations and determinants were identified using t-test, Chi-square and multivariate logistic regression analysis.

Present study confirmed that cigarette smoking is a risk factor for decreasing sperm production and eventually leads to infertility. Individuals with heavy smoking showed a drastic decline of the sperm concentration, compared to the non-smokers. Smokers with a habit of using >5 cigarettes per day is highly vulnerable to become oligospermic. In the present study, it was identified that

both the motility analyses (none or progressive) showed a risk of asthenospermia with increased smoking. Similarly, studies reported that smoking significantly associated with low sperm concentration and semen quality.[6,17,18].

Further, similar studies showed that development and maturation of spermatozoa gradually decline with increasing levels of alcohol intake.[19,20] However, Alcohol consuming was not a significant factor for either sperm concentration or motility in the present study. In contrast to this study, Muthusamiet al in 2005 revealed that alcohol consuming individuals had significantly decreased semen volume, sperm concentration, motility and percentage of normal sperm morphology.[10]

Boxer briefs and tight underwear users showed significantly low sperm concentration and low progressive motility of sperms than other underwear users. It was significantly associated with both parameters and identified as one of the main determinants for low sperm concentration and low progressive motility of sperms. Wang et al in 1997 reported that temperature increase in the scrotum in athletic supporters (0.8°C to 1°C) who wear tight underwear. When temperature increases by 1°C in testis, a total of 14% decline in the spermatogenesis is occurred.[21] Therefore, genital heat stress is a risk factor for male infertility.[21] Boxer briefs and tight underwear are popular among younger generation in Sri Lankan population especially who are involved with sports. Therefore preventive measures should be taken to avoid regular use of boxer briefs and tight underwear by educating them.

In the present study, chemical, agrochemical, heat and radiation were considered as occupational exposures for poor sperm quality. Individuals exposed to either chemical or heat exposed individuals have shown a significant association with low sperm concentration and low sperm motility. Similarly, a previous study in Sri Lanka, reported that a significant relationship between occupational exposure (agrochemical or industrial chemical and heavy metals) with sperm concentration and quality.[14] However in detail analysis should be conducted to identify the type of exposure, nature and quantity to make the policy in future studies.

Poor semen parameters increase with the advancement of male ages. In the present study, low sperm concentration and high rate of non-motility, abnormal forms and progressive motility were observed in >40 years of age category. Similarly, several studies reported that low sperm concentration, volume and progressive motility of sperm were significantly associated with increasing age after 40 years old.[22,23] Some studies showed total of 0.17-0.6% of motility rate decreased with per year of age and resulting 3-12% decline in motility over 20 years.[24,25] Although the production of spermatozoa exists until death, the quality of male germ cells is negatively associated with advanced paternal age.[26] It is a well-known fact. Individuals who exposed to mumps at ≥13 years of age have a risk of lower motile sperm concentration.[27] Mumps infections are associated with the production of anti-sperm anti bodies and inflammation. Anti-sperm antibodies adversely affect sperm quality and production and finally cause infertility. However in the present study, no significant relationship was found between mumps infection with semen parameters.

Glucose metabolism is very important to produce sperms. The present study found that sperm motility and volumes are significantly low in individuals with diabetes compared to non-diabetics. And multivariate logistic regression analysis also had proven the same. Many have reported that diabetes associated with male infertility by reduced motility, structural defects in nuclear and mitochondrial DNA and decreased zonapellucida binding capacity of sperms.[28-30] In this study we identified that the people with older age, tobacco smoking and diabetes mellitus identified as major determinants for male infertility as similar with other literature. In addition, wearing tight underwear was identified as a special risk factor for infertility and that it explained the high temperature maintaining for a long time period in genital area will contribute high. Especially countries with high temperature zones may have high risk for getting infertility.

Further we identified, some occupations exposed to high temperature had high risk for this condition. We identified these conditions in terms of poor semen parameters and we analyzed according to two criteria that explained in the WHO.

Overweight and obese are well known characteristics with low sperm quality and a greater risk of infertility in males. Present study did not find any significant difference between normal and high BMI group of individuals with sperm concentration.

In the present study, only 300 patients were selected and in future we need to extend this study by recruiting more. The occupation risk factors need to study more in detail to identify which characteristics of them contribute more to this condition. And we hope to consider both criteria we used together with the control group to identify the relative risk and odds ratios on significant factors.

CONCLUSION

There was a strong association among low sperm concentration and low sperm motility with lifestyle factors such as smoking and wearing boxer brief/tight underwear occupational exposure, age and diabetes. Prospective studies should be conducted to identify/assess the effect of risk factors for the generation of poor semen parameters mentioned in the study. Further studies to find out relationships of semen parameters with factors such as psychological stress, occupation categories, drugs use could be very important. Implementation of educational

programs to create awareness about male infertility in society should be also suggested.

ACKNOWLEDGEMENTS

We would like to express our deepest gratitude to the male individuals who participated in this study. It is our pleasure to thank medical officers and other health care workers in Castle Street Teaching Hospital, Colombo, Sri Lanka for their cooperation for this study. Our sincere thanks also go to the academic and non-academic staff of the Department of Medical Laboratory Sciences, Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University, Sri Lanka for their continuous support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Hochschild F, Adamson GD, Mouzon J, Ishihara O, Mansour R, Nygren K, et al. International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary of ART terminology, 2009. Fertil Steril. 2009;92(5):1520-4.
2. Practice Committee of tAmerican Society for Reproductive Medicine. Definitions of infertility and recurrent pregnancy loss. Fertil Steril. 2008;90(5):60.
3. Agarwal A, Mulgund A, Hamada A, Chyatte MR. A unique view on male infertility around the globe. Reprod Biol Endocrinol. 2015;13:37.
4. Simon H, David ZD. Infertility in men, University of Maryland Medical Center, 2012. Available at: http://umm.edu/health/medical/reports/articles/infertility-in-men. Accessed on 17 February 2017.
5. Jurewicz J, Radwan M, Sobala W, Radwan P, Bochenek M, Hanke W. Effects of occupational exposure - is there a link between exposure based on an occupational questionnaire and semen quality? Syst Biol Reprod Med. 2014;60(4):227-33.
6. Adewoyin M, Ibrahim M, Roszaman R, Isa MLM, Alewi NAM, Rafa AAA, et al. Male Infertility: The Effect of Natural Antioxidants and Phytocompounds on Seminal Oxidative Stress. Diseases. 2017;5(1):9.
7. Agarwal A, Durairajanayagam D. Are men talking their reproductive health away? Asian J Androl. 2015;17(3):433-4.
8. Wong WY, Zielhuis GA, Thomas CM, Merkus HM, Steegers-Theunissen RP. New evidence of the influence of exogenous and endogenous factors on sperm count in man. Eur J Obstet Gynecol Reprod Biol. 2003;110(1):49-54.
9. Wong WY, Zielhuis GA, Thomas CM, Merkus HM, Steegers-Theunissen RP. New evidence of the influence of exogenous and endogenous factors on sperm count in man. Eur J Obstet Gynecol Reprod Biol. 2003;110(1):49-54.
10. Muthusami KR, Chinnaswamy P. Effect of chronic alcoholism on male fertility hormones and semen quality. Fertil Steril. 2005;84(4):919-24.
11. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys. PLoS Med. 2012;9(12):e1001356.
12. Samarakoon S, Rajapaksa L, Seneviratne HR. Prevalence of primary and secondary infertility in the Colombo District. Ceylon J Med. Sci. 2002;45:83-91.
13. Hewabatage PN, Gunawardhana LKMP, Gunarathna MKNS, Bandara EMS, De Silva BSS. Reasons for primary sub-fertility among couples attending sub-fertility clinics at two government hospitals. Proceed Open University Res Sess. 2016;160.
14. Wijesekara GU, Fernando DM, Wijerathna S, Bandara N. Environmental and occupational exposures as a cause of male infertility. Ceylon Med J. 2015;60(2):52-6.
15. WHO. Waist Circumference and Waist-Hip Ratio-Report of a WHO Expert Consultation. Geneva: WHO; 2008.
16. WHO. WHO laboratory manual for the examination and processing of human semen. Geneva: WHO; 2010.
17. Hansen CH, Thulstrup AM, Aggerholm AS, Jensen MS, Toft G, Bonde JP. Is smoking a risk factor for decreased semen quality? A cross-sectional analysis. Hum Reprod. 2007;22(1):188-96.
18. Colagar AH, Jorsaraee GA, Marzony ET. Cigarette smoking and the risk of male infertility. Pak J Biol Sci. 2007;10(21):3870-4.
19. Gaur DS, Talekar MS, Pathak VP. Alcohol intake and cigarette smoking: impact of two major lifestyle factors on male fertility. Indian J Pathol Microbiol. 2010;53(1):35-40.
20. Zhang ZB, Jiang YT, Yun X, Yang X, Wang RX, Dai RL, et al. Male infertility in Northeast China: a cytogenetic study of 135 patients with non-obstructive azoospermia and severe oligozoospermia. J Assist Reprod Genet. 2012;29(1):83-7.
21. Durairajanayagam D, Agarwal A, Ong C. Causes, effects and molecular mechanisms of testicular heat stress. Reprod Biomed Online. 2015;30(1):14-27.
22. Levitas E, Lunenfeld E, Weisz N, Friger M, Potashnik G. Relationship between age and semen parameters in men with normal sperm concentration: analysis of 6022 semen samples. Andrologia. 2007;39(2):45-50.
23. Maya W, Berdugo J, Cadavid JA. The effects of male age on semen parameters: analysis of 1364 men attending an andrology center. Aging Male. 2009;12(4):100-3.
24. Samplaski MK, Bachir BG, Lo KC, Grober ED, Lau S, Jarvi KA. Cocaine Use in the Infertile Male Population: A Marker for Conditions Resulting in Subfertility. Curr Urol. 2015;8(1):38-42.
25. Nieschlag E, Vorona E. mechanisms in endocrinology: Medical consequences of doping with

anabolic androgenic steroids: effects on reproductive functions. Eur J Endocrinol. 2015;173(2):47-58.
26. Lawson G, Fletcher R. Delayed fatherhood. J Fam Plann Reprod Health Care. 2014;40(4):283-8.
27. Povey AC, Clyma JA, McNamee R, Moore HD, Baillie H, Pacey AA, et al. Modifiable and non-modifiable risk factors for poor semen quality: a case-referent study. Hum Reprod. 2012;27(9):2799-806.
28. Agbaje IM, Rogers DA, McVicar CM, McClure N, Atkinson AB, Mallidis C, et al. Insulin dependant diabetes mellitus: implications for male reproductive function. Hum Reprod. 2007;22(7):1871-7.
29. Baccetti B, La Marca A, Piomboni P, Capitani S, Bruni E, Petraglia F, et al. Insulin-dependent diabetes in men is associated with hypothalamo-pituitary derangement and with impairment in semen quality. Hum Reprod. 2002;17(10):2673-7.
30. Roessner C, Paasch U, Kratzsch J, Glander HJ, Grunewald S. Sperm apoptosis signalling in diabetic men. Reprod Biomed Online. 2012;25(3):292-9.

Cite this article as: Ranasinghe C, Gamage Y, Perera O, Karunarathna C, Galgamuwa LS, Batcha M, et al. Lifestyle and occupation risk factors for poor semen quality: a cross sectional study in Sri Lanka. Int J Reprod Contracept Obstet Gynecol 2022;11:2611-8.