



High red blood cell folate is associated with an increased risk of death among adults with diabetes, a 15-year follow-up of a national cohort



B. Kyte ^a, E. Ifebi ^a, S. Shrestha ^a, S. Charles ^b, F. Liu ^c, J. Zhang ^{a,*}

^a Department of Epidemiology, Jiann-Ping Hsu College of Public Health, Georgia Southern University, Statesboro, GA 30460, USA

^b Department of Environmental Health Sciences, Jiann-Ping Hsu College of Public Health, Georgia Southern University, GA 30460, USA

^c Veterans Affairs Medical Center – Augusta, GA 30904, USA

Received 10 January 2015; received in revised form 19 June 2015; accepted 17 August 2015

Available online 21 September 2015

KEYWORDS

Folate;
Red blood cell;
Mortality;
Fatality;
Diabetes

Abstract *Background and aim:* To describe the mortality and fatality of diabetes and assess their relationship with the level of red blood cell (RBC) folate.

Methods and result: We analyzed the data of 526 adults with diabetes who participated in the National Health and Nutrition Examination Survey (1991–1994) as the baseline examination, and were followed up through December 31, 2006. Estimates of the hazard ratios (HRs) of selected death causes for individuals with different levels of RBC folate were obtained from Cox proportional hazards regression. A total of 295 deaths were recorded by the end of a 15-year follow-up with a mortality rate of 58.48 per 1000 person year (py). Diabetes was listed as a contributing cause for 136 deaths, accounting for 46.1% of the total deaths with a fatality rate 26.96 per 1000 py. Mortality rate for all-cause in the group with upper quartile of RBC folate was almost twice as high as that among the group with lower quartile, 82.75 vs. 44.10 per 1000 py. After adjusting for covariates, including serum concentration of vitamin B12, cotinine, homocysteine and the history of cardio-cerebral vascular diseases assessed at the baseline, the HRs for dying from any causes were 1.00 (reference), 1.82 (95% CI = 1.25–2.66) and 2.10 (1.37–3.20) among diabetic adults with lower, intermediate, and upper quartiles of RBC folate.

Conclusion: Diabetes was listed as a contributing cause for less than half of the deaths among adults with diabetes after 15+ years of follow-up; high RBC folate concentration was associated with an elevated risk of death among adults with diabetes.

© 2015 The Italian Society of Diabetology, the Italian Society for the Study of Atherosclerosis, the Italian Society of Human Nutrition, and the Department of Clinical Medicine and Surgery, Federico II University. Published by Elsevier B.V. All rights reserved.

Introduction

Crucial for proper brain function, folic acid is added to grain products in many countries to prevent major birth defects of the baby's brain and spine. Like all B vitamins,

folate also helps the body convert carbohydrates into glucose for energy, and has great biologic and clinical implications in diabetes, which is characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism. However, limited literature was available on relationship between folate level and the health status of individuals with diabetes [1]. Studies examining this issue included animal studies [2], small scale clinical trials with adults [1,3–6] or children [4]. The only observational cohort study with a relatively large

* Corresponding author. Jiann-Ping Hsu College of Public Health, Georgia Southern University, PO Box 8015, Statesboro, GA, USA. Tel.: +1 912 478 2290; fax: +1 912 478 2479.

E-mail address: jianzhang@georgiasouthern.edu (J. Zhang).

sample size was conducted among population surveyed before folic acid fortification by Loria et al. [7]. Loria used the serum folate, a measure of circulating folate representing short-term store. Red blood cell (RBC) folate might be a better indicator of circulating folate since it represents intermediate stores. Moreover, Loria et al. did not adjust for homocysteine and vitamin B12 – potential confounders for the association between diabetes and folate.

To the best of our knowledge, there have been no studies performed on diabetic adults to examine the relationship between the risks of death by the level of RBC folate after Loria et al.'s study. We therefore analyzed the data of diabetic adults from the Third National Health and Nutrition Examination Survey (NHANES III), a nationally representative cohort to describe the death pattern of diabetes and to examine its relationship with RBC folate level.

Methods

Study population

We used the data from the Third National Health and Nutrition Examination Survey (NHANES III) mortality follow-up file. The NHANES was conducted by the National Center for Health Statistics, the Centers for Disease Control and Prevention (CDC) among a nationwide probability sample of non-institutionalized civilians. A diabetic adult was identified if an individual answered “yes” to the question “Have you ever been told by a doctor that you have diabetes or sugar diabetes?” and/or if an individual reported current use of insulin and/or an oral anti-diabetic medication. Since the serum homocysteine was tested in phase II only (1991–1994) of NHANES III, we restricted the analyses to 648 adults 19 years or older who participate the phase II of NHANES and had been diagnosed with diabetes before the baseline survey. The participants who missed data on RBC folate ($n = 55$), family income ($n = 52$), cigarette smoking and alcohol drinking ($n = 14$) were excluded. A woman with gestational diabetes at the baseline survey was also excluded. After exclusions, a total of 526 adults with diabetes were retained for analysis. Applying same exclusion criteria, we selected 6791 diabetes-free adults as a group for comparison to assess the differences between diabetic adults and non-diabetic adults among general population. The NHANES protocol was reviewed and approved by the National Center for Health Statistics Institutional Review Board (IRB); and the current study was exempt from ethics review by Georgia Southern University IRB committee.

Baseline data collection

The baseline data were collected as part of the NHANES III during an in-home interview and a subsequent visit to a mobile examination center (MEC). The demographic and health-related information, data of prescription medications, dietary intake and food supplements were collected using standardized questionnaires. Under controlled and constant environmental conditions and following the

standardized protocol, trained technicians drawn blood and other biochemistry specimens and processed in the MECs for transportation to appropriate laboratories. All laboratory measurements were carried out in a blinded fashion with respect to vital status and other clinical data.

Assessment of folate concentrations

RBC folate concentrations were measured using whole blood samples, which were collected by venipuncture at the MEC according to standard protocols. Ethylenediamine tetraacetic acid was added into tubes as an anticoagulant. The specimens were frozen at or below -20°C and transported on dry ice to the CDC-accredited laboratories for analysis. RBC folate concentrations were assayed using the Quantaphase II folate radioassay kit (Bio-Rad Laboratories) [8]. Gender-specific cutoffs were derived from all eligible adults with diabetes to categorize the study participants into three groups: RBC folate concentrations ≥ 634 nmol/L (280 ng/mL) for men and 659 nmol/L (290 ng/mL) for women as upper quartile, < 335 nmol/L (148 ng/mL) for men and 315 nmol/L (139 ng/mL) for women as lower quartile, otherwise as intermediate quartile.

Socioeconomic status (SES)

Ethnicity was coded as non-Hispanic white, non-Hispanic black, or Hispanic American, all the remaining groups were grouped under ‘Other’. Educational attainment was measured as the highest completed grade of school regardless of age, and categorized into three levels: high school/equivalent or below, some college years, and college graduate or above. Poverty status was assessed using the poverty income ratio (PIR) which was calculated using the previous year's family income and family size, and comparing the midpoint for the category and the family size with the federal poverty line ($\text{PIR} = 1$).

Health risk factors and the history of medical illnesses

The respondents who self-reported drinking were categorized as ‘heavy’ (if the respondents reported more than 10 days in the past 12 months on which five drinks or more were consumed), and ‘moderate’ (if 10 days or less on which five drinks or more were consumed in the past 12 months). The self-reported smokers were defined as ‘heavy’ smokers if the respondents reported that in the past five days 40 cigarettes or more were smoked, and as ‘moderate’ smokers if less than 40 but more than 0 cigarettes were smoked. In the baseline interview, the participants were asked “Have you ever been told by a doctor that you had one or more of the following general medical illnesses: asthma, arthritis, cancer, chronic bronchitis, diabetes, hypertension, gout, lupus, stroke, or thyroid disease?”

Biochemical covariates

Homocysteine (Hcy) was measured at the US Department of Agriculture Human Nutrition Research Center on Aging, Tufts University School of Medicine, Boston, MA, with the high-performance liquid chromatography (HPLC) method

Download English Version:

<https://daneshyari.com/en/article/5996460>

Download Persian Version:

<https://daneshyari.com/article/5996460>

[Daneshyari.com](https://daneshyari.com)