International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Parental Factors Associated with Pregnancy Outcome With Reference to Spontaneous Abortion

Riddhi Thaker[1], Hina Oza[2], Vinita Verma[1], Sunil Kumar[1]

[1]Div. of Reproductive & Cytotoxicology, ICMR- National Institute of Occupational Health, Ahmedabad-380016, Gujarat, India.
[2]Department of Obstetrics and Gynecology, Civil Hospital, Ahmedabad-380016, India

Corresponding Author: Sunil Kumar

ABSTRACT

Objective: To assess the role of environmental, occupational and lifestyle factors among women with history of spontaneous abortion (SAb Cases) with respect to women without such history (bearing child - Controls).
Methods: A total of 406 (203 SAb and equal number of control subjects) were enrolled from Gynecology department, Civil hospital, Ahmedabad and personal demographic information, medical, occupational, lifestyle and reproductive history especially details of number of SAb, duration of last SAb, number of child etc. were collected on predesigned proforma.
Results: The mean BMI of SAb subjects and their partners was significantly higher as compared to BMI of control group. Area of residence appeared to have no impact in the pregnancy outcome. More number of women with SAb was employed as compared to controls. With respect to lifestyle habits among women, it was found that the proportion of chewers (mixture containing tobacco or areca nut as main compound) were more in SAb subjects as compared to control, this difference was statistically significant. With regards to impact of paternal lifestyle factors on spontaneous abortion, it was also noted that number of male subjects with habit of tobacco chewing or smoking or alcohol consumption was higher in SAb case group as compared to control group (NS). The results of logistic regression analysis indicated that the BMI of female subjects was significantly associated with risk of SAb. One unit elevation in the BMI increases the risk of SAb by 1.093 times (OR-1.093, 95% CI-1.026 to 1.161). Also, working women were at more risk for SAb (OR-1.86%, 95% CI-1.041 to 3.355).
Conclusion: The study indicated that working women, higher BMI and women with tobacco chewing habits have significant risk of SAb than housewives, normal BMI and women without habit of tobacco chewing. No such significant impact of paternal exposure was found with respect to risk of spontaneous abortion.
Keywords: Spontaneous abortion, Lifestyle, Occupation, Area of residence, BMI, Tobacco chewing.

INTRODUCTION

Various exogenous and endogenous factors are involved for attaining the successful pregnancy and its outcomes. Spontaneous abortion is defined as a clinically recognized pregnancy loss before the 20th week of gestation. Spontaneous abortion is also affected at least in part by exogenous causes such as environmental, occupational and lifestyle factors in addition to the various other factors such as higher age, miscarriage history, obesity, diabetes, thyroid problems etc, and exposure to tobacco smoke, drug or alcohol use etc. Both maternal and paternal factors may also pose threat for spontaneous abortion which might depend upon time, duration, time and intensity of such exposure. Spontaneous

abortion (SAb) is an extremely emotional issue for the couples as well as to their family. Most of the SAb are caused due to genetic or biological reasons (~50%); however, many SAb are still remain idiopathic (~40%). [1] Hence, it is desirable to understand the cause of such SAb.

Exposure to certain chemicals may have a role in elevated reproductive disorders in both the sexes; which might also be associated with elevation in SAb/ recurrent spontaneous abortion (RSA). The number of women at the workplace is increasing worldwide steadily in recent decades and a considerable of them are in reproductive age. [2] Hence they may be exposed to certain occupational factors. Exposure to some of the persistent chemicals has been reported to cause disruption in the fetal development and cause adverse pregnancy outcome. It is recognized that fetus is more vulnerable to minute concentration of toxic chemicals as compared to same magnitude of exposure to such chemicals in adulthood. These exposures might also be responsible for altered gene expression; and in turn associated with SAb/RSA. However, information on relation between specific exposure of reproductive toxicants and spontaneous abortion is scanty. Earlier Weselak *et al.* reported that close to 30% of all pregnancies end up in spontaneous abortion. Although about 60% of spontaneous abortions are thought to be due to genetic, infectious, hormonal, and immunological factors. Pregnancy involves a delicate balance of hormonal and immunological functions, which may be affected by various toxic substances and this exposure may disrupt this equilibrium. This might also exaggerate the problem of spontaneous abortion. [3] Later Tan *et al.* conducted a case-control study to assess the association between maternal life style factors and risk of threatened miscarriage. They found a positive association between threatened miscarriage with second hand tobacco smoke exposure, excess computer, mobile usage and caffeine consumption and fish oil consumption reduced the risk of threatened miscarriage. [4] Recently Kim *et al.* investigated the relationship between job type and the risk for spontaneous abortion in the workers in the semiconductor industry. They observed risk for spontaneous abortion in female semiconductor workers was not significantly higher for fabrication and packaging process workers than for clerical workers. However, when they stratified by time period, the odds ratio for spontaneous abortion was significantly higher for packaging process workers who became pregnant prior to 2008 when compared with clerical workers before automation in the industry. [5]

The present study was conducted to assess the role of both maternal and paternal environmental, occupational and lifestyle factors with respect to spontaneous abortion.

METHODS

A total of 406 women (203 SAb cases and 203-control subjects) were enrolled from the Gynecology department, Civil hospital, Ahmedabad, India. An informed written consent was obtained from each study participant after explaining the aim and objectives of the study and benefit of the study to the community as a whole. This paper is a part of a major project entitled "Relationship between spontaneous abortion and occupational, environmental exposure" for which ethical approval of the study was obtained from the institutional human ethical committee, NIOH, Ahmedabad, India.

The personal demographic information, medical history, occupational history, lifestyle history and reproductive history especially details of number of SAb, duration of last SAb, number of child etc. were collected through questionnaire interview of the SAb and control subjects in their language and recorded on predesigned and pretested proforma.

Statistical Analysis

The data obtained were computerized in excel program and analyzed to draw inference. The

significance between the two groups (SAb and control) of different variables studied was determined. The p value < 0.05 was considered as statistically significant. Logistic regression of male and female subjects' variables was done to assess the risk associated with SAb. The data were presented and depicted in table 1-4.

RESULTS

Table 1 : Study Characteristics of female subjects

Subject Characteristics	SAb subjects (n=203) n (%)	Controls (n=203) n (%)	P value
Educational Status			
Illiterate (n=59)	27 (45.76)	32 (54.24)	0.57
Literate (n=347)	176 (50.72)	171 (49.28)	
Area of Residence			
Industrial (n=40)	22 (55.00)	18 (45.00)	0.50
Residential (n=339)	164 (48.38)	175 (51.62)	
			0.16
Agricultural (n=27)	17 (62.96)	10 (37.04)	
Occupational History			
Employed (n=67)	42 (62.69)	25 (37.31)	*0.031*
Unemployed (n=339)	161 (47.49)	178 (52.51)	
Lifestyle Habits			
Chewer (tobacco / areca nut(n=22)	16 (72.72)	06 (27.27)	*0.04*
Never Chewer (n=384)	187 (48.69)	197 (51.30)	
Mean Age (years)	25.94±0.28	26.30±0.26	0.361
BMI Category			
Mean BMI (kg/m^2)	22.18±0.28	20.87±0.22	*<0.000*
Underweight (n=81)	35 (43.21)	46 (56.79)	0.580
Healthy (n=259)	121 (46.72)	138 (53.28)	
			<0.000
Overweight/ obese (n=66)	47 (71.21)	19 (28.79)	

Table 2: Demographic, Lifestyle paternal variables among male subjects

Variables	Controls (n=203)	SAb subjects (n=203)	P value
Age and BMI			
Mean Age	29.50±0.30	29.18±0.31	0.45
Mean BMI	22.30±0.18	22.88±0.22	*0.04*
Residential area			
Industrial (n=40)	18 (45.0)	22(55.0)	0.50
Residential (n=339)	175 (51.6)	164(48.4)	
			0.16
Agricultural (n=27)	10 (37.0)	17(63.0)	
Educational Status			
Illiterate (n=36)	18 (50.0)	18(50.0)	0.85
Primary (n=79)	47 (59.5)	32(40.5)	0.41
Secondary* (n=167)	89 (53.3)	78(46.7)	-
Higher secondary (n=72)	30 (41.7)	42(58.3)	0.12
Graduate and above (n=52)	19 (36.5)	33(63.5)	*0.03*
BMI category (Kg/m^2)			
Under weight (<18.5) (n=19)	09 (47.4)	10 (52.6)	0.81
Healthy (18.5-24.9) (n=318)	164 (51.6)	154 (48.4)	
			0.23
Over weight (25-29.9) (n=69)	30 (43.5)	39 (56.5)	
Smoking Habits			
Nonsmoker (n=371)	189 (50.9)	182 (49.1)	0.28
Smoker (n=35)	14 (40.0)	21 (60.0)	
Chewing Habits			
Nonchewer (n=199)	102 (51.3)	97 (48.7)	ns
Chewer (n=207)	101 (48.8)	106 (51.2)	
Alcohol Use			
Yes (n=59)	24 (40.7)	35 (59.3)	0.15
No (n=347)	179 (51.6)	168 (48.4)	

*considered as reference category for Chi square test

The mean BMI of SAb subjects was significantly higher statistically as compared to BMI of control group. However, the mean age of the two groups (SAb and control) was more or less similar. Further, the SAb cases were significantly higher in

the overweight/ obese female subjects (fig 1). No significant role of education and area of residence with respect to SAb were found between SAb and control groups. More number of women with SAb was employed as compared to controls. This difference was statistically significant between the two groups. With respect to lifestyle habits among women, it was observed that the proportion of chewers (mixture containing tobacco or areca nut as main compound) were more in SAb subjects as compared to control, and this difference between SAb and control groups was also statistically significant (Table-1 and Fig 2).

The mean age was more or less same among the male partners of the two groups. The mean BMI of male partners of SAb subjects was significantly higher as compared to partners of controls (fig 1). With regards to impact of paternal lifestyle factors on spontaneous abortion, it was found that number of male subjects with habit of tobacco chewing or smoking or alcohol consumption was higher in SAb case group as compared to control group. However this difference was statistically non-significant with all the variables. Paternal other variables such as area of residence, role of education, dietary habit and employment history also do not have any significant relationship with respect to SAb in their partner (table-2).

Table 3: Paternal Occupational details of subjects

Categories of Variables	Control (n=203) %	SAb subjects (n=203) %	P value
Occupation			
Manual Labour* (n=105)	52 (49.5)	53 (50.5)	NS
Industrial Workers (n=64)	34 (53.1)	30 (46.9)	0.764
Business/Shopkeeper (n=43)	19 (42.9)	24 (57.1)	0.603
Farmer (n=15)	08 (53.3)	07 (46.7)	NS
Office Workers (n=33)	17 (51.5)	16 (48.5)	NS
Others (taxi driver, auto driver, constable, services job etc) (n=146)	73 (50.0)	73 (50.0)	-
Categories of Workers			
Unskilled worker (n=130)	71 (54.6)	59 (45.4)	0.26
Semiskilled worker* (n=203)	97 (47.8)	106 (52.2)	-
Skilled worker (n=34)	17 (50.0)	17 (50.0)	0.85
Clerical/shopowner/farmer (n=32)	15 (46.9)	17 (53.1)	NS
Semi Profession (n=06)	02 (33.3)	04 (66.7)	0.68

*considered as reference category for Chi square test

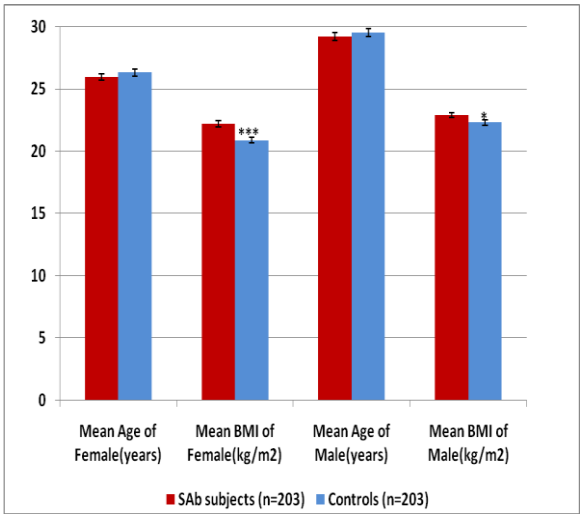
Table 4: Logistic Regression of demographic variable of male and female subjects modeled together for the risk of SAb

	B	p value	Odd Ratio Exp(B)	95% C.I. for OR EXP(B)	
				Lower	Upper
Industrial area	0.284	0.426	1.329	0.660	2.675
Agricultural area	0.765	0.085	2.149	0.901	5.125
Age of male partners	-0.015	0.704	0.985	0.912	1.064
BMI of male partners	0.061	0.095	1.063	0.989	1.141
Educational score of male	0.140	0.152	1.150	0.950	1.392
Occupational score of male	-0.013	0.918	0.987	0.765	1.273
Smoking habit of male	0.480	0.229	1.617	0.740	3.533
Chewing habit of male	0.119	0.596	1.127	0.724	1.754
Habit of alcohol consumption	0.239	0.445	1.270	0.688	2.344
Upper Lower SE Class	-0.080	0.750	0.923	0.563	1.513
Upper middle SE class	0.152	0.674	1.164	0.574	2.363
Age of female	-0.037	0.406	0.964	0.884	1.051
BMI of female	0.089	0.004	1.093	1.029	1.161
Educational score of female	0.107	0.281	1.113	0.916	1.352
Employment status of female	0.626	0.036	1.869	1.041	3.355
Chewing habit of female	0.903	0.085	2.467	0.883	6.889
Habit of caffeine intake female	0.444	0.163	1.559	0.835	2.912
Constant	-3.304	0.013	0.037		

a. Variable(s) entered on step 1: Area of residence, Age of Male and Female, actual BMI of male and female, Smoking habit of male, Chewing habit of male and female, Habit of alcohol consumption of male, Caffeine consumption habit of female. Socio economic class, Educational profile of both partners, and Occupational Score of male and employment status of female

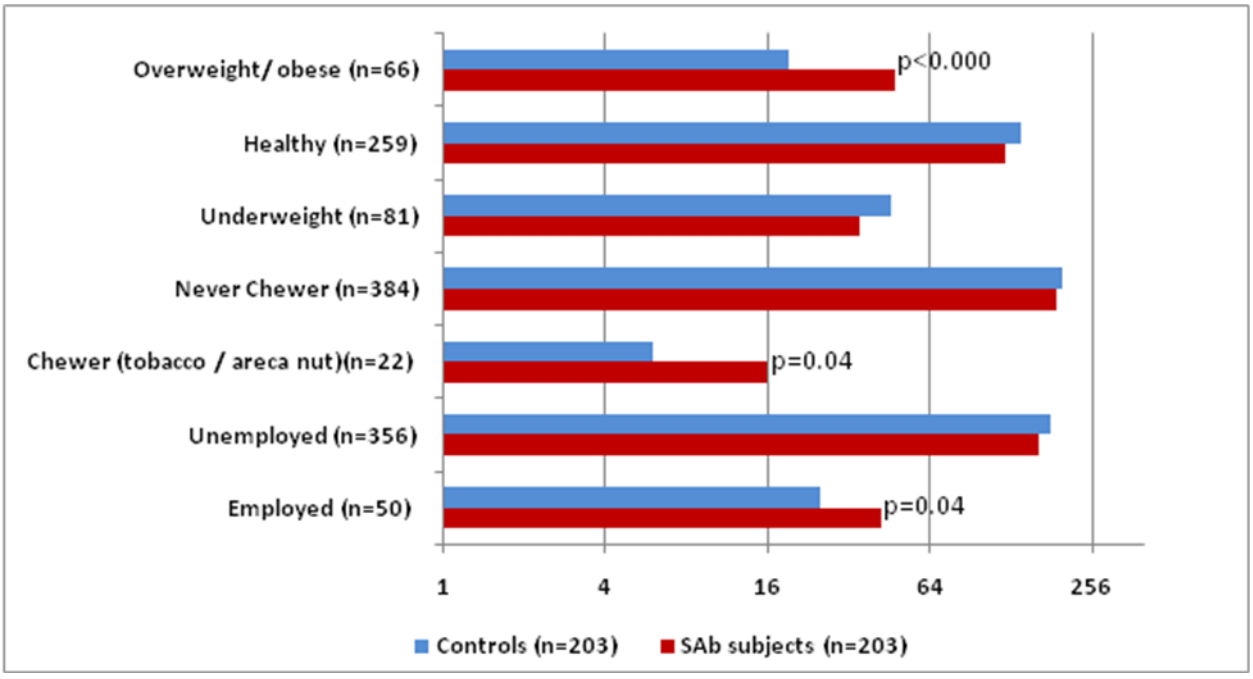
The paternal occupational detail of SAb and control subjects is depicted in table 3. The data with regards to occupations indicated that the partners of SAb subjects were slightly higher among manual labors and business/ shopkeepers. The data with regards to occupation as well as category is statistically non significant.

Table 4 depicted the Logistic regression analysis of demographic variables related of male and female subjects. The results reflected that the BMI of female subjects was significantly associated with risk of SAb. As one unit of BMI elevates, the risk of SAb increases by 1.093 times. Also, working women were at more risk for SAb (OR-1.86%, p<0.036, 95% CI-1.041 to 3.355) as compared to housewives.



***p<0.05, ***p<0.001 based on independent student's t test**

Fig 1: Mean Age and Mean BMI of study population



p values based on Chi square test

Fig 2: Ditribution of female subjects with respect to occupational status, lifestyle (areca nut/tobacco chewing) habits and categories of BMI.

DISCUSSION

Area of residence with regards to industrial and agricultural has no difference in the proportion of SAb cases and control subjects when compared to proportion of SAb subjects residing in residential area. However, more number of women with SAb was working women as compared to controls. This suggest that working women may have more risk for SAb than non-working women and various occupational factors such as physical, chemicals, stress at work place may also be associated with the occurrence of SAb in the study. There are several reports which indicated the role of occupational associated factors/exposure in SAb. Earlier Geshev reported the highest frequency of SAb was encountered in women working in the chemical industry, such as in pharmaceutical industries, light

and heavy metallurgy, plastics, and the railway industry. The lowest frequency was found in those women employed in offices. They also found an obvious correlation between the level of stress and the rate of spontaneous abortions. [6] Later Wong *et al.* found a reduced risk of miscarriage for women working in jobs with either light or medium physical activity during the first trimester of pregnancy and over all pregnancies as compared to women employed in sedentary jobs. However, frequent crouching during the work was associated with elevated risk of SAb. [7] Recently, Zheng *et al.* mentioned that generally women with lower Socio Economic Status (SES) had a higher risk of SAb. Lower income and educational attainment were inversely associated with the risk of SAb. Women with agricultural and related work also had a significantly higher prevalence of SAb. They further suggested that interventions could be targeted more on women with low SES. However, no role of education or area of residence was found to be associated with SAb in the present study. [8] Earlier al-Nuaim *et al.* found a direct statistically significant relationship between maternal age, level of education, parity and a history of previous abortion with respect to spontaneous abortions. [9] Recently Catak *et al.* reported that four factors namely educational status of women, employment status of women, exposure to physical violence and non-receipt of antenatal care (ANC) are associated with independent risk on spontaneous abortions. [10]

The mean BMI of SAb subjects was significantly higher while mean age of the SAb and control was more or less similar. Rochebrochard and Thonneau found that the risk of miscarriage was higher if the women age was greater than or equal to 35 years. They further reported that risk of an adverse pregnancy outcome was highest if both partner were in advanced in age. [11] However, in the present no considerable differences in age was observed between spontaneous abortion and control subjects as age matched control were enrolled in the study. Earlier Wang *et al.* examined the relationship between BMI and risk of SAb in subjects receiving infertility treatment. The effect of BMI was significant on the risk of SAb. Compared with reference group (healthy BMI), underweight women and overweight/ obese women were at risk of SAb. [12]

Further, there are several reports on various toxicants and life style factors such as ambient air pollution, [13-15] exposure to phthalates, [16,17] tobacco smoking and environmental tobacco smoke, [18-20] metals-mercury, lead [21,22] caffeine intake [23,24] alcohol consumption [25-27] may have some role in occurrence of spontaneous abortions. In the present study also more number of women with SAb was employed as compared to controls indicating various job related factors may be responsible for spontaneous abortion. Earlier Anttila and Sallmén reported that epidemiological studies indicate that paternal exposure to lead or mercury might be associated with the risk of spontaneous abortion and for maternal exposure, no clear conclusion could be drawn. In particular, paternal occupational exposure levels to metals were substantial compared with population values. They further reported that even though there are shortcomings in the present knowledge, protective goals for paternal exposure to lead and mercury are warranted. [21] In addition, Lindbohm reported that maternal high exposure to solvents may increase the risk of spontaneous abortion. Suggestive associations of spontaneous abortions have also been observed with some particular solvents especially for toluene. Evidence on the effects of paternal exposure to solvents on pregnancy outcome is limited and inconsistent. Suggestive results link paternal exposure to spontaneous abortion, congenital malformation, and low birth weight or preterm birth. [28] In addition, role of consanguinity and inbreeding on spontaneous abortion was also reported earlier by Hussain and mentioned that both

consanguinity and inbreeding were independent risk factors for spontaneous abortion despite undertaking control for other biological and socio-demographic factors that could confound the association. The combination of fetal and parental inbreeding led to a greater likelihood of a pregnancy ending in spontaneous abortion than one generation of inbreeding alone. [29] Further, Mills et al., found that diabetic women with good metabolic control are no more likely than nondiabetic women to lose a pregnancy, but diabetic women with elevated blood glucose and glycosylated hemoglobin levels in the first trimester have a significantly increased risk of SAb. [30]

The data available and coupled with the present findings it can be inferred that maternal life style factors advanced age, higher BMI, work as well as occupational/ environmental exposure to certain toxicants such as air pollutants, certain heavy metals, phthalates, solvents, tobacco smoke, etc. may have some role in SAb. Further, well plan studies are needed to pinpoint specific factors or toxicant responsible for SAb.

ACKNOWLEDGEMENTS

Authors are thankful to the participating subjects for their cooperation in providing the necessary relevant information's and ICMR-NIOH for providing the financial support initially to the study as an intramural program.

Conflict Of Interest: None

REFERENCES

1. Ford HB and Schust DJ. Recurrent pregnancy loss: Etiology, Diagnosis, and Therapy. Rev Obstet Gynecol 2009; 2(2): 76–83.
2. Kumar Sunil. Occupational, environmental and lifestyle factors associated with spontaneous abortion. Reprod Sci 2011; 18:915-930.
3. Weselak M, Arbuckle TE, Walker MC, Krewski D. The influence of the environment and other exogenous agents on spontaneous abortion risk. J Toxicol Environ Health B Crit Rev 2008; 11(3-4):221-41.
4. Tan TC, Neo GH, Malhotra R, Allen JC, Lie D, Ostbye T. Lifestyle Risk Factors Associated with Threatened Miscarriage: A Case Control Study. JFIV Reprod Med Genet 2014; 2:123.
5. Kim Heechan, Kwon Ho-Jang, Rhie Jeongbae, Lim Sinye, Kang Yun-Dan, Eom Sang-Yong, Lim Hyungryul, Myong Jun-Pyo, Roh Sangchul. The relationship between spontaneous abortion and female workers in the semiconductor industry. Annals of Occup and Environ Med 2017; 29: 49
6. Geshev G. Spontaneous abortions in working women. Akush Ginekol (Sofiia)1976;15(2):115-20.
7. Wong EY, Ray R, Gao DL, Wernli KJ, Li W, Fitzgibbons ED, Camp JE, Heagerty PJ, De Roos AJ, Holt VL, Thomas DB. Physical activity, physical exertion, and miscarriage risk in women textile workers in Shanghai, China. American journal of industrial medicine. 2010; 53(5):497-505.
8. Zheng Danni, Li Chunyan, Wu Taiwen, and Tang Kun. Factors associated with spontaneous abortion: a cross-sectional study of Chinese populations. Reprod Health 2017; 14: 33.
9. al-Nuaim L, Bamgboye EA, Abotalib Z, Chowdhury N, Adelusi B. Demographic and fertility variables as determinants of spontaneous abortions in women with previous abortions. Afr J Med Med Sci 1998; 27(3-4):165-7.
10. Catak B, Onor C, Sutlu S, Kilinc S. Effect of socio-cultural factors on spontaneous abortions in Burdur Turkey. A population based case control study. Pak J Med Sci 2016; 32:1257-1262.
11. Rochebrochard Elise de La and Thonneau Patrick. Paternal age and maternal age are risk factors for miscarriage; results of a multicentre European study. Human Reproduction 2002; 17:1649–1656.
12. Wang Jim X, Davies Michael J, Norman Robert J. Obesity Increases the Risk of Spontaneous Abortion during Infertility Treatment. Obesity 2002; 10(6): 551–554.
13. Enkhmaa Davaasambuu , Warburton Nicole, Javzandulam Badrakh, Uyanga Jadambajav, Khishigsuren Yarinpil, Lodoysamba Sereeter, Enkhtur Shonkuuz and Warburton David. Seasonal ambient air pollution correlates strongly with spontaneous abortion in Mongolia. BMC Pregnancy and Childbirth 2014;14:146

14. Dastoorpoor M, Idani E, Goudarzi G, Khanjani N. Acute effects of air pollution on spontaneous abortion, premature delivery, and stillbirth in Ahvaz, Iran: a time-series study. Environmental Science and Pollution Research. 2018; 25(6):5447-58.
15. Ha S, Sundaram R, Louis GMB, Nobles C, Seeni I, Sherman S, Mendola P. Ambient air pollution and the risk of pregnancy loss: a prospective cohort study. Fertil Steril 2018; 109:148-153.
16. Mu Di, Gao Fumei, Fan Zhanlan , Shen Huan, Peng Hui, and Hu Jianying. Levels of Phthalate Metabolites in Urine of Pregnant Women and Risk of Clinical Pregnancy Loss. *Environ. Sci. Technol* 2015; 49 (17): 10651–10657
17. Gao H, Zhang Y, Huang K, Yan S, Mao Lj, Ge X, Xu Ye, Xu Yu, Sheng J, Jin Z, Zhu P, Tao Xu-g, Hao Jia-hu, Tao F-b. Urinary concentrations of phthalate metabolites in early pregnancy associated with clinical pregnancy loss in Chinese women. Scientific Reports, 2017; 7. 10.1038/s41598-017-06450-2.
18. Himmelberger DU, Brown BW Jr, Cohen EN. Cigarette smoking during pregnancy and the occurrence of spontaneous abortion and congenital abnormality. Am J Epidemiol 1978; 108:470-479.
19. Ness RB, Grisso JA, Hirschinger N, Markovic N, Shaw LM, Day NL, Kline J.Cocaine and tobacco use and the risk of spontaneous abortion. N Engl J Med 1999; 4, 340(5):333-9.
20. George L, Granath F, Johansson AL, Annerén G, Cnattingius S. Environmental tobacco smoke and risk of spontaneous abortion. Epidemiology. 2006; 17(5):500-5.
21. Anttila A, Sallmén M. Effects of parental occupational exposure to lead and other metals on spontaneous abortion. J Occup Environ Med 1995;37(8):915-21.
22. Hertz-Picciotto I. The evidence that lead increases the risk for spontaneous abortion. Am J Ind Med 2000; 38(3):300-9
23. Klebanoff MA, Levine RJ, DerSimonian R, Clemens JD, Wilkins DG. Maternal serum paraxanthine, a caffeine metabolite, and the risk of spontaneous abortion. N Engl J Med 1999; 341(22):1639-44.
24. Cnattingius S, Signorello LB, Annerén G, Clausson B, Ekbom A, Ljunger E, Blot WJ, McLaughlin JK, Petersson G, Rane A, Granath F. Caffeine intake and the risk of first-trimester spontaneous abortion. N Engl J Med 2000; 21,343 (25): 1839-45.
25. Kline Jennie, Stein Zena, Shrout Patrick, Susser Mervyn, Warburton Dorothy. Drinking during pregnancy and spontaneous abortion. Lancet 1980; 316 (8187):176-180.
26. Abel EL. Maternal alcohol consumption and spontaneous abortion. Alcohol & Alcoholism 1997; 32(3):211-9.
27. Windham GC, Behren JV, Fenster Laura, Schaefer C and Swan SH. Moderate Maternal Alcohol Consumption and Risk of Spontaneous Abortion. Epidemiology1997; 8(5): 509-514.
28. Lindbohm ML. Effects of parental exposure to solvents on pregnancy outcome. J J Occup Environ Med 1995; 37(8):908-14.
29. Hussain R. The role of consanguinity and inbreeding as a determinant of spontaneous abortion in Karachi, Pakistan. Ann Hum Genet 1998; 62 (2):147-57.
30. Mills JL, Simpson JL, Driscoll SG, Jovanovic-Peterson L, Van Allen M, Aarons JH, Metzger B, Bieber FR, Knopp RH, Holmes LB, Peterson CM, Withiam-Wilson M, Brown Z, Ober C, Harley E, Macpherson TA, Duckles A, Mueller-Heubach E. Incidence of spontaneous abortion among normal women and insulin-dependent diabetic women whose pregnancies were identified within 21 days of conception. New Eng J Med 1988; 319 (25): 1617-1623.

How to cite this article: Thaker R, Oza H, Verma V et. al. Parental factors associated with pregnancy outcome with reference to spontaneous abortion. Int J Health Sci Res. 2018; 8(12):1-8.

******