Exploring the impact of frequent consumption of fruits and vegetables on of life satisfaction: study for the United States

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DOI: 10.1481/icasVII.2016.f31

ABSTRACT

A large literature exists on the positive link between the consumption of fruits and vegetables and physical health. The World Health Organization and many western nations have adopted postures that suggest a healthy diet being one where individuals are advised to consume five portions of fruits and vegetables per day (2002). Not a lot of research has been done, however, on measuring the impact of a healthy diet on psychological well-being. Despite the increased interest both by scholars and governments in the study of life satisfaction as a proxy for progress in a nation or society as a whole, there has been little research on a very basic element of human life which is the impact of the people's dietary choices in their happiness.

Building upon the exercise made by Blanchflower and Oswald for the UK (2012), this study investigates on the existence of a link between the regular consumption of fruits and vegetables and life satisfaction in the United States. With the aid of Gallup-Healthways Well-Being Index, a unique data source that surveys 500 US citizens daily on well-being and health related aspects, a cross-sectional analysis was done to determine if regular consumption of the five portions of fruits throughout the week has an important role in emotional wellbeing of individuals. Controlling for different economic, demographic and other socioeconomic factors the data demonstrates that an increased number days having the correct amount of portions is accompanied by an increase in life satisfaction evaluations. Reverse causality remains possible. Limitations to the study, policy implications and further research are discussed.

Keywords: Gallup Healthways Wellbeing Index, Healthy Food, Positive Impact

1. Introduction

Through its year-round daily surveys, the Gallup-Healthways Well-Being Index provides the most up-to-date data and insights available on US citizens' purpose, social, financial, community and physical well-being. Gallup published nearly 60 articles in 2015 about US citizens' health, well-being and life-satisfaction. Some of the key findings showed uninsured rates among US adults falling, obesity surging, cigarette consumption among young adults decreasing significantly over the past decade or nearly two in ten people in the United States saying they take drugs to relax almost every day. Factors contributing to these findings include negative workplace environments and difficulty making positive health decisions about modifiable health behaviours like diet, exercise, and stress.

In that same line of trying to determine what impacts well-being and life satisfaction, this study uses the Gallup-Healthways Well-Being dataset to study what the impact of regular consumption of fruits and vegetables is on life satisfaction in the United States. A large literature exists on the positive link between the consumption of fruits and vegetables and physical health. The World Health Organization and many western nations have adopted postures that suggest a healthy diet being one where individuals are advised to consume five portions of fruits and vegetables per day (2002). Not a lot of research has been done, however, on measuring the impact of a healthy diet on psychological well-being. Despite the increased interest both by scholars and governments in the study of life satisfaction as a proxy for progress in a nation or society as a whole, there has been little research on a very basic element of human life which is the impact of the people's dietary choices in their happiness.

There are particular dietary constituents like vitamins and minerals that have proven to be beneficial to physiological health. Such a great benefit to the body creates the need to answer the question of whether these benefits also happen in the psychological realm. Rooney, McKinley and Woodward (2013) show in the most thorough literature review on the matter how more and more papers are suggesting that choice of food intake may have the potential to influence psychological well-being. Foods with complex carbohydrate content (like beans, peas and bananas), high on vitamin B (in particular folate (spinach, Brussels sprouts) and vitamin B6 (peas and bananas), antioxidants or minerals (iron, calcium and magnesium) contained in fruits and vegetables have been linked to improvements in brain functions including neural development and synoptic plasticity in neurons.

Although there are exceptions like Graham (2008) and Powdthavee (2009), there has not been a lot of work on how happiness interacts with health and dietary choices. Building upon the exercise made by Blanchflower and Oswald for the UK (2012), this study investigates on the possible existence of a link between the regular consumption of fruits and vegetables and life satisfaction in the United States. By using 2014 and 2015 yearly data, this study provides evidence of a positive association between the regular consumption of fruits and vegetables with psychological well-being, using life satisfaction as a proxy. The more days a week a person consumes the recommended 5 units of fruits and vegetables the greater their life satisfaction is. The nature of this relationship is evaluated across a series of controls and possible confounders like income, race or educational level and the results are robust. That is important in this setting, because so many 'healthy' attributes, including high levels of education and income, are likely to be correlated with the eating of fruit and vegetables. The study also finds that higher levels of fruit and vegetable consumption appear to be predictive of future life satisfaction of individuals.

A limitation to the study should be made clear from the beginning. The data set is cross-sectional. Even though the margin of sampling error for the study being 0.2 percentage points at the 95% confidence level, we cannot draw direct inferences about causality. Given the policy implications of

this topic and the difficulty of obtaining daily individual food consumption datasets, it would perhaps be valuable to create future longitudinal data sets in which fruit-and-vegetable portions are measured.

2. Methodology

The data for this study comes from the Gallup-Healthways Well-Being Index. Quoting from their own methodology, in the U.S., the Gallup-Healthways Well-Being Index provides an ongoing assessment of Americans' health and well-being. By interviewing no fewer than 500 adults each day, the Well-Being Index gives the ability to analyse and monitor U.S. residents' health and well-being on a continuous basis, allowing for unique insights on how to create behavioural change to ultimately improve well-being and lower healthcare costs. The Gallup-Healthways Well-Being Index includes questions that fall into six sub-indexes: Basic Access, Physical Health, Emotional Health, Healthy Behaviours, Life Evaluation, and Work Environment. The Well-Being Index segments the data for respondents in adverse and optimum situations according to household income, location demographics (based on ZIP code), and personal health status.

Gallup daily tracking relies on live (not automated) interviews, dual-frame sampling (which includes random-digit-dial (RDD) list-assisted landline interviewing and RDD wireless phone sampling to reach those in wireless-only and wireless-mostly households), and a random selection method for choosing respondents within the landline household. Gallup stratifies the random-digitdial (RDD) list-assisted landline and the wireless phone samples to ensure that the unweighted samples are proportionate by U.S. Census region and by time zone within region. Gallup weights the data daily to compensate for disproportionalities in selection probabilities and nonresponse. For this study, yearly data for 2014 and 2015 was combined. The total sample available was of 353,983 individuals, aged 18 and up. The two sequentially asked questions in the survey that are used as key dependant variables in our study are the following:

- "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?"
- On which step do you think you will stand about five years from now?

These questions are self-reported measures of life satisfaction. The response distribution for the first question shows that more than 45% of the people gave a score of 8 or more with the mean score for the sampled individuals is 7.00 with a standard deviation of 2.00. For the second one, life satisfaction in 5 years' time, the mean score is of 7.81 with a standard deviation of 2.21.
The study uses one key question relating to fruit and vegetable consumption.

- In the last seven days, on how many days did you have five or more servings of fruits and vegetables

Possible responses to this question range from 0 (no days with 5 or more servings of fruits and vegetables) to 7 (having 5 or more servings every day). More than two fifths of the people claim to have less than 3 days with the suggested servings and an overwhelming 30% say they have the 5 servings every day of the week.
We are interested in the size and statistical significance of the coefficient accompanying the consumption fruits and vegetables variable. To allow for possible confounding effects and check for robustness, using a similar methodology as Blanchflower, a series of independent variables were incorporated to estimate equations of the general form of:

Life Satisfaction = (number of days with 5 portions of fruit and vegetables consumed; age; gender; education; income)

3. Results

Table 1 reports the simplest regression specification in which the dependent variable is a person's current life satisfaction on scale from zero to ten and the independant variables are dummies for the number of days with five serving of fruits and vegetables each person had. Everything is normalized against the case of no days having the five portions of fruits and vegetables. A strong positive correlation is noticed. The more days having the right amount of servings the greater the impact on life satisfaction. Those that eat 5 servings on a daily basis have a life satisfaction score that is almost 19 times bigger than those with only one day. (0.028 vs 0.568)

Table 1: *Number of days with 5 servings of fruits and vegetables on life satisfaction*

		B	Std. Error	T
1	(Constant)	6.631	.009	753.810
	1 day of fruit	.028	.018	1.546
	2 days of fruit	.168	.014	12.111
	3 days of fruit	.302	.013	23.892
	4 days of fruit	.451	.014	33.275
	5 days of fruit	.518	.013	40.512
	6 days of fruit	.610	.020	31.246
	7 days of fruit	.568	.011	52.976

Table 2 of is an adjusted version of the first specification adding demographic characteristics: this regression equation incorporates gender, race and age. Like in Blanchflower and Oswald (2008), there is also evidence here of a U-shape in age, lower levels of satisfaction among black people and higher ones for Asian and Hispanic populations (compared to White). The fruit-and-vegetable coefficients, despite decreasing slightly, remain large and statistically significant. It is worth mentioning that the coefficient accompanying daily consumption of the optimal servings has the highest coefficient of impact on life satisfaction.

Table 2: *Number of days with 5 servings of fruits and vegetables and demographic variables on life satisfaction*

		B	Std. Error	T
1	(Constant)	6.862	.021	333.971
	1 day of fruit	.034	.019	1.760
	2 days of fruit	.142	.014	9.933
	3 days of fruit	.255	.013	19.923
	4 days of fruit	.395	.014	29.159
	5 days of fruit	.437	.013	34.494
	6 days of fruit	.484	.019	25.627
	7 days of fruit	.490	.011	45.791
	Gender	-.099	.007	-14.569
	Black	-.171	.012	-14.572
	Asian	.087	.023	3.764
	Hispanic	.034	.012	2.893
	Under 20	.135	.021	6.539
	Under 30	-.061	.021	-2.980
	Under 40	-.120	.020	-5.907
	Under 50	-.190	.020	-9.612
	Under 60	.106	.020	5.356
	Under 70	.234	.021	11.402
	Under 80	.215	.023	9.353

Table 3 shows the most encompassing equation. On top of the already added demographic variables, socioeconomic and other lifestyle habits were added. Income (normalized by household size), employment status, marital status, education level, excessive alcohol consumption, smoking, exercising regularly, having insurance and controlling for having experienced happiness in the previous day were added as controls. The majority of these variables have been used in previous papers that try to explain wellbeing and are used to correct for the possible confounding factors. It is important to consider these variables and control for them as the consumption of fruits and vegetables can be highly correlated with many of these socioeconomic variables. If many of these covariates were not included, it could be argued that the relationship could be spuriously driven by omitted factors like eating healthier by becoming richer, or eating poorly due to a difficult personal situation like a divorce or becoming unemployed.

The coefficients accompanying fruit and vegetable consumption fall, but still remain meaningful and statistically significant. To put the impact into context, having daily consumption of the required amount of fruits and vegetables has a similar impact 0.183 (0.017) on life satisfaction as being married 0.221 (0.016) or exercising regularly 0.237 (0.013). Not surprisingly, a big impact on current life satisfaction is the current state of happiness. Those who claim having experienced happiness in the previous day have a life satisfaction of almost 1.1 points more than those who have not. Being unemployed -0.594 (0.034), smoking -0.298 (0.015) or using drugs on a regular basis to relax -0.234 (0.012) have a strong negative impact.

Table 3: *Number of days with 5 servings of fruits and vegetables, demographic variables and other socioeconomic controls on life satisfaction*

		B	Std. Error	t
1	(Constant)	6.489	.048	135.384
	1 day of fruit	-.008	.029	-.271
	2 days of fruit	.020	.022	.882
	3 days of fruit	.071	.020	3.521
	4 days of fruit	.124	.021	5.806
	5 days of fruit	.129	.020	6.350
	6 days of fruit	.154	.030	5.183
	7 days of fruit	.183	.017	10.498
	Gender	-.210	.011	-18.588
	Black	.030	.020	1.483
	Asian	-.029	.038	-.775
	Hispanic	.245	.020	12.164
	Under 20	-.433	.051	-8.444
	Under 30	-.578	.036	-16.043
	Under 40	-.611	.035	-17.434
	Under 50	-.610	.034	-17.787
	Under 60	-.555	.033	-16.796
	Under 70	-.245	.031	-7.766
	Under 80	-.072	.032	-2.235
	Under $500 a month	-.617	.038	-16.129
	Under $2000 a month	-.676	.019	-35.496
	Under $4000 a month	-.446	.014	-31.866
	Unemployed	-.594	.034	-17.629
	In the Labour Force	-.079	.015	-5.425
	Chronic Illness	-.305	.012	-25.337
	Married/Living together	.221	.016	13.552
	Divorced/Separated	-.107	.021	-4.973
	Widowed	-.014	.028	-.503
	High School	-.040	.016	-2.480
	Bachelor	.096	.014	6.713
	Post Graduatate	.266	.016	16.830
	Have Health Insurance	.429	.021	20.493
	Binge Drink	.017	.020	.856
	Exercise Regularly	.237	.013	18.493
	Smoke	-.298	.015	-19.495
	Experienced Happiness	1.095	.019	58.179
	Had drugs to relax	-.234	.012	-20.279

To check for robustness of the results, the same specifications were used to measure the impact of fruit and vegetable consumption on future life satisfaction evaluation. Even though the scale of the impact of fruit and vegetable consumption is smaller, it remains statistically significant and it goes in the same direction as the evaluation of current life satisfaction. Even when current life satisfaction was entered as an independent variable, the results maintained. Controlling for current satisfaction (which not surprisingly comes into the equation with a large, positive and statistically significant coefficient) a greater number of days consuming the optimal amount of servings has a greater impact on the future life evaluation score.

4. Conclusions, limitations and further discussions and policy implications

With many issue like the rise of diabetes or obesity, many laboratory and other studies have shown the two way relationship between experiences of negative affect and food consumption. People eat more and less healthy food when going through negative experiences and it is through poor eating that other diseases like obesity occur - having a negative impact on life satisfaction. This paper tried to look to the other side of the balance. Other cross-sectional research has shown that healthy eating is associated with lower lifetime prevalence of depression and anxiety (White 2013) but there is not a lot of research showing if healthy eating also has an effect on the day to day evaluation of life satisfaction. This study was meant as a start to bride this gap. This study is meant to be an assessment of whether regular healthy eating, using fruits and vegetables as a proxy, has a positive connection with individual self-measured life satisfaction. Even though no direct causality can be established, the relationship between these two variables is strong and positive, even after controlling for many possible confounding factors. This study corroborates the findings of Blanchflower and Oswald's 2012 study for the UK, and even though this pattern cannot be considered as universal, it shows that in Western developed nations fruit and vegetable consumption can be seen as a determinant of life satisfaction.

Despite the significance of the findings – healthy eating is a good investment for current and future evaluations of life satisfaction – they should be interpreted with caution due to the cross sectional nature of the dataset. Correlation does not imply causation and the lack of panel data or a long term randomized controlled trials where different levels of fruits and vegetables are the sole treatment cannot allow us to suggest that eating more fruits and vegetables will make you happier. Even though the Gallup's dataset is one of the most robust ones for the purpose, given the large amount of confounding factors that can be controlled for, any sort of suggestive causal relationship must be taken with care. A bigger, longitudinal randomized controlled trial could be a way forward, but again, this would present limitations in the implementation of its own (external situations affecting emotions and satisfaction for example could not be controlled for). Asking for more detailed food consumption habits – not just fruits and vegetables – like red meat, fish, or other foods could also help the robustness of the results.

There is relevance for policy and further research that is derived from this study. The positive relationship between healthy eating and happiness found in this study can support the current widespread view of the importance of eating fruits and vegetables on a regular basis. Governments should try to find ways of fostering this type of behaviour. However, as claimed by Graham (2008), it is not obvious that policies that are beneficial from a public health standpoint would make the majority of the population happy. Another alternative for policy, similar to what Blanchflower and Oswald propose, could be using the findings to push the medical community to continue looking for linkages between subjective wellbeing like human optimism and the presence of certain substances in the blood and brain derived from vitamins/minerals/antioxidants that come from fruits and

vegetables. If a medical link can be established, the validity of this study increases substantially As for further research, trying to find the funding to have longitudinal data or an RCT could be the way forward. In the meantime, trying to replicate the findings not just with developed nations, but in a wider context for countries with different socioeconomic factors could support or dismantle the universal validity of the findings of this paper.

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