

Prevalence and Effect of Cigarette Smoking in Pregnancy and Pregnancy Outcomes

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Abstract

Objective: The objective of this study to ascertain if smoking to 10 cigarettes daily during pregnancy has an effect on the perinatal outcome and the laboratory parameters of pregnant women and their newborn.

Methods: The prospective study included 128 healthy pregnant women with equivalent parameters (normal course of pregnancy without a single pathological clinical or laboratory result). They were divided into groups according to whether they smoked (84 women) during pregnancy or not (44 women). The parameters which were taken into consideration were the following: course of pregnancy, method of delivery, smoker, body mass index (BMI), weight gain, length of breastfeeding, laboratory tests, which included blood (erythrocytes, leukocytes, hemoglobin), CRP, bilirubin, ferritin and iron.

Results: During the month of study, 183 pregnant women were born in maternity ward. The study included a total of 128 pregnant women and their newborn. Cigarettes consumed 89/183 pregnant women (48%). There are no statistically significant differences in the analyzed parameters between the two groups of pregnant women (delivery, weight gain, BMI, birth weight, breastfeeding) and the corresponding parameters of their newborn.

Conclusion: Despite all the recommendations on smoking hazards during pregnancy, the number of pregnant women who smoke is still high in the area covered by the research. Pregnant women who smoke should be cautioned that they are exposing their child to the toxic compounds of cigarette tobacco and informed of the possible detrimental effects their actions may have on their child, without the child's consent.

Keywords: Smoking; Pregnancy; Newborn; Ferritin; Breastfeeding

Introduction

Approximately one quarter to one third of all women of a reproductive age, including pregnant women, smoke cigarettes [1]. The prevalence of smoking during pregnancy differs significantly from country to country. In many developed countries, it appears that the frequency is decreasing, whereas in others smoking is becoming more common in the younger female population [2]. Epidemiological studies speak of a frequency of 25% of smokers in Croatia [3] and Poland [4], whereas in France, it was indicated that approximately 50%

of pregnant women attempted to stop smoking during pregnancy unsuccessfully [5]. Only one fifth to one quarter of them will stop smoking during pregnancy and breastfeeding, and two-thirds of them will continue smoking after this period. There is, however, increasingly more evidence about the detrimental effects of smoking on offspring. Yet, smoking remains a widespread phenomenon in our country and world-wide [6].

Smoking has multiple effects on reproductive health. Smoking in pregnancy is connected to an adverse perinatal outcome, such as the increase in the incidence of miscarriage, premature births [2], a lower birth weight of the newborn, an increase in intrauterine growth retardation, a lower vitality score, a more difficult and longer period of adaptation of the newborn [7], as well as a shorter breastfeeding period in comparison to pregnant women who do not smoke [8]. All existing complications in pregnancy, childbirth and in the newborn are directly proportional to the number of cigarettes smoked on a daily basis. The highest number of pathological states in pregnancy connected to smoking is caused by fetal hypoxia due to the decrease of uteroplacental circulation and the production of carboxyhemoglobin [9]. Chronic smoking in pregnancy has been particularly well researched with respect to perinatal outcome and long-term postnatal consequences of perinatal events, which include hypocarbia, placental insufficiency and intermediary metabolism disruption. *Fetal tobacco syndrome* has been defined in pregnant women who are chronic smokers (> 15-20 cigarettes daily), which besides multiple complications during pregnancy and delivery include small formation, with a 30% increased incidence of perinatal mortality and morbidity [10]. The test results of maternal smokers show a lower concentration of hemoglobin, hematocrit and iron, whereas no effect on the concentration of C-reactive proteins (CRP), ferritin and transferrin receptors has been indicated by a study published in 2016 [11]. The longer the exposure to smoking and the more cigarettes smoked daily lead to fetal hypoxia and the development of anemia in pregnant women, with the assumption that their newborn will have an adverse perinatal outcome and their later development will be jeopardized in comparison to children of mothers who do not smoke [12]. It is obvious that smoking is harmful. This is all the more dramatic as it can cause many disorders in newborn infants without their free consent to be exposed to the toxic effects of tobacco [7]. Taking into consideration the numerous negative effects of smoking in pregnancy, campaigns to suppress its incidence have become the most important preventive measures for the protection of children's health.

Objective

The objective of this study to ascertain if smoking to 10 cigarettes daily during pregnancy has an effect on the perinatal outcome and the laboratory parameters of pregnant women and their newborn.

Methods and Participants

The study was conducted at the Clinic for Gynecology and Obstetrics at the University Clinical Hospital Mostar (UCH) during one month in 2014. This cohort study included all the healthy pregnant women who were hospitalized for the purposes of delivery or 24 - 48 hours prior to term and accommodated for 48 hours after delivery. During one month in the hospital for deliveries, 183 pregnant women reported. The study excluded all who had complications during pregnancy or smoked more than 10 cigarettes a day. The prospective study included 128 healthy pregnant women with equivalent parameters (normal course of pregnancy without a single pathological clinical or laboratory result). They were divided into groups according to whether they smoked during pregnancy or not. The first group contained 84 pregnant women who smoked to 10 cigarettes daily before pregnancy and during pregnancy. The second group contained 44 pregnant women who neither smoked before pregnancy nor during pregnancy, and whose partners did not smoke. The study excluded all pregnant women who developed complications, who were administered antibiotics or blood products before delivery, and those that had pathological states (hypertension, diabetes), infections, rheumatism and intestinal diseases. Furthermore, all pregnant women who consumed alcohol and other possibly harmful toxic substances were excluded from the study. The group of women who did not smoke during pregnancy excluded those who had smoked prior to pregnancy but stopped smoking during pregnancy, as well as those whose husbands were smokers.

All participants gave informed written consent to participate in the study for themselves and their newborn, which have been appropriately archived. The study was conducted with the approval of the Ethics Committee at UCH Mostar, which has been documented.

The parameters which were taken into consideration were the following: course of pregnancy, method of delivery, smoker, body mass index (BMI), weight gain, length of breastfeeding, laboratory tests, which included blood (erythrocytes, leukocytes, hemoglobin), CRP, bilirubin, ferritin and iron. The pregnant women’s BMI was calculated a couple of days or hours prior to delivery.

The study also included and divided the newborn into two groups according to whether their mothers were smokers or not. The study excluded all the children with complications at birth (aspiration of meconium, infections, asphyxiation, hemorrhaging). The parameters which were taken into consideration with respect to the newborn were: gestational age, birth weight, vitality, CRP, ferritin, iron, bilirubin. 2 ml of venous blood was taken from the pregnant women and placed in glass test-tubes without anticoagulants. 2 - 3 ml of blood from the umbilical cord was taken from the newborn (ferritin, iron, CRP) and 2 ml of venous blood in the first 24 hours of life (blood sample). At the UCH Mostar laboratory, CRP was measured from the serum of venous blood by an immuno turbidimetric test for latex particles and was measured by an Olympus AU 680 analyzer. Iron values were determined in the laboratory using a bichromatic photometric test on an Olympus AU 680 analyzer. Ferritin values were determined using an immuno-chemical method on a Vitros eci analyzer. The 2 ml blood count sample was placed in a test tube with anticoagulant (EDTA). A Bilitest device, which detects bilirubin values in blood through the skin, was used to determine the bilirubin values.

Statistical analysis

The results are expressed by the following measures: absolute and relative frequency, mean (M) and standard deviation (SD), median (C) and inter quartile range (IQ).The following tests were used to determine the significance of differences between the groups: chi-square (χ^2) test, Fisher’s exact test (in the absence of the expected frequency), Student’s t test for independent samples and the Mann-Whitney U test. The limit of significance was set at $p = 0.05$ and p values that could not be expressed to three decimal places are reported as $p < 0.001$.

Results

During the month of study, 183 pregnant women were born in maternity ward. The study included a total of 128 pregnant women and their newborn. Cigarettes consumed 89/183 pregnant women (48%). 55 pregnant women were excluded from the study for complications during pregnancy or smoked more than 10 cigarettes a day (5 pregnant women). The control group contained 44 pregnant women who did not smoke, whilst the case group contained 84 pregnant women who smoked during pregnancy. The average age of the pregnant women was 30 years of age. The Apgar score of all the newborn was 9/10. Not a single newborn was treated at the ICU. The newborn that had higher concentrations of bilirubin were treated in the maternity ward in the first days of life with phototherapy.

Table 1 shows the distribution of the two groups of pregnant women according to method of delivery, weight gain in pregnancy, BMI, birth weight of newborn, and duration of breastfeeding.

Parameters	Groups		p
	NS (n = 44)	S (n = 84)	
Manner of birth			
Natural	27 (61.4)	65 (77.4)	0.056§
Caesarea	17 (38.6)	19 (22.6)	
BMI (body mass index)	21 [4.45]	20.8 [3.15]	0.412‡
weight gain in pregnancy(kg)	15 [7.0]	14 [7.5]	0.079‡
Birth weight (g)	3198.6 ± 296.7	3266.1 ± 331.9	0.260†
duration of breastfeeding a (month)	5.5 [6.0]	4 [11.0]	0.304

Table 1: Distribution of the tested pregnant women in the whole sample and in groups with respect to manner of birth, weight gain in pregnancy, body mass index, duration of breastfeeding and the newborn’s, birth weight.

NS: no smoking; S: smoking

Results are shown as n (%), Mean ± SD or Median [IQ]

† Student’s t test for independent samples; ‡ Mann-Whitney U test; §Chi-square test

There are no statistically significant differences in the analyzed parameters between the two groups of pregnant women and the corresponding parameters of their newborn.

Table 2 shows the distribution of individual laboratory parameters (ferritin, iron, CRP, erythrocytes, leukocytes and hemoglobin) and bilirubin in the two groups of pregnant women and their newborn.

Parameters	Groups		p
	NS (n = 44)	S (n = 84)	
Pregnant women			
CRP (C reactive protein)	7 [6.5]	6.3 [6]	0.864 [‡]
Bilirubin	7 [4.5]	7 [4]	0.322 [‡]
iron	12.5 [8.6]	12.8 [7.3]	0.796 [‡]
Ferritin	15.4 [10.3]	15.1 [11]	0.974 [‡]
Erythrocytes	3.9 [1]	3.9 [0.9]	0.603 [‡]
Leukocytes	8.9 [3.1]	8 [3.1]	0.124 [‡]
Hemoglobin	109 [20.5]	113.5 [23]	0.189 [‡]
Newborn			
CRP	5.3 [6.6]	4.2 [5.6]	0.164 [‡]
Bilirubin	200 [120]	160 [104.5]	0.013 [‡]
iron	27 [12.5]	27 [8.3]	0.794 [‡]
Ferritin	171 [142.7]	130 [100]	0.569 [‡]
Erythrocytes	4.8 [1]	4.7 [1.1]	0.980 [‡]
Leukocytes	18.7±3.1	18.1±2.9	0.287 [†]
Hemoglobin	132 [18.5]	134 [17]	0.474 [‡]

Table 2: Comparison of values of iron, bilirubin, CRP, ferritin and blood count in the serum of the newborn and two studied pregnant women.

NS: no smoking; S: smoking

Results are shown as Mean ± SD or Median [IQ]

† Student's t test for independent samples; ‡ Mann-Whitney U test

The concentration of bilirubin is significantly higher in the newborn of the pregnant women who did not smoke ($p < 0.05$). With respect to the other parameters there are no significant differences between the two groups of pregnant and women and their newborn.

Discussion

From a public health perspective, tobacco smoking and an increased BMI during pregnancy represent the most important variable risk factors for an adverse perinatal outcome [13]. Our results show that out of the total number of pregnant women 48 % consumed cigarettes. This is a very worrying fact. Considering the awareness of smoking hazards. Which is similar to other research [3,4]. Tobacco smoking is one of the greatest threats to man's health which can be prevented and eliminated. Today, tobacco products are recognized as the main cause of morbidity and mortality in humans from conception to old age [14]. Smoking during pregnancy influences the retardation of fetal growth, which results in the birth of children with a low birth weight for their gestational age and a lower average body mass. Smoking more than 15 cigarettes a day during pregnancy results in the reduction of the body mass of the newborn by 411 grams, according to research conducted in B&H in 2006 [9]. Our results indicate that the average weight of the newborn was 3200 grams, which can be

connected to the lower number of cigarettes smoked daily by the pregnant women in our study. Smoking also causes an increase in the heartbeat rate of the fetus, which is caused by an increase in the catecholamine level, leading to an increase in the frequency of surgical deliveries in pregnant women who smoke as indicated by a study in Israel in 2014 [15]. Our research shows that mothers who smoked breastfed for a shorter period of time, which may have been caused by a lower quantity of milk, and thus the lactation period is of a shorter duration. Smoking causes unfavorable changes in breast milk. Besides a decrease in protective qualities, it also affects the newborn's response to breastfeeding and its desire for breast milk [8]. The connection between smoking and the duration of breastfeeding has not been confirmed, and the psycho-social factors may affect the decision to stop breastfeeding in women who smoke [16].

By analyzing the effect of cigarette consumption on the course of pregnancy, the results show that smoking does not affect the concentration of ferritin, iron and CRP in pregnant women and their newborn. However, both groups of pregnant women have low levels of hemoglobin. In contrast to our study, a study conducted in Poland indicates that smoking causes lower concentrations of iron, erythrocytes and hemoglobin in pregnant women, without any influence on the concentrations of CRP and ferritin [11]. However, a study conducted in Kansas suggests that smoking during pregnancy leads to an increase in the concentration of iron in pregnant women, whilst their newborn have indications of sub-clinical anemia [12], while both groups of pregnant women from our study have a low value hemoglobin, a infants do not have signs of anemia. Some researchers have noted the tendency of a decrease in concentrations of hemoglobin, hematocrits and iron during long periods of exposure to smoke and a higher number of smoked cigarettes daily [17]. The conclusion of this research is that pregnant women who smoke, perinatal outcome and laboratory parameters are probably correlated with the number of smoked cigarettes daily. Nevertheless, it is necessary to warn all pregnant women that by smoking they expose their child to risk and that the consequences of their smoking will be evident during early and late childhood. Therefore, it is necessary to channel prevention campaigns against the consummation of nicotine products towards all females, future pregnant women and mothers.

Conclusion

Despite all the recommendations on smoking hazards during pregnancy, the number of pregnant women who smoke is still high in the area covered by the research. Although this study did not determine a direct effect of smoking on the tested parameters at the early neonatal stage, pregnant women who smoke should be cautioned that they are exposing their child to the toxic compounds of cigarette tobacco and informed of the possible detrimental effects their actions may have on their child, without the child's consent.

Conflict of Interest

The manuscript has not been published or submitted for publishing elsewhere, the manuscript has been read and approved by all the authors, and there is no any financial or other conflict of interest.

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