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Can eating five fruit and veg a day really keep the doctor away?

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ABSTRACT

The '5-a-day' fruit and vegetable campaign has been running in the U.K since 2003. However, as of 2013, only about a quarter of people in Britain met the recommended dietary intake of five portions of fruit and vegetables daily. Using data from the annual Health Survey for England, we estimate the association between daily intake of fruit and vegetables and various objective and subjective measures of health. We find that individuals who consume more portions of fruit daily report better overall health and have lower levels of cholesterol and blood pressure, compared to those who do not, while higher daily vegetable intake is associated with reduced risk of developing high blood pressure. Between fruit and vegetables, we find that consumption of fruit generally has stronger positive health outcomes. Our estimates, however, vary by gender, age and weight of the individual and exhibit considerable heterogeneity across different types of fruit and vegetables.

1. Introduction

In 2012, worldwide nearly 52% of the deaths annually of those under 70 years of age were due to non-communicable diseases (NCDs), with cardiovascular disease (CVD), diabetes, cancers and chronic respiratory diseases accounting for nearly three quarters of these deaths (WHO, 2015). An estimated six million deaths worldwide were attributable to CVD, the leading NCD in terms of mortality among those under the age of 70 (WHO, 2015). High blood pressure, high cholesterol levels, obesity, physical inactivity and insufficient consumption of fruit and vegetables, along with alcohol and tobacco use, are the major causes of these preventable diseases (WHO, 2002). Many of these deaths could have been averted if individuals changed their dietary habits, increased physical activity and made better lifestyle choices.

In the U.K poor diet is considered to be the major behavioral risk factor for NCDs, accounting for 14.3% of U.K's disease burden measured in disability-adjusted life years (Murray et al., 2013) and costing the National Health Service (NHS) £5.8 billion annually. This figure is 75% greater than the £3.3 billion spent on smoking and drinking related poor health and about six and a half times higher than the £0.9 billion spent on poor health resulting from physical inactivity (Scarborough et al., 2011). In response, the U.K government launched the '5-a-day' campaign in 2003 encouraging people to consume five portions of fresh fruit and vegetables each day, consistent with the recommendations of the World Health Organisation (WHO) (1990). Yet, despite this initiative (and other programs like it, such as 'eight tips for better living' and 'change4life'), the average daily intake of fruit and vegetables in the U.K remains below this benchmark. In 2013 it was 3.5 portions for men and 3.7 portions for women, with just 28% of women and 25% of men consuming at least the recommended five portions of fruit and vegetable per day (Roberts 2014).

Fruit and vegetables are rich in vitamins, such as vitamin A (beta-carotene), vitamin C, vitamin E, minerals (magnesium, potassium, zinc, phosphorous, folic acid), dietary fibers and antioxidants. Daily intake of the recommended portions of fruit and vegetables helps to ensure a balanced diet in terms of an adequate intake of these essential nutrients. Scientific evidence confirms that regular intake of fruit and vegetables helps reduce the risk of chronic diseases like cancer, type-II diabetes, heart disease, stroke and cataract formation (see eg. Duyn and Pivonka 2000; Southon, 2000; Cooper et al., 2012; Oyebode et al., 2014).[1] Such studies, however, are limited mostly to the nutritional epidemiology literature and have various limitations.

Their first limitation is that most do not involve the use of rigorous econometric testing, including controlling for a wide set of confounding factors likely to impact on the relationship between fruit and vegetable consumption and health. Second, most of these studies focus on specific health outcomes (eg. incidence of stroke) and none examine both objective and subjective measures of health. Third, many of these studies use samples of non-representative participants, such as doctors

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[1] For meta-analyses and reviews of the nutritional epidemiology literature see Boeing et al. (2012), Loef and Walach (2012), Rooney et al. (2013) and Hu et al. (2014).

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and nurses, who are likely to be particularly health conscious (Oyebode et al., 2014). There are several confounders associated with selection into non-representative cohorts, which bias the estimates from such studies (Ebrahim and Smith 2013).

The economics literature has considered the effect of factors such as macroeconomic fluctuations (Helliwell 2006; Abdallah et al., 2008; Oswald and Wu 2011), socio-economic shocks (Frijters et al., 2012), relative income (Clark et al., 2008), unemployment (Luechinger et al., 2010), terrorism (Metcalfe et al., 2011) and peer happiness (Powdthavee 2009; Schwarze and Winkelmann 2011) as determinants of subjective wellbeing. A few recent studies have used observational data to examine the relationship between fruit and vegetable consumption and psychological wellbeing or mental health (Jacka et al., 2011; Blanchflower et al., 2013; Boehm et al., 2013; White et al., 2013; Mujcic and Oswald, 2016; Warner et al., 2017). Mujcic (2014) uses individual level panel data from Australia to examine the relationship between fruit and vegetable consumption and several measures of mental and physical health.

We extend this literature by examining the relationship between daily intake of fruit and vegetables and various indicators of mental and physical health for a representative sample of English households using data from the annual Health Survey for England (HSE) over the period 2001–2013. To measure health we use self-assessed overall health, psychological health, blood pressure (BP) and cholesterol. We undertake heterogeneity analysis in order to separate out the effects of fruit and vegetable consumption by age group, gender and weight. We also consider if specific types of fruit or vegetables have stronger effects on our health measures as well as the optimal consumption of fruit and vegetables to maximize health.

We find that more portions of fruit are associated with better overall self-assessed health and lower levels of cholesterol and blood pressure, while more portions of vegetables are associated with reduced risk of developing high blood pressure and maintaining adequate levels of good cholesterol. These estimates, however, vary significantly by gender, age and weight of an individual. The optimal consumption of fruit is about four-five portions a day for self-assessed health and total cholesterol levels and more than five portions for lowering the probability of high blood pressure. While there seems to be no relationship between fruit or vegetable intake and overall mental health in general, when we separate out the effects by portions consumed we find that individuals who consume three-four portions of fruit daily report better mental health compared to those who do not. We also find that five or more portions of vegetables daily predict a lower probability of high blood pressure.

We find considerable heterogeneity in the health benefits of different fruit and vegetables. We find that those who consume more portions of fresh fruit daily have better overall health, fewer blood pressure problems and lower total cholesterol. We find that while fruit juices assist in reducing the likelihood of getting high cholesterol, frozen/canned fruits reduce the prospects of developing high blood pressure, although the trade-off is that they also reduce the level of good cholesterol in the blood stream. We find that consuming more portions of dry fruits, salads and vegetables in composite[2] is associated with having higher levels of good cholesterol.

The papers in the literature closest to ours are Capacci and Mazzocchi (2011), Blanchflower et al. (2013), Mujcic (2014) and Mujic and Oswald (2016). Capacci and Mazzocchi (2011) examine the effect of the 5-a-day campaign on fruit and vegetable consumption in the UK, but do not examine the effect of fruit and vegetable consumption on health. Blanchflower et al. (2013) find a positive association between fruit and vegetable consumption and psychological wellbeing using a range of cross-sectional UK datasets. We differ from their study in several ways. First, we look at a broader range of health outcomes. Second, they use just one year of the HSE (for 2008), while we use the HSE for 2001–2013. Third, unlike Blanchflower et al. (2013), we separate out and examine the health effects of different types of fruit and vegetables. As studies such as Bhupathiraju et al. (2013) have emphasized, it is important to separate out the health effects of different fruit and vegetables, in order to ascertain which fruit and vegetables have the biggest benefits.

Mujcic (2014) and Mujcic and Oswald (2016) use Australian individual level panel data. These studies find that fruit and vegetable consumption has positive effects on a range of health and well-being measures for the Australian population. We differ from Mujcic and Oswald (2016) in that their outcome variables are happiness and life satisfaction. We differ from Mujcic (2014) in that while he uses a range of health and well-being measures, the Australian dataset does not include measures of BP or cholesterol. While Mujcic (2014) and Mujcic and Oswald (2016) have the advantage of having a panel, which we do not, both these studies have a much shorter timeframe than us–2007, 2009 in the case of Mujcic (2014) and 2007, 2009, 2013 in the case of Mujcic and Oswald (2016). Finally, in common with Blanchflower et al. (2013), neither of these studies separate out the health effects of different types of fruit and vegetables, which is an important contribution of our paper.

2. Background to the '5 a day' fruit and vegetable program

During the late 1980s, the California Department of Health Services observed an outbreak of chronic diseases, such as CVD and certain cancers, potentially due, in part, to insufficient consumption of fruit and vegetables and developed the '5 a day–for better health' public health policy recommendation. In 1990, the WHO started a '5 a day' campaign, recommending countries to encourage their citizens to consume five portions of fruit and vegetables per day, which is equivalent to a daily intake of 400 g of fruit and vegetables, excluding potatoes and other starchy tubers. Since then, various governments from all over the world have promoted the benefits of higher fruit and vegetable consumption as part of more general public health marketing campaigns designed to promote healthy dietary and lifestyle choices.

The recommended number of portions, and portion size, of fruit and vegetables varies across countries (Slavin and Lloyd, 2012; Woodside et al., 2013). Some countries, such as Denmark, Japan, and the United States have chosen to extol the benefits of consuming more fruit and vegetables in general, without recommending a specific minimum amount. For example, in 2007 the United States adopted the slogan: 'Fruit and Veggies–More Matters' (Oyebode et al., 2014; Mujcic, 2014). Meanwhile, the specific '5 a day' policy recommended by the WHO has been adopted in countries such as Germany, the Netherlands, New Zealand, Norway and the U.K. Other countries have adopted variations on the '5 a day' policy. For example, in 2005 the Australian government launched the 'Go for 2+5' campaign, which encourages people to eat two portions of fruit (150 g per portion) and five portions of vegetables (75 g per portion) (Oyebode et al., 2014; Mujcic, 2014), while Canada has promoted the 'Mix it up! 5-to-10-a-day' public health campaign (Mujcic, 2014).

As Rekhy and McConchie (2014) note, the estimated costs of these promotional campaigns have reached millions of dollars. Yet, as Mujcic (2014, p. 2) laments, with a few exceptions, 'a key issue surrounding [these] public health announcements has been the clear lack of an empirical basis' about the potential association between fruit and vegetable consumption (and the optimal number of fruit and vegetable portions) and health. Our study provides an empirical basis for evaluating the efficacy of the '5 a day' campaign in the U.K and contributes to the small literature providing an empirical basis for evaluating the merits of similar WHO inspired fruit and vegetable campaigns in other countries (Mujcic, 2014; Mujcic and Oswald, 2016).

[2] Vegetables in composite are dishes made mainly from vegetables, such as vegetable curry or vegetable lasagna.

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