

Effect of Magnetic Fields during Pregnancy on Fetal Growth and Preterm Labor: A Review Article

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Abstract

Background

Low birth weight is one of the most important health indicators in evaluating pregnancy care worldwide. We aimed to evaluate the effect of cell phones used in pregnancy on fetal growth and preterm labor.

Materials and Methods

The search process included screening the relevant articles on electronic databases of Scopus, EMBASE, Cochrane, Web of Science, and Medline to analyze the association of maternal exposure to magnetic fields with fetal growth, birth weight, small-for-gestational-age (SGA), and preterm labor.

Results

In the first study, the duration of pregnancy was shorter for mothers using cell phones for more than one hour per day than those use shorter than one hour. In the second study, the intermediate use of cell phones by mothers indicated an increased risk of preterm birth. In the third study, the birth weight were lower in excessive cell phone users than normal status. In the fourth study, low, medium, and high cell phone exposure during the six months before conception had no effect on low birth weight, preterm birth, and SGA. In the fifth study, a negative correlation was observed between magnetic fields expose during pregnancy and the birth week, birth weight, and birth length of the newborn. In the sixth study, the risk of low birth weight, preterm birth, and SGA was close to null. In the seventh study, dental radiography during pregnancy was associated with low birth weight, specifically with term low birth weight.

Conclusion

In general, there are contradictory findings on the impact of cell phone exposure during pregnancy. These results should be interpreted with caution because of the small sample size and recall bias.

Key Words: Cell phone, Growth, Magnetic Fields, Pregnancy, Preterm Labor.

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1- INTRODUCTION

Birth weight is an important indicator of infant health and reflects the quality of fetal growth. According to the World Health Organization (WHO), the normal birth weight for newborns is between 2500 and 4000 g, and the infants weighing less than 2500 grams fall into the group of low birth weight (LBW) infants. The rate of low-weight births is one of the most important health indicators in any country (1). The LBW is an important determinant of neonatal mortality. This problem, which is caused by factors such as preterm birth, intrauterine growth restriction (IUGR), or both, is three times higher in such infants than in those with normal weight. The main cause of LBW is preterm birth in Western societies and the United States, but often IUGR in developing countries (1). The development of power plants, radio, radar, television, computers, microwaves, ovens, countless medical devices, and cell phones has exposed people to low-frequency ionizing radiation (2). Cell phones are now one of the most widely used electromagnetic wave-emitting devices, easily accessible to almost half of the world's people of all ages. The expansion of cell phone networks and the variety of services provided by service providers, such as short message servers, easy-to-send images, movies, and simple and rapid electronic payments, have led to an increase in public acceptance of using these devices. Therefore, today, the cell phone is no longer a luxury device but one of the necessary tools for the daily life of people (3). Among the age groups using this device, pregnant women are more exposed to the side effects of this communication device than others due to their special conditions. The cell phone technology operates in the range of microwave frequency (300 MHz to 300 GHz) based on its electromagnetic radiation. The cell phones often have

electromagnetic radiation, which appears to be safe because of the non-ionizing nature of their waves (3). However, there have been recent reports on the abnormal effects of these waves on various developmental processes, which have raised many concerns about the detrimental effects of the waves emitted by cell phones on human health (4). Some maternal factors, including cell phone exposure during pregnancy, multiple pregnancies, maternal age, maternal smoking during pregnancy, and primiparity have been reported to be associated with neonatal birth weight (5); however, the relationship between many other factors and birth weight is still unclear (6). Cell phones are also one of the devices that emit low levels of radiofrequency (RF) in the microwave range (7). There are currently more than 3.5 Billion cell phone users in the world. These cell phones generate different frequencies in various countries and continents. Exposure to RF energy depends on the frequency of cell phones.

Analog, digital, and third-generation phones generate frequency ranges of 450-900 MHz, 850-1900 MHz, and 2000 MHz, respectively (8). According to the Ministry of Health, Labor, and Welfare, the mean neonatal birth weight in Japan reduced from 3.15 kg for girls and 3.24 kg for boys in 1975 to 2.96 kg for girls and 3.04 kg for boys in 2014 (5). Shirai et al. (2016) showed that the electromagnetic waves did not affect fetal development and the course of pregnancy in pregnant rats. However, animal studies have shown that the exposure to cell phone waves of 940 MHz increases the number of micronucleus in peripheral blood erythrocytes in 2-day-old infants and their mothers. However, no increase in the number of micronuclei was observed in 18.5-day-old embryos and their mothers (4). A review of four studies examining the effects of using RF waves on neonatal growth and preterm birth

revealed contradictory results (2, 5, 9, 10). Due to the very limited and contradictory results regarding the effect of cell phone electromagnetic waves during pregnancy on neonatal growth and preterm birth, the present study aimed to evaluate the effect of cell phone use in pregnancy on fetal growth and preterm labor.

2- MATERIALS AND METHODS

The search process was to screen the relevant articles on electronic databases of Scopus, EMBASE, Cochrane, Web of Science, and Medline to analyze the association of maternal exposure to magnetic fields with fetal growth, birth weight, small-for-gestational-age (SGA), and preterm labor. Meta-analysis was not conducted regarding the difference in the included studies, study designs, lack of control groups in some studies, sample size, type of intervention used, duration of treatment, and duration of follow-up.

3- RESULTS

Seven studies were finally included in this research. In a study by Col-Araz, the duration of pregnancy was shorter for mothers using cell phones for more than one hour per day than that of mothers talking shorter than one hour. The use of cell phones (OR=2.5, 95%CI=1.1-5.7, $p<0.035$) affects birth weight (2). In a study by Tsarna et al., the intermediate use of cell phones by mothers during pregnancy had an increased risk of preterm birth; however, it did not affect fetal growth or birth weight (9). In a study by Lu et al., birth weight and birth chest circumference were less in maternal excessive cell phone users than normal status (5). In a study by Valborg Baste et al., the adjusted RR showed that low, medium and high cell phone exposure during the six months before conception had no effect on low birth weight, preterm birth and SGA (10). Karusercil et al. observed a negative correlation between

multiple mobile phones (more than a mobile phone) usage during pregnancy and the birth week, birth weight, and birth length of the newborn. A negative correlation was observed between the head circumference of the newborn and watching television (TV) and living close to a base station during pregnancy (11). In the sixth study, the risk of LBW, preterm birth, and SGA was close to null (10). In the seventh study, dental radiography during pregnancy is associated with low birth weight (odds ratio:2.27), especially with term low birth weight (odds ratio:3.61) (12).

4- DISCUSSION

To the best of our knowledge, this is the first review article to examine the effect of magnetic fields during pregnancy on fetal growth and preterm labor. The birth weight and preterm birth are affected by fetal, placental, maternal, and environmental factors (11, 12). In a study by Col-Araz, pregnancy duration was shorter for mothers using cell phones for more than one hour per day than that of mothers talking shorter than one hour. Therefore, it is seen that that cell phone use (OR=2.5, 95%CI=1.1-5.7, $p<0.035$) affects birth weight (2). In a study by Tsarna et al., the intermediate use of cell phones by mothers during pregnancy had an increased risk of preterm birth; however, the intermediate application of cell phones did not affect fetal growth or birth weight (9). In a study by Lu et al., birth weight and birth chest circumference were lower in maternal excessive cell phone users than normal status (5). In a study by Valborg Baste et al., the adjusted RR showed that low, medium, and high cell phone exposure during the six months before conception had no effect on low birth weight, preterm birth, and SGA (10). There are contradictory findings regarding the impact of using cell phones during pregnancy on fetal growth and preterm labor. Only one study found beneficial

effects on infant development. In a study by Papadopoulou et al., children whose mothers used a cell phone in early pregnancy compared to children with non-exposed mothers reported fewer problems with sentence complexity and motor skills at the age of three years (13). Sudan showed a significant increase in emotional and behavioral problems in children aged 7 and 11 years whose mothers used a cell phone in pregnancy (OR=1.36, 95% CI=1.14 -1.63) (14). Choi et al. (2017) reported no association of cell phone use in pregnancy with child psychomotor development index (PDI) and mental development index (MDI) at months 6, 12, 24, and 36 (15). Divan et al. (2008) found behavioral disorders at the age of 7 years in children whose mothers used cell phones during pregnancy (16).

The depression and state-trait anxiety levels are higher, and sleep quality is poorer in cell phone users. The results also exhibited texting and digital audio player dependence when compared with ordinary users (17). In a study, the levels of anxiety and dependency were enhanced with daily cell phone exposure, and a nighttime awakening showed a high rate, thereby affecting the sleep. Lu et al. found that mental disorders and maternal health can result in low birth weight and neonatal health, probably necessitating infant emergency transport (18). This review study involves some limitations as most of the studies reviewed had a small sample size. Hence, future studies are recommended to have a sufficient sample size and examine the effects of confounding factors such as recall bias.

5- CONCLUSION

Contradictory findings are available about the effect of prenatal cell phone exposure on fetal growth and preterm labor. Thus, these findings should be

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interpreted with caution regarding the limitations due to the small sample size and recall bias.

6- CONFLICT OF INTEREST: None.

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