

Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: findings from the Prospective Urban Rural Epidemiology (PURE) study



Victoria Miller, Salim Yusuf, Clara K Chow, Mahshid Dehghan, Daniel J Corsi, Karen Lock, Barry Popkin, Sumathy Rangarajan, Rasha Khatib, Scott A Lear, Prem Mony, Manmeet Kaur, Viswanathan Mohan, Krishnapillai Vijayakumar, Rajeev Gupta, Annamarie Kruger, Lungiswa Tsolekile, Noushin Mohammadifard, Omar Rahman, Annika Rosengren, Alvaro Avezum, Andrés Orlandini, Noorhassim Ismail, Patricio Lopez-Jaramillo, Afzalhussein Yusufali, Kubilay Karsidag, Romaina Iqbal, Jephath Chifamba, Solange Martinez Oakley, Farnaza Ariffin, Katarzyna Zatonska, Paul Poirier, Li Wei, Bo Jian, Chen Hui, Liu Xu, Bai Xiulin, Koon Teo, Andrew Mentz

Summary

Background Several international guidelines recommend the consumption of two servings of fruits and three servings of vegetables per day, but their intake is thought to be low worldwide. We aimed to determine the extent to which such low intake is related to availability and affordability.

Methods We assessed fruit and vegetable consumption using data from country-specific, validated semi-quantitative food frequency questionnaires in the Prospective Urban Rural Epidemiology (PURE) study, which enrolled participants from communities in 18 countries between Jan 1, 2003, and Dec 31, 2013. We documented household income data from participants in these communities; we also recorded the diversity and non-sale prices of fruits and vegetables from grocery stores and market places between Jan 1, 2009, and Dec 31, 2013. We determined the cost of fruits and vegetables relative to income per household member. Linear random effects models, adjusting for the clustering of households within communities, were used to assess mean fruit and vegetable intake by their relative cost.

Findings Of 143 305 participants who reported plausible energy intake in the food frequency questionnaire, mean fruit and vegetable intake was 3·76 servings (95% CI 3·66–3·86) per day. Mean daily consumption was 2·14 servings (1·93–2·36) in low-income countries (LICs), 3·17 servings (2·99–3·35) in lower-middle-income countries (LMICs), 4·31 servings (4·09–4·53) in upper-middle-income countries (UMICs), and 5·42 servings (5·13–5·71) in high-income countries (HICs). In 130 402 participants who had household income data available, the cost of two servings of fruits and three servings of vegetables per day per individual accounted for 51·97% (95% CI 46·06–57·88) of household income in LICs, 18·10% (14·53–21·68) in LMICs, 15·87% (11·51–20·23) in UMICs, and 1·85% (–3·90 to 7·59) in HICs ($p_{\text{trend}}=0\cdot0001$). In all regions, a higher percentage of income to meet the guidelines was required in rural areas than in urban areas ($p<0\cdot0001$ for each pairwise comparison). Fruit and vegetable consumption among individuals decreased as the relative cost increased ($p_{\text{trend}}=0\cdot00040$).

Interpretation The consumption of fruit and vegetables is low worldwide, particularly in LICs, and this is associated with low affordability. Policies worldwide should enhance the availability and affordability of fruits and vegetables.

Funding Population Health Research Institute, the Canadian Institutes of Health Research, Heart and Stroke Foundation of Ontario, AstraZeneca (Canada), Sanofi-Aventis (France and Canada), Boehringer Ingelheim (Germany and Canada), Servier, GlaxoSmithKline, Novartis, King Pharma, and national or local organisations in participating countries.

Copyright © The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND license.

Introduction

Most nutritional guidelines recommend the consumption of at least two servings of fruits and three servings of vegetables per day.^{1,2} However, a large proportion of individuals do not meet these targets.^{3–5} An improved understanding of the factors that affect fruit and vegetable consumption is essential to improving the diet quality of populations.

Food cost has been shown to affect dietary intake in developed countries,^{6,7} but similar data for low-income countries (LICs) and middle-income countries (MICs) are sparse. High food cost might particularly affect

affordability among households spending a considerable proportion of their income on food.^{8,9} Increases in the cost of food have been shown to result in food-based coping strategies such as reductions in the quantity, quality, and diversity of food selections, and consumption of increased quantities of cheap, energy-dense foods.^{10–12}

Determining the affordability of essential foods such as fruits and vegetables in countries with different levels of economic development is important. In this study, we aimed to document the availability cost of fruits and vegetables in community grocery stores and market places, and the affordability of meeting dietary guidelines

Lancet Glob Health 2016;
4: e695–703

Published Online

August 23, 2016

[http://dx.doi.org/10.1016/S2214-109X\(16\)30186-3](http://dx.doi.org/10.1016/S2214-109X(16)30186-3)

See [Comment](#) page e664

Population Health Research Institute, Hamilton Health Sciences and McMaster University, Hamilton, ON, Canada (V Miller BSc, Prof S Yusuf DPhil, M Dehghan PhD, S Rangarajan MSc, Prof K Teo PhD, Prof A Mentz PhD); Westmead Hospital and the George Institute for Global Health, Sydney University, Sydney, NSW, Australia (C K Chow PhD); Ottawa Hospital Research Institute, Ottawa, ON, Canada (D J Corsi PhD); Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, UK (Prof K Lock PhD); Carolina Population Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA (Prof B Popkin PhD); Stritch School of Medicine, Loyola University Chicago, Maywood, IL, USA (R Khatib PhD); Institute of Community and Public Health, Birzeit University, Ramallah, Occupied Palestinian Territory (R Khatib); Faculty of Health Sciences, Simon Fraser University, Burnaby, BC, Canada (Prof Scott A Lear PhD); St John's Medical College & Research Institute, Bangalore, India (Prof P Mony MD); School of Public Health, Postgraduate Institute of Medical Education and Research, Chandigarh, India (M Kaur PhD); Madras Diabetes Research Foundation, Chennai, India (V Mohan DSc); Community Medicine, Health Action By People,

Thiruvananthapuram, Kerala, India (Prof K Vijayakumar MD); Department of Medicine, Fortis Escorts Hospital, Jaipur, India (R Gupta MD); Faculty of Health Sciences North-West University, Potchefstroom Campus, Potchefstroom, South Africa (Prof A Kruger PhD); University of the Western Cape, Bellville, South Africa (L Tsolekile MPH); Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran (N Mohammadifard PhD); Independent University, Bangladesh Bashundhara, Dhaka, Bangladesh (Prof O Rahman MD); Sahlgrenska Academy and Sahlgrenska University Hospital, Gothenburg, Sweden (Prof A Rosengren MD); Research Division, Dante Pazzanese Institute of Cardiology, São Paulo, Brazil (Prof A Avezum MD); Estudios Clinicos Latino America, Rosario, Argentina (A Orlandini MD); Department of Community Health, University Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia (N Ismail MD); Grupo Investigaciones FOSCAL, Fundacion Oftalmologica de Santander and Medical School, Universidad de Santander, Bucaramanga, Colombia (Prof P Lopez-Jaramillo MD); Hatta Hospital, Dubai Health Authority, Dubai, United Arab Emirates (Prof A Yusufali MD); Department of Internal Medicine, Istanbul University, Istanbul, Turkey (K Karsidag MD); Department of Community Health Sciences and Department of Medicine, Aga Khan University, Karachi, Pakistan (R Iqbal PhD); Physiology Department, University of Zimbabwe College of Health Sciences, Harare, Zimbabwe (J Chifamba MPhil); Facultad de Medicina, Universidad de La Frontera, Temuco, Chile (S Martinez Oakley MSc); Faculty of Medicine, UiTM Sungai Buloh Campus, Selangor, Malaysia (F Ariffin MBBS); Department of Social Medicine, Medical University in Wrocław, Wrocław, Poland (K Zatonka MD); Laval University Heart and Lungs Institute, Quebec City, QC, Canada (P Poirier MD); and

Research in context

Evidence before this study

We searched PubMed for articles published between Jan 1, 1960, and Jan 15, 2016, using the search term “fruit” OR “vegetable” OR “produce” OR “food” AND “cost” OR “afford*” OR “price” OR “purchasing” OR “availability” OR “diversity”. We used search terms in English but did not apply any language restrictions. We screened papers by title and abstract to identify full-text reports that were relevant to the study aims. We also screened citation lists from these full-text reports to identify other relevant articles. Papers were considered relevant if they report assessment of the relation between fruit and vegetable intake and availability or affordability. The papers cited here were selected to be representative of the existing evidence base and are not an exhaustive list of relevant research. Existing evidence was limited to the affordability of healthy food items in high-income countries. The absolute cost of food items was reported in several papers. However, information on the relative cost and proportion of individuals unable to afford the food items was not described.

Added value of this study

To our knowledge, this study is the first to describe the availability and affordability of fruits and vegetables across economic regions globally and to relate affordability to consumption. Our results show that the consumption of fruits and vegetables is low worldwide, particularly in low-income countries because of low affordability.

Implications of all the available evidence

Most dietary guidelines recommend the consumption of two servings of fruits and three servings of vegetables per day. However, purchasing this recommended amount would require a substantial proportion of household income, making fruits and vegetables unaffordable in many low-income and middle-income countries. Policies that enhance the affordability of fruits and vegetables are crucially needed to meet these recommendations.

for fruit and vegetable consumption in 18 countries with different income levels. We also aimed to relate the affordability of fruits and vegetables to their consumption.

Methods

Study design and sample selection

Between Jan 1, 2003, and Dec 31, 2013, the Prospective Urban Rural Epidemiology (PURE) study enrolled 157 254 adults aged 35–70 years in 667 communities from 18 countries on five continents. Countries were selected from four income strata according to the World Bank classification in 2006 on the basis of gross national income per person. There were four LICs (Bangladesh, India, Pakistan, and Zimbabwe), four lower-middle-income countries (LMICs; China, Colombia, Iran, Occupied Palestinian Territory), seven upper-middle-income countries (UMICs; Argentina, Brazil, Chile, Malaysia, Poland, Turkey, South Africa), and three high-income countries (HICs; Canada, Sweden, United Arab Emirates). A detailed description of participant, community, and country selection has been published elsewhere (appendix pp 4–5).^{13,14} In the PURE study, 147 938 participants completed country-specific, validated semi-quantitative food frequency questionnaires (appendix p 6).^{15–22} Of these individuals, we included those who had plausible energy intake (500–5000 kcal per day) in our analyses of fruit and vegetable consumption.

For analyses of food availability and affordability, we collected information on the cost of at least one fruit and one vegetable in each PURE community between Jan 1, 2009, and Dec 31, 2013. A 1 km observation walk was done by research staff in a centrally located area within each community. Within each area, non-sale prices (ie, retail prices before any discounts) were collected from

the grocery store or market place located in closest proximity to the observation walk zone for the following fruits and vegetables: apples, oranges, bananas, pears, carrots, tomatoes, and cabbage. A checklist of 48 types of fruits and 59 types of vegetable was used to assess the variety of fruits and vegetables available. Additional grocery stores or market places in the 1 km area were visited if research staff were unable to collect the cost of the fruits and vegetables. The total number of types of fruit and vegetable available for sale in each community was calculated to assess the diversity (see appendix p 7 for methods used to estimate fruit and vegetable availability and affordability). Additionally, we collected household income data from participants in these communities (appendix p 8). The methods used to calculate daily income, and fruit and vegetable costs and consumption are shown in appendix p 12. The study variables and their unit of analysis are summarised in appendix pp 13–14.

Statistical analysis

The affordability of two servings of fruits and three servings of vegetables per day was assessed using the least expensive fruit and vegetable available for sale within each community. Additionally, the affordability of purchasing five servings of the cheapest fruit or vegetable was assessed to estimate the most optimistic scenario of affordability that is reflective of substituting either type of produce to reach five daily servings. To define affordability, we used a threshold of less than 20% of household income per household member required to purchase two servings of fruits and three servings of vegetables per day for every household member. We used this demarcation point for affordability because we found that few households in HICs used more than 20% of

Download English Version:

<https://daneshyari.com/en/article/3408689>

Download Persian Version:

<https://daneshyari.com/article/3408689>

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