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Original Article

Food intake patterns and cardiovascular disease in different age cohorts: The relevance of food variety

Alexander Dzien [a], Hannes Winner [b], Engelbert Theurl [c], Christine Dzien-Bischinger [a], Monika Lechleitner [d,*]

[a] Medical Center Hentschelhof, Buergerstrasse, A-6020 Innsbruck, Austria
[b] Department of Economics and Social Sciences, University of Salzburg, Kapitelgasse 5-7, A-5010 Salzburg, Austria
[c] Department of Public Economics, University of Innsbruck, Universitätsstrasse 15/4, A-6020 Innsbruck, Austria
[d] Department of Internal and Geriatric Medicine, Hospital Hochzirl, Anna Dengel-Haus, A-6170 Zirl, Austria

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SUMMARY

Background: Dietary recommendations for healthy food intake are an essential part of preventive strategies, food variety might offer one additional approach.
Methods: Between January 2005 and September 2009, a total of 2548 persons attended a medical outdoor centre for diagnostic and/or therapeutic interventions. To obtain information on their nutrition behaviour, patients were requested to complete a 51-item semi-quantitative food frequency questionnaire. Frequencies of consumption of food items were reported on a scale between 1 (seldom or never) and 6 (more than once per day). To investigate the impact of nutrition patterns on the probability of cardiovascular event and/or medication we estimated four alternative versions of logistic regressions.
Results: Up to the age-decade 51–60 of years, the majority of the patients reported a moderate to high food consumption variety. A low variety was primarily found in the age decades older than 60 years. Within each age cohort, the predicted probability of cardiovascular events and/or medication was lower for patients with higher food variety. Our parameter estimates indicate that, on average, the consumption of one additional food item reduced the probability of a cardiovascular disease by about 0.5%. Adding overall daily intakes of energy or nutrient contents did not change this result.
Conclusion: Our study shows that food diversity has a significant impact on the probability to stay healthy.

1. Introduction

Dietary recommendations for healthy food intake are an essential part of preventive strategies, especially for cardiovascular disease, hypertension, dyslipidemia, type 2 diabetes and obesity.[1–3] In the elderly population, malnutrition as a consequence of age-related changes in appetite control is considered as a major health care problem for geriatric patients.[4,5]

In general, an excess of saturated fat and refined sugars are responsible for the development of cardiometabolic disorders, while a low content of fat and refined sugars, as well as an increased intake of vegetables, fruits and fibre-rich cereals characterize a more favourable dietary pattern.[2,3,6] Dietary recommendations include cutting down saturated fat intake and refined sugar, eating more vegetables and drinking less alcohol. The focus on one single nutrient, such as fat intake,[7] has the advantage of a more simple evaluation of possible effects on cardiovascular events or other morbidities. However, nutrient effects might be more complex, because each meal comprises a mix of several foods, which are composed of many nutrients in different amounts.[8,9] The analysis of food intake patterns and their relationship to overweight, obesity and co-morbidities could offer additional information leading to the development of a more practical approach for dietary recommendations. For the analysis of food intake patterns, several diet diversity scores have been developed.[10] One often used measure is the number of different food items that are consumed within a distinct time period.[10,11]

A meta-analysis of studies about the association of food intake patterns with overweight and obesity revealed no consistent relationship.[9] While some studies found that an intake pattern with fatty, sweet or energy dense nutrition was associated with an increase in BMI values, no such relationship was found in other

* Corresponding author. Tel.: +43 5238 501 45001.
E-mail address: monika.lechleitner@tilak.at (M. Lechleitner).

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studies. It might be speculated that these inconsistent results are due to diet underreporting and confounders, such as age, gender, physical activity, smoking and other consumption attitudes.[9] A clear relationship between an unfavourable dietary pattern – defined as a high intake of saturated fatty acids, low intake of fruit and vegetables – with symptomatic ischaemic stroke and carotid atherosclerosis in patients younger than 65 years of age was described by a recently published French study.[12] A significant positive association between dietary patterns and major cardiovascular events could also be observed for women aged 50 years and older.[13]

Considering these findings of previous research we were interested in the impact of food intake patterns and food variety on the probability of cardiovascular disease in a cohort of patients assigned to age decades from <20 to ≥80 years. Thereby, we control for potential confounding factors such as age, gender, smoking and physical activity.

2. Data basis

Between January 2005 and September 2009, a total of 2548 persons attended a medical outdoor centre for diagnostic and/or therapeutic interventions. All patients underwent clinical routine controls and laboratory measurements. Laboratory tests were performed from blood samples taken in the morning after an overnight fasting period. Information on the BMI and on fat free mass (FFM) were collected from all patients.[14,15] The kind, dosage and application rate of medication were available from the prescriptions, which were noted for all patients.

Patients were assigned to eight age groups from <20 years to ≥80 years, thereby also separating patients with and without events. The term "*event*" summarized all cardiovascular events, including a history of angina with typical clinical symptoms and findings in electrocardiography and/or coronary angiography, status post myocardial infarction, arterial fibrillation, heart failure, as well as peripheral arterial disease, reported stroke or cerebral ischaemia. Further, patients were assigned to groups with and without medication. The term "*medication*" summarized all kinds of continuous drug therapy including antihypertensive, lipid lowering and antidiabetic medication, as well as diuretics and antiaggregatory substances.

To obtain information on the nutrition behaviour, patients were requested to complete a semi-quantitative food frequency questionnaire including 51 food items.[16] Frequencies of consumption of food items were reported on a scale between 1 (seldom or never) and 6 (more than once daily). The questionnaire included questions on various types of fats, on milk and other dairy products, on bread and cereals, on fruit, greens and root vegetables, on soft drinks and sugar containing snacks, and on spirits, wine and beer. A large part of the questions recorded directly intake of potatoes, rice, pasta, meat and fish, and six varied items, such as salty snacks, coffee, tea and juice. Participants who had more than 10% missing answers were excluded. Based on this sample, we defined dietary diversity as the total number of different food items consumed during one week.[17–19]

The level of physical activity was determined by the patient's report about the number of sports activity per week. Among all 2548 patients, 27% reported to be actual smokers. The smoking status was evaluated according to the cigarette consumption per week. All other patients were non-smokers for their lifetime or had stopped smoking for a period longer than a year.

Among all patients, 9.5% were diagnosed as manifest diabetics. The patients enrolled in the study revealed euthyroid function. No changes in life-style during the last 3 months were reported by the patients, and none of the patients reported about an actual weight reduction program. Patients with acute or chronic inflammatory disease, severe renal or hepatic failure or chemotherapy were excluded from our study. Beside the clinical status, an increased erythrocyte sedimentation rate, C-reactive protein and leucocyte count were the diagnostic criteria for inflammatory disease, renal disease was defined by a serum creatinine >1.5 mg/dL, and

Table 1
Patients characteristics. (sample: 2548 patients.)

Variable	Mean	s.d.	Minimum	Maximum
Cardiovascular event and/or medication	0.434	0.496	0	1
Sex	0.370	0.483	0	1
Age	46.948	18.812	11.12936	93.90554
Physical activity (sports units per week)	1.585	1.999	0	20
Nicotine consumption (cigarettes per day)	3.414	7.957	0	60
Calorie	2107.301	599.440	766.544	6604.136
Protein	89.931	27.379	36.363	324.717
Dietary fibre	22.447	7.556	6.633	65.433
Fat content	78.087	26.949	30.096	319.189
Glucose	183.110	53.655	68.457	538.743
Salt	3698.414	1350.389	1182.333	15,088.130
Bioavailability	16,469.930	11,558.910	3924.533	80,668.430
Sausage	2.970	1.366	1	6
Pork	1.973	1.008	1	6
Liver, kidney	1.097	0.397	1	4
Fried sausage	1.422	0.692	1	6
Mayonnaise, ketchup	1.635	0.982	1	6
French fries	1.381	0.690	1	6
Fried potatoes	1.732	0.889	1	6
Pizza	1.574	0.776	1	5
Hamburger	1.192	0.526	1	6
Sausage bun	1.662	1.067	1	6
Leberkäse (meat loaf)	1.323	0.710	1	6
Candies	3.024	1.470	1	6
Beer, wine	2.376	1.330	1	6
Spirits	1.303	0.734	1	6
Food diversity: number of food items per week	30.895	7.404	7	50

Notes: Indexation of consumption of food items (answers in the questionnaire): 6 – more than once daily; 5 – once daily; 4 – each second or third day; 3 – once or twice a week; 2 – at least four times a month; 1 – seldom or never.