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Associations between diet and cardiometabolic risk among Yup'ik Alaska Native people using food frequency questionnaire dietary patterns

T.K. Ryman [a], B.B. Boyer [b], S. Hopkins [b], J. Philip [b], S.A.A. Beresford [a], B. Thompson [a], P.J. Heagerty [a], J.J. Pomeroy [c], K.E. Thummel [a], M.A. Austin [a,*]

[a] University of Washington, Seattle, WA 98195, USA
[b] Center for Alaska Native Health Research, University of Alaska Fairbanks, Fairbanks, AK 99775, USA
[c] Marshfield Clinic Research Foundation, Marshfield, WI 54449, USA

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Abstract *Background and aims:* In previous analyses, we identified three dietary patterns from food frequency questionnaire data among a sample of Yup'ik Alaska Native people living in Southwest Alaska: a "subsistence foods" dietary pattern and two market-based dietary patterns "processed foods" and "fruits and vegetables". In this analysis, we aimed to characterize the association between the dietary patterns and cardiometabolic (CM) risk factors (lipids, blood pressure, glucose, adiposity).
Methods and results: We used multilevel linear regression to estimate the mean of each CM risk factor, comparing participants in the 4th to the 1st quartile of each dietary pattern ($n = 637$). Models were adjusted for age, sex, past smoking, current smoking, and physical activity. Mean log triglyceride levels were significantly higher among participants in the 4th compared to the 1st quartile of the processed foods dietary pattern ($\beta = 0.11$). Mean HbA1c percent was significantly lower ($\beta = -0.08$) and mean diastolic blood pressure (DBP) mm Hg was significantly higher ($\beta = 2.87$) among participants in the 4th compared to the 1st quartile of the fruits and vegetables dietary pattern. Finally, mean log triglyceride levels and mean DBP mm Hg were significantly lower among participants in the 4th compared to the 1st quartile of the subsistence foods dietary pattern ($\beta = -0.10$ and $\beta = -3.99$ respectively).
Conclusions: We found increased CM risk, as reflected by increased triglycerides, associated with eating a greater frequency of processed foods, and reduced CM risk, as reflected by lower triglycerides and DBP, associated with eating a greater frequency of subsistence foods.

Abbreviations: AN, Alaska Native; CM, cardiometabolic; CPD, counts per day; FFQ, food frequency questionnaire; CANHR, Center for Alaska Native Health Research; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; TG, triglycerides; SBP, systolic blood pressure; DBP, diastolic blood pressure; HbA1c, glycated hemoglobin; FBG, fasting blood glucose; WC, waist circumference.

* Corresponding author. Department of Epidemiology, Box 357236, School of Public Health, University of Washington, Seattle WA, 98195, USA. Tel.: +1 206 616 9286; fax: +1 206 543 8525.
E-mail address: maustin@u.washington.edu (M.A. Austin).

Introduction

American Indian and Alaska Native (AN) people have long suffered from health disparities [1], and these health disparities continue despite efforts to reduce them. Between 1990 and 2009, all-cause mortality was 65% higher in AN people relative to United States (US) whites [1]. Cardiovascular and metabolic diseases are substantial contributors to

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this increased mortality in AN people [1]. A number of lifestyle factors including physical activity, stress, depression, smoking, alcohol consumption, and diet may contribute to cardiometabolic (CM) disease risk in AN people [2].

Many indigenous populations, including AN people, are undergoing nutritional transitions, characterized by the substitution of traditional foods for market-based processed foods [3,4]. The traditional diet of some AN people, including Yup'ik people residing in remote communities in the Yukon–Kuskokwim Delta of Southwest Alaska, is abundant in marine mammals and fish that include high levels of omega-3 polyunsaturated fatty acids. These may have beneficial effects in preventing cardiovascular disease risk by lowering circulating triglycerides and inflammatory markers and increasing high-density lipoprotein cholesterol (HDL-C) and apolipoprotein A–I [5–7]. Thus, this nutritional transition in Yup'ik people could have adverse effects in terms of CM disease [8–12], potentially further amplifying current health disparities.

In this analysis, we use dietary patterns previously identified from a food frequency questionnaire (FFQ) in a sample of Yup'ik people to characterize associations between diet and CM risk factors.

Methods

Study sample

This study took place as part of the Center for Alaska Native Health Research (CANHR) studies for which detailed study recruitment methods have been published elsewhere [13,14]. In brief, CANHR conducts recurring cross-sectional research in 10 purposefully selected communities from the 58 remote Yup'ik communities in the Yukon–Kuskokwim Delta [15]. Within these communities, study participants were recruited using convenience sampling methods in which all individuals who self-identified as Alaska Native or who were married to an Alaska Native descendent, were greater than 14 years of age, and were non-pregnant, were eligible to participate. Our sample included 637 individuals who participated in CANHR studies between September 2009 and May 2013, were 18 years of age or older, were not pregnant, who self-reported their ethnicity as Yup'ik, and had complete data required to determine the dietary patterns, as described below. For individuals who had participated in more than one research visit, we used the data from their most recent visit with both FFQ and activity data available for analysis.

Informed consent was obtained from participants prior to data collection. This study was approved by the University of Alaska Fairbanks and University of Washington Institutional Review Boards and the Yukon–Kuskokwim Health Corporation Human Studies Committee.

Data collection

Diet

Dietary data were collected using a Yup'ik specific FFQ developed by CANHR researchers and local community research assistants [15]. Participants reported how frequently they typically consumed each food during the previous 12 months. For traditional subsistence foods it was further elicited whether they ate the food seasonally or year-round. Serving size was not collected in order to reduce participant burden and because it does not substantially improve nutritional ranking of study participants [16].

Briefly, 3 dietary patterns were identified using a 2-stage exploratory factor analysis [15] and then reproduced using a confirmatory factor analysis [17]. The resulting dietary patterns included 2 market-based dietary patterns, a "processed foods" pattern and a "fruits and vegetables" pattern, as well as a "subsistence foods" dietary pattern that captured traditional diet. The "processed foods" dietary pattern was measured using the following foods from the FFQ: salty snacks, sweetened cereals, pizza, sweetened drinks, hot dogs and lunch meat, fried chicken, and canned tuna; the "fruits and vegetables" dietary pattern was measured using fresh citrus, potato salad, citrus juice, corn, green beans, green salad, and market berries in akutaq (Eskimo ice cream); and finally the "subsistence foods" dietary pattern included seal or walrus soup, non-oily fish, wild greens, and bird soup (Supplemental Table A).

Dietary pattern scores were estimated as the average of the natural log transformed frequency of consumption for each food measuring the dietary pattern [17]. The greater the dietary pattern score, the greater the frequency of consumption of the foods used to measure that dietary pattern. Dietary pattern scores were grouped into quartiles in which the 1st represented the lowest frequency of consumption for that dietary pattern and the 4th quartile represented the highest frequency of consumption of foods used to measure that dietary pattern.

Cardiometabolic risk factors

Participants were asked to fast for 8–12 h prior to providing blood samples for lipid determinations (low-density lipoprotein cholesterol [LDL-C], HDL-C, triglycerides [TG]), fasting blood glucose (FBG) levels, and glycated hemoglobin (HbA1c). Lipid concentrations were measured with the Poly-Chem System Chemistry Analyzer in the Nutritional Assessment Laboratory at the University of California Davis. FBG was measured using whole blood tested immediately with a Cholestech LDX analyzer and HbA1c was measured using the Bayer HbA1c DCA 2000+ analyzer.

Systolic (SBP) and diastolic (DBP) blood pressure was obtained using the OMRON HEM907 automated blood pressure cuff. We used the mean of the last 2 of the 3 measures that were collected, unless the final measure was not available in which case the mean of the first 2 measures was used.

Waist circumference (WC) was measured by trained staff using protocols from the NHANES III Anthropometric Procedures Manual [18] as previously described [2]. If the 2 WC measures differed by more than 2 cm, then a third measure was taken and the final measure was the average of the 2 closest measures.