Journal of Family Medicine and Primary Care
Official journal of the Academy of Family Physicians of India
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J Family Med Prim Care. 2018 May-Jun; 7(3): 511–514.
doi: 10.4103/jfmpc.jfmpc_311_17
PMCID: PMC6069651
PMID: 30112299

Ultraviolet radiation and its effects on pregnancy: A review study

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Abstract

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Seasons and Vitamin D are factors that are directly and indirectly related to ultraviolet (UV) radiations and can affect pregnancy. Therefore, the present study

aims at investigating the effects of being exposed to direct UV radiation during pregnancy period and its effects on fetal growth, premature birth, and high blood pressure. This study was conducted by searching different websites such as Medline, Embase, ProQuest, Global Health, Google Scholar, and Scopus. Of the 430 papers found, between 1985 and 2017, seventeen related articles were used. The results showed that being exposed to UV radiation during the first 3 months of pregnancy is associated with improved fetal growth and causes high blood pressure during pregnancy. The literature shows that being women exposure to UV radiation had beneficial effects on fetal growth and blood pressure during pregnancy period. However, since this issue has not been extensively studied in the past, the results from previous studies should be generalized with extreme care and caution. Therefore, it is suggested that further studies be carried out in this area.

Keywords: Fetal growth, gynecology, pregnancy, ultraviolet radiation

Introduction

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Proper development and growth of the fetus and the presence of diseases is related to weight at birth, the length of pregnancy, and geographical location.[1,2,3] A significant relationship has been found between premature birth, low birth weight at birth, and season with the immune system, infections, Vitamin D, and hormone paths.[4,5] Meteorologically, using different seasons as a variable has some special limitations. Seasons are not just a meteorological phenomenon, but they are related

to psychological, biological, and behavioral effects, and it also affects ovulation rate and pregnancy.[6] Although the relationship between pregnancy and seasons is interesting, it is the ultraviolet (UV) radiation that plays the main role in seasons and its amount is variable and different in different seasons.[7,8] UV radiation is classified into the three spectrums, i.e., A, B, and C. The whole UV spectrum varies from 290 to 400 nanometers. The A spectrum varies from 315 to 400 nanometers and B from 290 to 315 nanometers. The determinants of being exposed to UV radiation are as follows: how the sun shines toward the earth, calendar time and date, altitude of the geographic location, degree of cloud coverage, and being close to coasts. People's behavioral factors can also determine the effectiveness of UV radiation. These factors include how people dress, the amount of time spent outside the home, and using sunscreen.[9] The mortality rate associated with cardiovascular diseases in adults who are less exposed to the sunlight is higher in winter and in high places.[10,11,12,13]

Increasing UV exposure during pregnancy is associated with an increase in MS and schizophrenia in adult children.[14] Palacios *et al*. and Wei *et al*. in two separate meta-analysis studies showed that lack of vitamin D which is a main indicators of being less exposed to the sunlight is related to low eight at birth, premature birth, preeclampsia (pregnancy poisoning), and pregnancy diabetes.[15,16]

There are also reliable biological paths that support the relationship between the results of UV radiation and pregnancy, which are independent of Vitamin D path.

J Family Med Prim Care

For example, clinical studies have shown that sunlight, especially UVA, has direct effects on vascular health and reduces blood pressure through the release of nitric oxide from the skin.[17] Being exposed to UVA for 20 min causes a 3.5 mmHg reduction in the average systolic arterial pressure and 4.9 mmHg in the diastolic blood pressure in healthy adults.[17] In the animal sample, the beneficial effects of UVA exposure on the immune system and metabolic systems have been confirmed. When exposed to UV radiation, the weight of mice fed with high-fat diets was 40% lower and had fewer metabolic disorders and less fasting glucose, insulin, and glucose intolerance.[18]

In the present study, it is assumed that UV radiation can affect pregnancy. Therefore, the objective is to review the literature on the relationship between UV radiation and the results of pregnancy, including weight at birth, the length of pregnancy, premature birth, and high blood pressure complications.

Methods

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We take into consideration those studies in which exposure to sunlight has been reported. These measurements include direct and indirect exposure to sunlight and UV radiation. These studies were conducted from 1985 to 2017. In the present study, the search was done in different websites such as Medline, Embase, ProQuest, Global Health, Google Scholar, and Scopus. Of the 430 papers found, between 1985 and 2017, seventeen related articles were used.

J Family Med Prim Care

The effect of being exposed to ultraviolet radiation on the growth of the fetus

Five studies showed that UV radiation exposure has positive effects on fetal growth. All these studies used government information system at birth to determine these effects. Three studies directly investigated weight at birth.[19,20,21] and two studies considered the length of pregnancy.[22,23] Different methods had been considered to measure UV radiation and the duration of exposure. The incidence of low weight at birth (<2500 g) and its correlation with average annual UV index was investigated by Thayer in a cross-sectional study in America. The results showed that higher average annual UV index was related to lower birth weight. Tustin *et al*. and Waldie *et al*. both reported the relationship between average birth weight and average hours of sunlight exposure and found a positive correlation between exposure to sunlight and weight in the first 3 months.[20,21] Waldie *et al*. used spectrum analysis to compare average monthly birth weight fluctuations with average monthly sunlight fluctuations and showed that, in the pattern of these fluctuations, the peak of birth weight is related to the peak of sunlight during the first 3 months of pregnancy.[21] Tustin *et al*. tested exposure to sunlight during the first 3 months of pregnancy as a hypothesis. They investigated 903 births who had been exposed to sunlight at peak hours of radiation during the first 3 months of pregnancy and observed a 67.9 g increase ($P < 0.05$) in weight at birth.[20] Pereira

et al. and Walter (2004), however, did not find a significant relationship between exposure to sunlight during the whole period of pregnancy and weight after birth. [23]

Premature delivery and ultraviolet radiation

A relationship between pregnancy length and UV has been reported in only one study in 2007. Thayer investigated the relationship between UV and premature delivery rate in America. Methodologically, the study was similar to the study conducted on low weight birth.[19] Similarly, they found that premature delivery both in white and black women increases as average annual UV index increases. [19] A positive relationship was found between state UV index and poverty factors that limit the applications of these results.[19]

High blood pressure and ultraviolet radiation

Only two studies investigated the relationship between pregnancy high blood pressure complications and UV, and they assumed that the peak of exposure to sunlight during the first 3 months of pregnancy is critical in causing complications associated with high blood pressure.

Algert *et al*. reviewed a study in Australia which had investigated 424,732 births. Further exposure to sunlight during the first 3 months and less exposure to sunlight

in the third 3 months are strongly related to the risk of pregnancy high blood pressure.[24]

Tran *et al*. reviewed a comprehensive study in France that had investigated 63,000 births and in which the incidence of acute preeclampsia (pregnancy poisoning) was 526 cases. During the first 3 months of pregnancy, high exposure to UV radiation increases acute preeclampsia but not significantly.[25] Both studies used direct regional government measurement of UV in sunlight in Megajoule (MJ) per square meter for the time period of first 3 months of pregnancy. Algert (2010) used a region but Tran used the daily average of the two regions[24,25]

Conclusions

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The present study is a review of the effects of UV radiation on birth consequences and pregnancy complications. Despite the importance of such a study, few studies were available to be able to extract more general results. Despite the scarcity of studies in the area, the studies showed that exposure to UV during the first 3 months of pregnancy is beneficial for the growth of the fetus. On the other hand, UV radiation causes pregnancy blood pressure to increase. In the present review, the effects on fetal growth due to exposure to UV are not contradictory, but methodological limitations force us to apply the results with extreme care and caution. Fetal growth may be affected by exposure to UV radiation, and the review studies by Pérez-López *et al*. and Wei *et al*. lend support to the conclusion. In their

J Family Med Prim Care

review studies, the data for Vitamin D and pregnancy showed similar relationships between early and mid-pregnancy defects and fetal growth limitations.[16,26] The two studies conducted in New Zealand showed beneficial effects for exposure to UV in the first 3 months of pregnancy, while neither Elter (2004) nor Pereira *et al*. reported these beneficial effects in areas with low altitudes in the two countries of Turkey and Australia.[20,21,22,23] Regarding cardiovascular complications and diseases in adults, the effects of UV have been identified. Less exposure to UV causes high blood pressure in people.[11,27,28,29] High blood pressure in common among 10% of pregnant women, and it is an important and significant factor in infants and mother mortality rates.[30] Nitric oxide path has been identified by Liu (2014). During exposure to UV, nitric oxide is released from the skin, and nitric oxide is a central signal for vascular compatibility and also causes the growth of the fetus during pregnancy.[31,32] Nitrate donors such as L-arginine, sildenafil, and isosorbide mononitrate are used in clinical cases to prevent preeclampsia in fetal growth limitation.[33,34] Less exposure to in the third 3 months of pregnancy is associated with pregnancy high blood pressure.[24,25]

Conclusions

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Optimizing pregnancy conditions is vital to the health of future generations. Sunlight is considered an important environmental variable in eliminating public health worries since Vitamin D supplement tests during pregnancy continue to show negative effects on pregnancy. This review study showed the effects of UV radiation

J Family Med Prim Care

on pregnancy consequences in 7 studies, and exposure to UV radiation was found to be an explanatory variable. Few studies and little evidence exist in support of the effects of UV exposure on pregnancy. Therefore, it is suggested that further studies be conducted, so that their results can be used with a higher degree of certainty.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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J Family Med Prim Care

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J Family Med Prim Care

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