Journal of Affective Disorders 225 (2018) 552–558

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Dietary patterns and depressive symptoms during pregnancy in Japan: Baseline data from the Kyushu Okinawa Maternal and Child Health Study

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ARTICLE INFO

Keywords:
Cross-sectional study
Depressive symptoms during pregnancy
Dietary patterns
Intake
Japan

ABSTRACT

Background: Only one Brazilian study has examined the association between dietary patterns and depressive symptoms during pregnancy. The current cross-sectional study examined this issue in Japan.
Methods: Study subjects were 1744 pregnant women. Between April 2007 and March 2008, information under study was obtained. Dietary patterns were derived from a factor analysis of 33 predefined food groups based on a self-administered diet history questionnaire. Depressive symptoms were defined as a Center for Epidemiological Studies Depression Scale score ≥ 16. Adjustment was made for age, gestation, region of residence, number of children, family structure, history of depression, family history of depression, smoking, secondhand smoke exposure, employment, household income, education, and body mass index.
Results: Three dietary patterns were identified: 'healthy', characterized by high intake of green and yellow vegetables, other vegetables, mushrooms, pulses, seaweed, potatoes, fish, sea products, miso soup, sugar, and shellfish; 'Japanese', characterized by high intake of rice and miso soup; and 'Western', characterized by high intake of beef and pork, processed meat, vegetable oil, chicken, eggs, shellfish, and salt-containing seasonings. The healthy and Japanese patterns were independently inversely associated with depressive symptoms during pregnancy: the adjusted prevalence ratios (95% confidence intervals, *P* for trend) between extreme quartiles were 0.56 (0.43–0.73, < 0.0001) and 0.72 (0.55–0.94, 0.008), respectively. No association was observed between the Western pattern and depressive symptoms during pregnancy.
Limitations: Information was obtained between the 5th and 39th week of pregnancy.
Conclusions: The healthy and Japanese dietary patterns may be inversely associated with depressive symptoms during pregnancy.

1. Introduction

Depressive symptoms are probably associated with several dietary factors (Murakami and Sasaki, 2010). Dietary pattern analysis allows simultaneous evaluation of the effects of combinations of many foods and offers a perspective different from that of the traditional approach which focuses on a single or a few nutrients or foods (Hu, 2002). In the traditional approach, the assessment of isolated foods or nutrients makes it difficult to account for potential interactions among nutrients and foods and is frequently confounded by other dietary factors (Martínez-González and Sánchez-Villegas, 2016); dietary pattern analysis enables us to avoid this limitation. In 2014, a meta-analysis of 13 observational studies demonstrated that the healthy dietary pattern was significantly inversely associated with depressive symptoms while there was no association between the Western dietary pattern and depressive symptoms (Lai et al., 2014). Of the 13 studies included in this meta-analysis, 12 were conducted in Western countries; only one cross-sectional study in Japan was included. Recent epidemiological investigations regarding the relationship between dietary patterns and depressive symptoms in Asian countries (Suzuki et al., 2013; Chan et al., 2014; Miki et al., 2015; Tsai, 2016; Xia et al., 2016) as well as those in Western countries (Jacka et al., 2014; Lucas et al., 2014; Ruusunen et al., 2014; Vilela et al., 2014; Dipnall et al., 2015; Gougeon et al., 2015; Sánchez-Villegas et al., 2015; Kim et al., 2016; Lai et al., 2016;

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http://dx.doi.org/10.1016/j.jad.2017.08.073
Received 20 February 2017; Received in revised form 21 August 2017; Accepted 27 August 2017
Available online 30 August 2017

Vermeulen et al., 2016) that were not included in the meta-analysis have produced conflicting results. Associations between dietary patterns and health outcomes are sometimes different between studies performed in populations with different dietary habits.

Only one study of Brazilian women examined the association between dietary patterns and depressive symptoms during pregnancy (Vilela et al., 2014). In view of the lack of epidemiological information with respect to the relationship between dietary patterns and depressive symptoms during pregnancy in non-Western populations, the current cross-sectional study assessed this issue in pregnant Japanese women using baseline data from the Kyushu Okinawa Maternal and Child Health Study (KOMCHS). According to our previous studies which showed significant inverse associations between intake of fish, yogurt, seaweed, soy products, eicosapentaenoic acid, docosahexaenoic acid, calcium, vitamin D, isoflavones, and manganese and depressive symptoms during pregnancy, our hypothesis was that the healthy dietary pattern would be inversely related to depressive symptoms during pregnancy (Miyake et al., 2013, 2014, 2015a, 2015b, 2016, 2017).

2. Methods

2.1. Study population

The current study utilized data from the KOMCHS which is an ongoing prospective prebirth cohort study investigating risk and preventive factors for maternal and child health problems. Details of the baseline survey of the KOMCHS have been described elsewhere (Miyake et al., 2013). In the baseline survey, eligible study subjects were pregnant women who lived in one of seven prefectures on Kyushu Island in southern Japan, with a total population of approximately 13.26 million, or in Okinawa Prefecture, an island chain in the southwest of Japan, with a total population of nearly 1.37 million. From April 2007 to March 2008, at 423 obstetric hospitals in the abovementioned eight prefectures, as many pregnant women as possible received a set of leaflets explaining the KOMCHS, an application form to participate in the KOMCHS, and a self-addressed and stamped return envelope. Pregnant women who decided to participate in the KOMCHS sent the application form containing a written description of their personal information by mail to the data management center. Research technicians then gave each participant a detailed explanation of the KOMCHS by telephone and sent them a self-administered questionnaire after obtaining their consent. Finally, 1757 pregnant women between the 5th and 39th weeks of pregnancy gave their written informed consent to participate in the KOMCHS and completed the baseline survey. The current study was restricted to women who provided complete information on the variables under study, leaving data on 1744 pregnant women available for analysis. The KOMCHS was approved by the ethics committees of the Faculty of Medicine, Fukuoka University and Ehime University Graduate School of Medicine.

2.2. Measurements

In the baseline survey, each study subject spent about 1.5 h filling out a 53-page two-part questionnaire and mailed it to the data management center between the 5th and 39th week of pregnancy. Research technicians clarified or completed missing or illogical data by telephone interview.

The first part of the questionnaire elicited information on age, gestation at baseline, region of residence, number of children, family structure, personal history of doctor-diagnosed depression, family history of depression, smoking habits, secondhand smoke exposure at home and at work, employment status, household income, and educational level. A family history of depression was defined as being present if one or more parents or siblings of the study subjects had been diagnosed with depression by a doctor. A history of smoking was defined as having smoked at least once per day for at least one year. Secondhand smoke exposure at home and at work was assessed, respectively, by the following questions: “Have you ever been exposed to smoke from family members at home?” and “Have you ever been exposed to smoke at your workplace?” Information on employment status was elicited for the year in which the questionnaire was conducted and for the preceding year; women were classified as unemployed if they were unemployed both in the year in which the questionnaire was completed and in the preceding year.

The first part of the questionnaire also included a Japanese version (Shima et al., 1985) of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D consists of 20 questions collectively assessing all major components of depressive symptoms, including depressed mood, feelings of guilt or worthlessness, helplessness or hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance experienced during the preceding week. Each question is rated on a four-point scale of 0–3 according to the frequency of the symptoms, and the total CES-D score ranges from 0 to 60. The criterion validity of the CES-D scale has been well established in adult Western (Radloff, 1977) and Japanese (Shima et al., 1985) populations. According to the validation study, we defined the presence of depressive symptoms as a CES-D score $\geq$ 16.

As the second part of the questionnaire, a semi-quantitative, comprehensive diet history questionnaire (DHQ) was used to assess dietary habits during the preceding month (Sasaki et al., 1998, 2000; Kobayashi et al., 2012; Shiraishi et al., 2012, 2013a, 2013b, 2015). Daily intake values for a total of 150 foods, energy, and selected nutrients were estimated using an ad hoc computer algorithm for the DHQ based on the Standard Tables of Food Composition in Japan (Science and Technology Agency, 2005). One hundred forty-five DHQ food items (the five excluded items were cornflakes, nutritional supplement bars, Japanese-style pancakes, noodle soup and water) were grouped according to their nutrient profiles and culinary usage into thirty-three predefined food groups to enable the extraction of dietary patterns (Okubo et al., 2010). Information on dietary supplements was not used in the calculation of dietary intake because of the lack of a reliable composition table in Japan. Body weight and height were self-reported as part of the DHQ. Body mass index was calculated as weight (kg) divided by the square of height (m).

2.3. Statistical analysis

Factor analysis to derive dietary patterns based on the 33 predefined food groups from the DHQ was conducted according to the PROC FACTOR procedure. Intake of these food groups (g food per day) was adjusted for total energy intake using the residual method (Willett and Stampfer, 1986). The number of factors was determined based on the scree plot and interpretability. A factor solution with the three identified factors was found to be reasonable and meaningful. The proportion of variance explained by each factor was calculated by dividing the sum of the squares of the respective factor loadings by the number of variables. The factor scores for each pattern and for each individual were determined by summing the intake of each food group weighted by the factor loading. All data presented here are from the Varimax rotation. The validity of dietary patterns derived from the DHQ has been reported previously (Okubo et al., 2010).

Scores for each dietary pattern were categorized at quartile points based on their distribution in 1744 subjects. Age, gestation at baseline, region of residence, number of children, family structure, history of depression, family history of depression, smoking, secondhand smoke exposure at home and at work, job type, household income, education, and body mass index were selected *a priori* as potential confounding factors. Age, gestation at baseline, and body mass index were used as continuous variables.

The association between quartiles of the dietary pattern scores and the prevalence of depressive symptoms during pregnancy was examined using Poisson regression with a robust variance, and the first