



Association of Smoking Habits of Mother during Pregnancy with Pregnancy Outcome

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Abstract

Background: The objectives of this work were to study the association of maternal smoking habits with stillbirths, abortions, neonatal deaths, birth weights, placental weights and the outcomes on the 28th day of life.

Methods: A questionnaire was developed and completed with the hospitals' recorded data collected over a period of 5 years from 47,000 babies born in several hospitals in Ontario, Canada. The mothers were classified into four categories: non-smokers, light smokers (less than 10 cigarettes per day), moderate smokers (between 10 and 19 cigarettes per day) and heavy smokers (20 or more cigarettes per day). The population surveyed was of mixed ethnicity from both rural and urban areas. Statistical analysis was performed using the SPSS statistical package.

Results: Even the light smoking habit has an effect on the birth weight and the placental weight but for other characteristics, stillbirth, abortion, and the outcomes on the 28th day of life, no significant difference observed between light smokers and non-smokers.

Conclusion: While quit smoking must be the ultimate goal for any smoker, the present study concludes that moderate and heavy smokers, if they will not be able to quit, they should reduce their number of cigarettes per day to at least the level of light smokers to achieve the same results for non-smokers. All characteristics show significant difference between non-smokers and moderate and heavy smokers.

Keywords: Maternal smoking, Pregnancy, Cigarette

Introduction

The effects of smoking habits of mother during pregnancy have been studied in the past century or so in various communities and different cultures. One of the earliest studies (1) in Birmingham, UK, reported in 1959 shows that infants of mothers who smoked regularly during pregnancy were on the average more than 170 g lighter than the infants of those who never smoked during pregnancy.

Despite the association of the children's health with the smoking habits of mother during pregnancy have been investigated for many years and well-documented, the topic is still being studied by

various research groups. Salihu et al. (2) estimated that about 5% of infant deaths in the United States are attributable to maternal smoking while pregnant, with variations by race/ethnicity. A recently published study (3) reported that an experimental citywide smoking ban in Pueblo, Colorado, USA, improved maternal and fetal outcomes.

Roelands et al. (4) discussed not only the relationship of smoking habits of mothers and fetal risks, but the importance of negative impact of smoking on the health of mothers as well. They suggested that smokers have a higher chance of experiencing cardiovascular problems (deep vein thrombosis,

myocardial infarction, and stroke) and pulmonary disorders (bronchitis, asthma, pneumonia, influenza) than non-smokers.

In the United States, Mateja et al. (5) investigated the data from the Pregnancy Risk Assessment Monitoring Survey (PRAMS) for nine states over a 10-year period (1996–2005), and revealed the risk factor of maternal alcohol use and smoking habits, in early pregnancy, and congenital heart defects. Ingersoll et al. (6) also suggested the importance of preconception prevention efforts for women who are at dual risk for alcohol and smoking habits. Zhao et al. (7) investigated the healthy lifestyle behaviors during pregnancy, from 2001 to 2009, in a survey from 22,604 American pregnant women aged 18–44 years, and pointed out the importance of reducing alcohol use, binge drinking, and smoking and increasing fruit and vegetable consumption during pregnancy.

This paper describes the association of maternal smoking habits with stillbirths, abortions, neonatal deaths, birth weights, placental weights and the outcomes on the 28th day of life.

Materials and Methods

Research Design

During 2001 and 2002, the first author had a fellowship at the Division of Clinical and Metabolic Genetics, Hospital for Sick Children, Toronto, Canada, in the late Prof. Ahmad Teebi's Department. A questionnaire was developed and completed with the hospitals' recorded data which have been collected over a period of 5 years from about 47,000 babies born in several hospitals in Ontario. This number includes all alive and stillbirths. The designed questionnaire covered a comprehensive range of information on both mothers and their babies' health, which were and will be the source for a series of other articles. The babies, whose records had missing data on any of the maternal or infant variables under study, were excluded from the analyses. Consequently, the total number of samples in different tables is not equal. The population surveyed was of mixed ethnicity from both rural and urban areas.

Data Collection

For the purpose of this study, the mothers were classified into four categories: non-smokers, light smokers (less than 10 cigarettes per day), moderate smokers (between 10 and 19 cigarettes per day) and heavy smokers (20 or more cigarettes per day). Other groups such as sportive smoking, ex-smokers and mothers who have smoked before pregnancy and ceased during pregnancy were out of the scope of present study. Throughout this study the non-smoker category was considered the reference category.

Statistical Analysis

Statistical analysis was performed using the SPSS statistical package, version 15.0 for Windows (SPSS, Chicago, USA) and the chi-square test was used to estimate the probable association between the variables, and a *P* value less than 0.05 was considered statistically significant for all the tables. The odds ratios (OR) were calculated for categorical variables using 95% confidence intervals (95% CI). The present analysis is a cohort study where the maternal smokers during pregnancy are compared with the maternal non-smokers during pregnancy.

Results

Each variable was divided into a number of categories. Previous stillbirths were consisted of three subgroups of no previous stillbirths, 1 previous stillbirth and 2 or more previous stillbirths. Previous abortions were divided into four subgroups of no previous abortions, 1 previous abortion, 2 previous abortions and 3 or more previous abortions. Table 1 shows the incidence of previous stillbirths and previous abortions in regard to smoking habits. It was found, that mothers who smoke have significantly more previous stillbirths ($\chi^2 = 60.98, P < 0.0001$) and also previous abortions ($\chi^2 = 290.77, P < 0.0001$) than mothers who do not smoke. Our data shows that there is no significant difference between non-smokers and light smokers with regard to the number of previous stillbirths ($\chi^2 = 2.38, P > 0.30$) and also to the number of previous abortions ($\chi^2 = 8.51, P > 0.036$).

Table 1: Distribution of smoking habits with respect to previous stillbirths and abortions

	Non-smokers*	< 10 cigs/day	10 - 19 cigs/day	≥ 20 cigs/day
No Previous Stillbirths	28093 (98.07)	5154 (97.76)	8007 (97.07)	4683 (96.58)
Odds Ratios	1.00	1.00	1.00	1.00
1 Previous Stillbirth	514 (1.80)	111 (2.11)	229 (2.77)	157 (3.24)
Odds Ratios	1.00	1.18	1.56	1.83
(95% CI)		(0.96 – 1.45)	(1.33 – 1.83)	(1.53 – 2.19)
2 or more Previous Stillbirths	38 (0.13)	7 (0.13)	13 (0.16)	9 (0.18)
Odds Ratios	1.00	1.00	1.20	1.42
(95% CI)		(0.45 – 2.24)	(0.64 – 2.25)	(0.69 – 2.94)
Total/category	28645 (100.0)	5272 (100.0)	8249 (100.0)	4849 (100.0)
Non-smokers and light smokers $\chi^2 = 2.38, P > 0.30$ (see text)				
All categories $\chi^2 = 60.98, P < 0.0001$ (see text)				
No Previous Abortions	23397 (81.68)	4296 (81.49)	6513 (78.96)	3524 (72.67)
Odds Ratios	1.00	1.00	1.00	1.00
1 Previous Abortion	4146 (14.47)	810 (15.36)	1330 (16.12)	961 (19.82)
Odds ratios	1.00	1.06	1.15	1.54
(95% CI)		(0.98 – 1.15)	(1.07 – 1.23)	(1.42 – 1.67)
2 Previous Abortions	821 (2.87)	127 (2.41)	292 (3.54)	243 (5.01)
Odds Ratios	1.00	0.84	1.28	1.97
(95% CI)		(0.69 – 1.02)	(1.12 – 1.47)	(1.70 – 2.28)
3 or more Previous Abortions	281 (0.98)	39 (0.74)	114 (1.38)	121 (2.50)
Odds Ratios	1.00	0.76	1.46	2.86
(95% CI)		(0.54 – 1.06)	(1.17 – 1.82)	(2.30 – 3.55)
Total/category	28645 (100.0)	5272 (100.0)	8249 (100.0)	4849 (100.0)
Non-smokers and light smokers $\chi^2 = 8.51, P > 0.036$ (see text)				
All categories $\chi^2 = 290.77, P < 0.0001$ (see text)				

Cigs: cigarettes/*Reference category

The frequency of previous neonatal deaths in relation to smoking habits is given in Table 2. In this study neonatal deaths were scored as being absent or 1, 2 or more. Neonatal deaths consisted of early and late neonatal deaths.

Early neonatal mortality refers to a death of a live-born baby within the first 7 days of life. Late neonatal mortality refers to a death of a live-born baby after 7 days until before 28 days of life. Our results revealed that the proportion of previous

neonatal deaths was significantly higher amongst smoker mothers than non-smokers ($\chi^2 = 45.02, P < 0.0001$). The results show that there is no significant difference between no-smokers and light smokers in regard to previous neonatal deaths ($\chi^2 = 1.22, P > 0.50$). Birth weight was consisted of six subgroups of 2.5 kg or less, (2.6 – 2.9) kg, (3.0 – 3.3) kg, (3.4 – 3.7) kg, (3.8 – 4.1) kg, and 4.2 kg or more.

Table 3 gives the distribution of smoking habits with respect to birth weight.

Table 2: Distribution of Smoking Habits with Respect to Previous Neonatal Deaths

	Non-smokers*	< 10 cigs/day	10 -19 cigs/day	≥ 20 cigs/day
No Neonatal Death	28107 (98.12)	5178 (98.22)	8026 (97.29)	4702 (96.97)
Odds Ratios	1.00	1.00	1.00	1.00
1 Neonatal Death	486 (1.70)	88 (1.67)	201 (2.44)	131 (2.70)
Odds Ratios	1.00	0.98	1.45	1.61
(95% CI)		(0.78 – 1.23)	(1.23 – 1.71)	(1.32 – 1.96)
2 or more Neonatal Deaths	52(0.18)	6(0.11)	22(0.27)	16(0.33)
Odds Ratios	1.00	0.63	1.48	1.84
(95% CI)		(0.27 – 1.47)	(0.90 – 2.44)	(1.05 – 3.23)
Total/category	28645(100.0)	5272(100.0)	8249(100.0)	4849(100.0)

Non-smokers and light smokers $\chi^2 = 1.22, P > 0.50$ (see text)/ All categories $\chi^2 = 45.02, P < 0.0001$ (see text)/ Cigs: cigarettes/*Reference category

Table 3: Distribution of Smoking Habits in Relation to Birth Weights

Birth Weight	Non-smokers*	< 10 cigs/day	10 -19 cigs/day	≥ 20 cigs/day
2.5 kg or less	2247(7.85)	580(11.02)	1225(14.87)	792(16.36)
Odds Ratios	1.00	1.00	1.00	1.00
2.6 – 2.9 kg	4255(14.87)	1041(19.78)	1884(22.87)	1147(23.70)
Odds Ratios	1.00	0.95	0.81	0.76
(95% CI)		(0.85 – 1.06)	(0.74 – 0.88)	(0.68 - 0.84)
3.0 – 3.3 kg	8625(30.14)	1679(31.90)	2669(32.39)	1502(31.03)
Odds Ratios	1.00	0.75	0.57	0.49
(95% CI)		(0.68 – 0.84)	(0.53 – 0.62)	(0.44 – 0.54)
3.4 – 3.7 kg	8257(28.85)	1261(23.96)	1725(20.94)	983(20.31)
Odds Ratio	1.00	0.59	0.37	0.34
(95% CI)		(0.53 – 0.66)	(0.34 – 0.40)	(0.31 – 0.38)
3.8 – 4.1 kg	3954(13.81)	568(10.79)	594(7.21)	333(6.88)
Odds Ratios	1.00	0.56	0.28	0.24
(95% CI)		(0.49 – 0.64)	(0.25 – 0.31)	(0.21 – 0.28)
4.2 or more	1281(4.48)	134(2.55)	142(1.72)	83(1.72)
Odds Ratios	1.00	0.41	0.20	0.18
(95% CI)		(0.34 – 0.50)	(0.17 – 0.24)	(0.14 – 0.23)
Total/category	28619(100.0)	5263(100.0)	8239(100.0)	4840(100.0)

All categories $\chi^2 = 1689.11, P < 0.0001$ (see text)/ Cigs: cigarettes/*Reference category

The data from the present study suggest that mothers who smoke have lighter babies than mothers who do not smoke. The differences were statistically highly significant ($\chi^2 = 1689.11, P < 0.0001$). Placental weight was divided into four subgroups of 400 g or less, (400 – 599) g, (600 – 799) g, and 800 g or more. Table 4 shows the distribution of smoking habits in regard to placental weight. The pattern of results is similar to that found for birth weight results and indicates that those babies born to smoking mothers have significantly lighter placental weight than those born to non-smokers ($\chi^2 = 145.20, P < 0.0001$).

The result of smoking habits and outcome with respect to mortality up to 28th days after birth is given in Table 5. This outcome mortality consisted of the perinatal deaths plus the deaths after 7 days until 28th days after birth. It was found that babies born to heavy smokers have the highest mortality rate, and the rate, gradually increases as smoking increases. The differences were highly significant ($\chi^2 = 34.89, P < 0.0001$). Our results show that there is no significant difference between non-smokers and light smokers ($\chi^2 = 0.01, P > 0.90$) and also no significant difference between moderate and heavy smokers ($\chi^2 = 0.15, P > 0.60$).

Table 4: Distribution of Smoking Habits with Respect to Placental Weight

Placental Weight	Non-smokers*	< 10 cigs/day	10 -19 cigs/day	≥ 20 cigs/day
400 g or less Odds Ratios	872(3.18) 1.00	209(4.18) 1.00	358(4.54) 1.00	199(4.32) 1.00
400 – 599 g Odds Ratios (95% CI)	11662(42.51) 1.00	2311(46.24) 0.83 (0.71 – 0.97)	3594(45.59) 0.75 (0.66 – 0.85)	2164(46.92) 0.81 (0.69 – 0.95)
600 – 799 g Odds Ratios (95% CI)	12393(45.18) 1.00	2144(42.90) 0.72 (0.61 – 0.84)	3327(42.21) 0.61 (0.54 – 0.69)	1909(41.39) 0.67 (0.57 – 0.79)
800 g or more Odds Ratios (95% CI)	2506(9.13) 1.00	334(6.68) 0.56 (0.46 – 0.68)	604(7.66) 0.59 (0.51 – 0.69)	340(7.37) 0.59 (0.49 – 0.71)
Total/category	27433(100.0)	4998(100.0)	7883(100.0)	4612(100.0)

All categories $\chi^2 = 145.20, P < 0.0001$ (see text)/ Cigs: cigarettes/*Reference category

Table 5: Distribution of Smoking Habits in Respect of the Outcomes (on the 28th day of life)

On the 28 th day of life	Non-smokers*	< 10 cigs/day	10 -19 cigs/day	≥ 20 cigs/day
Number of Lives Odds Ratios	28051(97.92) 1.00	5165(97.90) 1.00	8009(97.04) 1.00	4698(96.93) 1.00
Number of Deaths Odds Ratios (95% CI)	596(2.08) 1.00	111(2.10) 1.01 (0.82 – 1.24)	244(2.96) 1.43 (1.23 – 1.66)	149(3.07) 1.49 (1.24 – 1.79)
Total/category	28647(100.0)	5276(100.0)	8253(100.0)	4847(100.0)

Non-smokers and light smokers $\chi^2 = 0.01, P > 0.90$ (see text)/ Moderate and heavy smokers $\chi^2 = 0.15, P > 0.60$ (see text)/ All categories $\chi^2 = 34.89, P < 0.0001$ (see text)/ Cigs: cigarettes/*Reference category

Discussion

1) Smoking Habits and Previous Stillbirths and Previous Abortions

Källén (8) reported that maternal smoking during pregnancy is associated with a number of effects such as pre-term birth, intrauterine growth retardation, a small head circumference, and stillbirths and neonatal deaths. Their study is based on all births in Sweden during 1983-1996. The smoking habits of the mothers were recorded in three categories: non-smokers, <10 cigarettes/day and ≥ 10 cigarettes/day. The results showed the stillbirths risk estimates are 0.42% and 0.32% for smokers and non-smokers, respectively.

Högberg and Cnattingius (9) reported that maternal smoking during pregnancy is causally associated with stillbirth risk. They showed that compared with nonsmokers, women who smoked during the first pregnancy but not during the second do not have an increased risk of stillbirth (OR 1.02; 95% CI 0.79-1.30), while corresponding risk among women who smoked during both pregnancies was 1.35 (95% CI 1.15-1.58).

Gray et al. (10) studied the contribution of smoking during pregnancy to inequalities in stillbirth in Scotland from 1994 to 2003 and reported that smoking during pregnancy accounted for 38% of the inequality in stillbirths.

We studied the association of smoking during pregnancy and the incidence of previous stillbirths. It was found that (1). There is no significant difference between moderate and heavy smoking mothers with respect to previous stillbirths where the odds ratios vary from 1.20 (95% CI: 0.64 – 2.25) to 1.42 (95% CI: 0.69 – 2.94) for 2 or more previous stillbirths, and (2) there was no significant difference between non-smokers and light smokers (<10 cigs/day) with any previous stillbirths. ($\chi^2 = 2.38, P > 0.30$)

In a study (11) conducted in Montreal, Quebec, Canada, the researchers interviewed approximately 56,000 women who had had a delivery or a spontaneous abortion in 11 Montreal hospitals during the two-year period 1982-1984. The researchers found that 22% of the women had

had previous pregnancies that ended in spontaneous abortion. Compared with women who abstained during pregnancy, women who smoked cigarettes had a 20% increase in spontaneous abortion (odds ratio of 1.20) for each 10 cigarettes smoked per day.

A prospective study of maternal smoking and spontaneous abortion reported by Wisborg et al. (12) shows that they found no association between maternal smoking and the risk of spontaneous abortion. Nielsen et al. (13) has also reported that smoking status was only weakly related to spontaneous abortion after adjustment for maternal age.

The results of the present study show that the previous abortion is a significant factor for women who smoke 20 or more cigarettes per day. The odds ratios for the previous number of abortions of 1, 2 and ≥ 3 are 1.54 (95% CI, 1.42 – 1.67), 1.97 (95% CI, 1.70 – 2.28) and 2.86 (95% CI, 2.30 -3.55), respectively. No significant difference was observed between the light smokers (< 10 cigs/day) and non-smokers ($\chi^2 = 8.51, P > 0.036$).

2) Smoking Habits and Previous Neonatal Deaths

One of the early studies on smoking and pregnancy (14) reports the prospective survey of almost 7000 women from 11 Paris hospitals between 1963 and 1969. The results show while smokers had a stillbirth rate more than three times as high (28 versus 8 per 1000 births) they found that the neonatal death rates were almost the same for smokers and nonsmokers.

In a study (15) conducted in Sweden between 1983 and 1985, significant relative risks for early neonatal mortality were found for multiple births (4.9) and smoking (1.2). They concluded that maternal cigarette smoking may be the most important preventable risk factor for late fetal death.

The study (16) based on the number of stillbirths or neonatal deaths among infants born in Sweden from 1983 to 1995 showed that maternal smoking seems to aggravate the placental abruption because the death risk in the presence of abruption increases when mother smoked (OR = 1.74, 95% CI 1.45 – 2.08).

The present results show that there is no significant difference between non-smokers and light smokers with < 10 cigarettes per day ($\chi^2 = 1.22, P > 0.50$). For moderate and heavy smokers the odds ratios are up to OR = 1.84, 95% CI 1.05 – 3.23.

3) Smoking Habits and Birth Weight

In a study reported by D'Souza et al. (17) a total of 452 mothers who attended antenatal clinics regularly at St Mary's Hospital, Manchester, UK, were selected with a normal singleton pregnancy. At each visit the mothers were asked about the number of cigarettes smoked per day, and they were grouped as follows: (a) non-smokers, (b) light-to-moderate smokers, (1-14 cigarettes/day), and (c) heavy smokers (15 or more cigarettes/day). In both sexes babies born to non-smokers were heavier, longer, and had larger head circumferences than those born to heavy smokers. Smoking during pregnancy appears to have caused a general retardation in intrauterine growth, resulting in babies born with lower birth weights, shorter lengths, and smaller head circumferences. Dickute (18) reported a case-control study involved 851 newborns with low birth weight (<2500 g) and 851 normal weight newborns. The study started 1 February 2001 and ended 31 October 2002 in six main maternity hospitals in Lithuania. The results showed that smoking during pregnancy in combination with the socioeconomic inequalities is significantly associated with the higher risk of low birth weight. The Association of socioeconomic status with health and birth weight has been discussed by some authors (19-22). In a study in Illinois, USA, Keeton et al. (23) suggested that the Family Case Management Program may be effective in reducing very low birth weight and low birth weight rates among infants born to low-income women.

Chertok et al. (24) reported the prenatal smoking status of West Virginia, USA, women and the associated changes in infant birth weights. A population-based secondary data analysis was conducted for all singleton infant siblings born between 1989 and 2006. They found that infants born to women who smoked during pregnancy

had significantly lower birth weights than infants born to non-smokers. The results showed that maternal prenatal smoking was the strongest predictor of low birth weight (< 2500 g) with an odds ratio of 3.29 (95% CI 2.87, 3.77) for smoking during the recent pregnancy.

The odds ratio is significantly reduced from the birth weight of < 2.5 kg to => 4.2 kg for smoking mothers. The variation of odds ratio is from 0.95 (95% CI 0.85 – 1.06) to 0.18 (95% CI 0.14 – 0.23).

4) Smoking Habits and Placental Weight

Jones et al. (25) reported a study with the objective of determining whether maternal smoking during pregnancy is associated with bone mass and other growth variables in pre-pubertal children in Tasmania, Australia. They showed that the mothers who smoked during pregnancy had lower placental weight (- 56 g, 95% CI - 95 to - 17).

Mortensen et al. (26) reported the study conducted in the County of North Jutland, Denmark. They examined the association between mothers' smoking habits during pregnancy, taking the sex of the offspring into consideration, and the risk and prognosis of placental abruption, placenta previa, and preeclampsia. The results showed that smoking was associated with the risk of placental abruption (OR=1.99, 95% CI 1.72–2.30) and placenta previa (OR=1.88, 95% CI 1.15–3.07).

The effect of maternal smoking on placental volume was studied (27) in 80 pregnancies categorized according to cigarette consumption: group A never smoked, B smoking < 10 cigarettes/day, C smoking 10-20 cigarettes/day, and D smoking > 20 cigarettes/day. The three-dimensional power Doppler ultrasonography of the placenta was performed in this study and the results showed no differences in placental volume among different groups.

Our results show that there is no significant difference between different smoker categories. The odds ratios for heavy smokers (>20 cigs/day) are 0.81 (95% CI: 0.69 – 0.95), 0.67 (95% CI: 0.57 – 0.79) and 0.59 (95% CI: 0.49 – 0.71) for the placental weight groups of 400 – 599 g, 600 – 799 g and =>800 g, respectively.

5) Smoking Habits and Outcomes on the 28th Day of Life

The perinatal mortality (PNM) has been defined (28) as the total number of stillbirths and deaths in the first week of life (early neonatal deaths). The sudden infant death syndrome (SIDS) happens usually with no known illness and typically affecting sleeping infants between the ages of two weeks to six months. There are numerous studies of the effects of maternal smoking on SIDS.

Schoendorf and Kiely (29) reported the results of a case-control analysis performed on data from the 1998 US National Maternal and Infant Health Survey (NMIHS). They showed that sudden infant death syndrome (SIDS) is associated with maternal smoking during pregnancy. However, the relationship between tobacco exposure during infancy and SIDS is unknown. Chong *et al.* (30) have shown that maternal smoking during pregnancy remains the most important risk factor for SIDS in Sweden.

In the present study we defined the outcome of pregnancy as whether the infant was alive on the 28th day of life. We considered the total number of infants' deaths as the sum of stillbirths and neonatal deaths (early neonatal: within the first 7 days of life and late neonatal: after 7 days until 28th day). A total of 47023 infants were followed up for 28 days after birth. The outcomes on the 28th day were 45923 (97.66%) lives and 1100 (2.34%) deaths. The odds ratios were 1.01 (95% CI 0.82 – 1.24), 1.43 (95% CI 1.23 – 1.66) and 1.49 (95% CI 1.24 – 1.79) for light smokers (<10 cigs/day), moderate smokers (10 – 19 cigs/day) and heavy smokers (≥ 20 cigs/day), respectively. It was found, firstly, that babies born to moderate and heavy smokers have the highest mortality rate. Secondly, there were no significant differences between non-smokers and light smokers ($\chi^2 = 0.01, P > 0.90$) or between moderate and heavy smokers ($\chi^2 = 0.15, P > 0.60$).

Conclusions

The association of smoking habits of mother during pregnancy investigated with the stillbirths,

abortions, neonatal deaths, birth weights, placental weights and the outcomes on the 28th day of life. The smoker mothers were classified as light smokers (less than 10 cigarettes per day), moderate smokers (between 10 and 19 cigarettes per day) and heavy smokers (20 or more cigarettes per day). The results show that even the light smoking habit has an effect on the birth weight and the placental weight but for other characteristics, stillbirth, abortion, and the outcomes on the 28th day of life, there is no significant difference between light smokers and non-smokers. While quit smoking must be the ultimate goal for any smoker, the present study concludes that moderate and heavy smokers should reduce their number of cigarettes per day to at least the level of light smokers to achieve the same results for non-smokers.

Ethical considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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