学位論文の要旨

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学位論文名　Relationship Between Environmental Factors Including Nutritional Status and Stress of Pregnant Women and Birthweight in Shimane Prefecture

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論文内容の要旨

## INTRODUCTION

Low birthweight infants have been suggested to be at increased risk of developing non communicable diseases such as obesity, glucose intolerance, and cardiovascular disorders in the future. The percentage of births to low-birthweight infants (less than 2500g) in Japan has increased since 1975 and currently stands at about 10%. This is one of the highest rates among OECD countries. In Shimane Prefecture, the percentage of low-birthweight infants is higher than the national average, for which no definitive explanation has been given. We previously surveyed the nutritional intake of 29 pregnant women in the early pregnancy in Shimane Prefecture. The study showed that the energy intake and the intake of many nutrients in the early pregnancy did not reach the required levels. However, the relationship between nutrient intake and infant birthweight in early, mid, and late pregnancy is still not clear. Therefore, in Survey 1 of this research, we conducted a longitudinal study on the same group of subjects to clarify the relationship among the nutritional intake status at each stage of pregnancy (early, mid, and late), the presence of stress, and infant birthweight. In our previous study, the number of subjects and the amount of data were limited, therefore in Survey 2, we obtained more detailed information in larger number of samples on the relationship among nutrient intake, stress during early pregnancy, employment status during early pregnancy and infant birthweight to provide basic information for reducing the number of low birthweight infants in

Shimane Prefecture.

## MATERIALS AND METHODS

In Survey 1, the Food Frequency Questionnaire Based on Food Groups (FFQg) was administered to pregnant women undergoing maternal health checkups at delivery facilities in Shimane Prefecture at around 12, 26, and 36 weeks of gestation, i.e., early, mid, and late pregnancy, respectively, and 26 women who continuously responded were analyzed. Attributes of the subjects, qualitative data of nutrition, and stress during pregnancy were statistically analyzed in relation with infant birthweight. The study protocol was approved by the Ethics Committee of The University of Shimane.

In Survey 2, the DHQ (self-administered dietary history questionnaire) was administered to 84 pregnant women at 12 weeks of gestation, early pregnancy, to analyze statistically the relationship between nutritional intake, stress, smoking status, and employment status in early pregnancy and infant birthweight. The study protocol was approved by the Ethics Committee of Shimane University.

## RESULTS AND DISCUSSION

In both Surveys 1 and 2, weak correlation with birthweight was found in gestational weeks. In Survey 2, weak correlation with birthweight was found in maternal height and weight (early pregnancy and at delivery), BMI at delivery, weight gain. As in the previous study, it was suggested that the maternal body shape influences the infant birthweight. A survey in Shimane Prefecture in 2016 reported that approximately 20% of women in their 20s and 30s were thin, and the proportion of thin people was higher among women in their 30s and 40s than in the rest of the country. Since 15% of the subjects in Survey 1 and 20.2% of the subjects in Survey 2 were emaciated, education about body shape is necessary even before pregnancy.

In Survey 1, the average energy levels in early, mid, and late pregnancy were less than the estimated energy needs, whereas the PCF balance (energy-producing nutrient balance) was within the recommended range. This may have contributed to the lack of association between nutrient intake and infant birthweight.

In the Survey 2 on early pregnancy, there was no significant difference in the infant birthweight or weight gain during pregnancy between the high stress group and the low stress group. The high stress group consumed significantly more energy and other nutrients, and PFC balance was within the recommended range for both groups. On the other hand, in Survey 1 covering the entire period of pregnancy, comparing the group that felt stressed and tired with the group that felt little stress and tired, the group that felt

stressed and tired had a higher weight gain during pregnancy, but significantly lower infant birthweight. In terms of nutritional intake during the pregnancy, the stressed and tired group tended to have a lower energy intake in the early pregnancy and a higher energy intake in the mid and late pregnancy than the group with little or no stress. This discrepancy between the results of surveys may be related to the different methods used to investigate stress.

An international systematic review reported that a healthy dietary pattern characterized by a high intake of vegetables, fruits, whole grains, low-fat dairy products, and fat-free protein foods tends to be associated with a lower risk of small for gestational age. These results suggest that even if a woman is stressed in early pregnancy, a healthy diet with energy intake close to the recommended energy requirements may reduce impact on the infant birthweight.

When the full-time and part-time work groups were compared by a t-test in Survey 2. In the comparison of nutrient intake, the part-time group tended to have lower average energy and protein intakes, but there was no significant difference in the infant birthweight between the two groups. There was also no significant difference between the two groups in the PFC balance. It is possible that well-balanced nutrition may have been responsible for the lack of difference in birthweight between the two groups in this study. Shimane Prefecture ranks first in Japan in both the labor force participation rate of women and the labor rate of the child-rearing generation, and the percentage of full-time female employees is 52.1%. It is necessary to monitor their dietary intake and provide them with lifestyle guidance in the light of their working conditions.

## CONCLUSION

The relationship among nutritional intake status, stress, type of work, and infant birthweight was examined using questionnaire-based analyses in pregnant women in Shimane Prefecture.

In Survey1, the stress group had significantly lower infant birthweight. In Survey2, there was no significant difference in infant birthweight between high and low stress groups, whereas energy intake was significantly higher with an adequate PFC balance in the high stress groups in early pregnancy. Energy intake and PFC balance maintained within the recommended range might reduce the impact of stress on infant birthweight.